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CENTRAL AND SOUTHERN FLORIDA PROJECT: COMPREHENSIVE EVERGLADES RESTORATION PLAN C–111 SPREADER CANAL WESTERN PROJECT

COMMUNICATION

FROM

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

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COMPREHENSIVE EVERGLADES RESTORATION PLAN
C-111 SPREADER CANAL WESTERN PROJECT

FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

Volume 4 – Appendix A, Part I

January 2011

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U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

This Report Contains [5] Volumes
You Are Here

Volume 1 – Main Report

- Executive Summary
- Section 1 – Introduction
- Section 2 – Existing Conditions/Affected Environment
- Section 3 – Future "Without Project" Condition
- Section 4 – Identification of Problems and Opportunities
- Section 5 – Formulation and Evaluation of Alternatives
- Section 6 – The Recommended Plan
- Section 7 – Environmental Effects
- Section 8 – Plan Implementation
- Section 9 – Coordination, Public Views, and Comments
- Section 10 – Recommendations
- Section 11 – List of Preparers
- Section 12 – Index
- Section 13 – Glossary of Terms
- Section 14 – Acronym List
- Section 15 – References

Volume 2 – Annex A-B

- Annex A – FWCA and Endangered Species Act Compliance
- Annex B – NEPA Information

Volume 3 – Annex C-F

- Annex C – Analyses Required by WRDA 2000 and State Law
- Annex D – Draft Project Operating Manual
- Annex E – Project Monitoring Plan
- Annex F – Reports Provided by RECOVER to Support the PIR

Volume 4 – Appendix A

- Appendix A – Engineering Part I
- Appendix A – Engineering Part II, HTRW Reports

Volume 5 – Appendix B-H

- Appendix B – Cost Estimates
- Appendix C – Environmental Information
- Appendix D – Real Estate
- Appendix E – Agency / Public Coordination
- Appendix F – Plan Formulation and Evaluation
- Appendix G – Economic and Social Considerations
- Appendix H – Recreation Plan

CENTRAL AND SOUTHERN FLORIDA PROJECT
C-111 SPREADER CANAL WESTERN PROJECT

FINAL PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

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SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

January 2011

APPENDIX A
ENGINEERING

APPENDIX A
ENGINEERING
PART I

TABLE OF CONTENTS

A.0 ENGINEERING PART I A-1
A.1 PROJECT BACKGROUND A-1
A.1.1 Instructions to Readers A-1
A.1.2 Introduction A-1
A.1.3 Real Estate Utilized for Project A-2
A.1.3.1 Frog Pond Detention Area A-4
A.1.3.2 Aerojet Canal Modifications A-4
A.1.3.3 C-110 Canal Plugs A-4
A.1.3.4 L-31E Canal Plug A-4
A.1.3.5 Control Structure S-198 ..... A-4
A.2 SUMMARY OF PROJECT COMPONENTS A-5
A.2.1 Pump Station S-200 ..... A-5
A.2.2 S-200 Conveyance Channel A-6
A.2.3 Frog Pond Detention Area A-6
A.2.4 Frog Pond Header Distribution Channel A-7
A.2.5 Aerojet Canal Modifications A-7
A.2.6 Pump Station S-199 ..... A-8
A.2.7 S-199 Conveyance Channel A-8
A.2.8 Aerojet Canal Extension A-9
A.2.9 Aerojet Canal Plugs A-9
A.2.10 C-110 Canal Plugs A-9
A.2.11 L-31E Canal Plug A-9
A.2.12 Control Structure S-198 ..... A-10
A.3 TOPOGRAPHIC AND BOUNDARY SURVEYS A-16
A.3.1 Legal Description of Project Location A-16
A.3.2 Historical Surveys A-16
A.3.3 Recent Project Specific Surveys A-18
A.4 GEOTECHNICAL STUDIES A-18
A.4.1 General Purpose A-18
A.5 GEOLOGY A-19
A.5.1 Regional Geology A-19
A.5.2 Soil Survey A-19
A.5.3 Topography A-21
A.5.4 Historical Surface Water and Groundwater Data A-22
A.5.4.1 Historical Surface Water Data A-22
A.5.4.2 Historical Groundwater Data A-23
A.5.5 U.S. Geologic Survey Published Data A-23
A.5.6 Permeability Data A-23
A.6 GEOTECHNICAL ENGINEERING EVALUATION A-24
A.6.1 Existing Geotechnical Data Review A-24
A.6.2 SPT and Rock Core Borings A-25
A.6.2.1 SPT Borings A-26
A.6.2.2 Rock Core Borings A-26
A.6.3 Groundwater A-27
A.6.4 Visual Classification A-27

A.6.5 Soil Testing A-28
A.6.5.1 Soil Index Property A-28
A.6.5.2 Corrosivity Test A-29
A.6.6 Rock Testing A-29
A.6.7 Subsurface Evaluation A-29
A.6.8 FPDA Seepage Evaluation A-30
A.6.8.1 General Description and Background A-30
A.6.8.2 Cases Analyzed A-31
A.6.8.3 Seepage Analysis Results A-32
A.6.9 FPDA Slope Stability Analyses A-36
A.6.9.1 General Description and Background A-36
A.6.9.2 Slope Stability Analysis Results A-36
A.6.10 Settlement Analyses A-37
A.6.11 Construction Recommendations A-38
A.6.11.1 Site Access and Work Surface Preparation A-38
A.6.11.2 General Excavations A-39
A.6.11.3 Blasting A-40
A.6.11.4 Dewatering for Structures A-40
A.6.11.5 Select Fill Composition, Placement, and Compaction A-40
A.6.11.6 On Site Material A-41
A.6.11.7 Canal Excavation A-41
A.6.11.8 Pump Stations and Water Control Structures A-41
A.6.11.8.1 Site Preparation A-42
A.6.11.8.2 Seepage Control A-43
A.6.11.8.3 Foundation Design A-43
A.6.11.8.4 Driven Sheet Piles A-44
A.6.11.9 Below Grade Wall A-45
A.6.11.10 Shallow Foundation A-45
A.6.11.11 Erosion Protection A-46
A.7 ENGINEERING OF EMBANKMENTS AND CANALS A-46
A.7.1 General A-46
A.7.2 Proposed Plan A-47
A.7.2.1 Pump Station S-200 ..... A-47
A.7.2.2 S-200 Conveyance Channel A-48
A.7.2.3 Frog Pond Detention Area A-48
A.7.2.4 Frog Pond Header Distribution Channel A-49
A.7.2.5 Aerojet Canal Modifications A-49
A.7.2.6 Pump Station S-199 ..... A-50
A.7.2.7 S-199 Conveyance Channel A-50
A.7.2.8 Aerojet Canal Extension A-50
A.7.2.9 Aerojet Canal Plugs A-51
A.7.2.10 C-110 Canal Plugs A-51
A.7.2.11 L-31E Canal Plug A-51
A.7.2.12 Control Structure S-198 ..... A-51
A.7.3 Site Preparation A-52
A.7.3.1 North Project Components A-52

A.7.3.2 South Project Components A-52
A.7.4 Site Access/Entrance Road A-52
A.7.4.1 North Project Components A-52
A.7.4.2 South Project Components A-52
A.7.5 Disposal/Borrow A-52
A.7.6 Embankments A-53
A.7.6.1 North Project Components A-53
A.7.6.1.1 Levee Height A-53
A.7.6.1.2 S-200 Intake Canal Embankments A-53
A.7.6.1.3 FPDA Eastern and Southern Perimeter Levees A-53
A.7.6.1.4 FPDA Northern Perimeter/ S-200 Conveyance Channel Levees A-54
A.7.6.1.5 FPDA Western Perimeter Levee A-54
A.7.6.1.6 Frog Pond Header Distribution Channel Berm A-54
A.7.6.1.7 FPDA East-West Intermediate Levees A-55
A.7.6.1.8 Levee Fill A-55
A.7.6.1.9 Bench A-55
A.7.6.1.10 Seeding and Sodding A-55
A.7.6.2 South Project Components A-55
A.7.6.2.1 S-199 Intake Canal Embankments A-56
A.7.6.2.2 S-200 Conveyance Channel Embankments A-56
A.7.6.2.3 Aerojet Extension Channel Embankments A-56
A.7.6.2.4 Aerojet Canal Berms A-56
A.7.7 Canal Plugs (South Project Components) A-56
A.7.7.1 Aerojet Canal Plugs A-56
A.7.7.2 C-110 Canal Plugs A-57
A.7.7.3 L-31E Canal Plug A-57
A.7.8 Canals and Channels A-57
A.7.8.1 North Project Components A-57
A.7.8.1.1 S-200 Intake Canal A-57
A.7.8.1.2 S-200 Conveyance Channel A-57
A.7.8.1.3 Frog Pond Header Distribution Channel A-58
A.7.8.2 South Project Components A-58
A.7.8.2.1 S-199 Intake Canal A-58
A.7.8.2.2 S-199 Conveyance Channel A-58
A.7.8.2.3 Aerojet Extension Channel A-59
A.7.9 Earthwork Volumes A-59
A.7.9.1 North Project Components A-59
A.7.9.2 South Project Components A-60
A.7.9.2.1 Cut Volumes A-60
A.7.9.2.2 Fill Volumes A-60
A.7.10 Relocations A-60
A.7.10.1 North Project Components A-60
A.7.10.2 South Project Components A-60
A.8 PUMP STATIONS S-200 AND S-199 ..... A-61
A.8.1 Introduction A-61
A.8.1.1 Pump Station Design Objectives A-62

A.8.1.2 General Pump Station Description A-62
A.8.1.3 Reliability and Cost Considerations A-63
A.8.1.4 Life Cycle Cost (LCC) Analysis A-63
A.8.1.5 Design Life A-64
A.8.2 Geotechnical Engineering Analysis and Design A-64
A.8.2.1 Field Exploration and Laboratory Testing A-64
A.8.2.1.1 SPT Borings and Coring A-64
A.8.2.2 Laboratory Testing A-65
A.8.2.3 Existing Site Conditions A-65
A.8.2.3.1 Site Surface Conditions A-65
A.8.2.3.2 Regional Geology and Subsurface Conditions A-65
A.8.2.3.3 S-200 and S-199 Site Limestone Parameters A-66
A.8.2.3.4 Groundwater Conditions A-67
A.8.2.3.5 Corrosion Potential A-67
A.8.2.4 Design Evaluations A-68
A.8.2.4.1 General Geotechnical Site Suitability A-68
A.8.2.4.2 Summary of Generalized Design Parameters A-68
A.8.2.5 Geotechnical Analysis A-68
A.8.2.5.1 Slope Stability A-68
A.8.2.5.2 Structure Stability Criteria A-69
A.8.2.5.3 Approach Channel Erosion Potential A-69
A.8.2.6 Construction Recommendations A-70
A.8.2.6.1 Site Access and Preparation A-70
A.8.2.6.2 Excavations and Dewatering A-71
A.8.2.6.3 Structural Backfill A-71
A.8.3 Hydraulic Analysis and Design A-72
A.8.3.1 Pump Station Hydrologic Background A-72
A.8.3.2 Location A-73
A.8.3.3 Hydrological and Hydraulic Data A-73
A.8.3.4 Pump Station Capacity A-74
A.8.3.5 Pumping System Operation A-75
A.8.4 Civil Engineering Analysis and Design A-76
A.8.4.1 General A-76
A.8.4.1.1 Project Design Considerations and Criteria A-76
A.8.4.1.2 Equipment Maintenance A-77
A.8.4.1.3 Channel Maintenance A-77
A.8.4.1.4 Site Security A-78
A.8.4.1.5 Site Safety A-78
A.8.4.2 Approach Channel Design A-78
A.8.4.2.1 Channel Slopes A-78
A.8.4.2.2 Channel Alignment A-79
A.8.4.2.3 Flow Velocity A-79
A.8.4.2.4 Scour Protection A-79
A.8.4.2.5 Design Stage A-80
A.8.4.2.6 Channel Design A-81
A.8.4.3 Site Design A-83

A.8.4.3.1 General A-83
A.8.4.3.2 Site Drainage A-83
A.8.4.3.3 Pavement A-83
A.8.4.3.4 Trash Collection Area A-84
A.8.4.3.5 LP Gas Underground Tank A-84
A.8.4.3.6 Communication Antenna Pole A-84
A.8.4.3.7 In-Bank Stilling Well A-84
A.8.4.4 Construction Consideration A-84
A.8.4.4.1 Turbidity Control A-84
A.8.4.4.2 Maintenance of Operation of Existing Facilities A-85
A.8.5 Structural Engineering Analysis and Design A-85
A.8.5.1 Station Design Standards and Codes A-85
A.8.5.2 General Design Load Parameters A-86
A.8.5.3 Structural Stability A-87
A.8.5.4 Concrete Design Criteria A-87
A.8.5.5 Masonry Design Criteria A-88
A.8.5.6 Steel Design Criteria A-89
A.8.5.7 General Description of Pump Station A-89
A.8.5.7.1 Control Building A-90
A.8.5.8 Structural Reinforcement Design A-90
A.8.5.8.1 Pump Station Substructure A-90
A.8.5.8.2 Control Building A-90
A.8.5.8.3 Sheet Piling System A-90
A.8.6 Mechanical Engineering Analysis and Design A-91
A.8.6.1 Project Background A-91
A.8.6.1.1 Pump Station Description A-91
A.8.6.1.2 Design Standards and Codes A-92
A.8.6.2 General Design A-92
A.8.6.2.1 Mechanical Arrangement A-92
A.8.6.2.2 Pump Station Geometric Criteria A-93
A.8.6.3 Plumbing Equipment A-93
A.8.6.3.1 Design Considerations A-93
A.8.6.3.2 Design Life A-93
A.8.6.3.3 Pump System Analysis A-94
A.8.6.3.4 Pump Performance Characteristics A-94
A.8.6.3.5 Pump Type A-94
A.8.6.4 Pump Intake Design A-96
A.8.6.4.1 Intake Physical Model Test A-97
A.8.6.5 Station Auxiliaries A-97
A.8.6.5.1 Trash Collection System A-97
A.8.6.5.2 Trash Rack A-97
A.8.6.5.3 Trash Rakes A-98
A.8.6.5.4 Trash Rake Operation Control A-99
A.8.6.6 Intake Dewatering A-99
A.8.6.7 LP Gas Fuel System for the Emergency Generator A-100
A.8.6.7.1 LP-Gas Generator Exhaust System A-101

A.8.6.7.2 Piping A-101
A.8.6.7.3 Silencer A-101
A.8.6.8 Flow Measurement A-102
A.8.7 Plumbing Analysis and Design A-102
A.8.8 Ventilation Design A-102
A.8.8.1 Design Standards and Criteria A-102
A.8.8.2 Outdoor Design Conditions A-103
A.8.8.3 Building Characteristics A-103
A.8.8.4 Ventilation Design A-104
A.8.8.5 Equipment A-105
A.8.8.5.1 Fans A-105
A.8.8.5.2 Fixed Wall Louvers A-106
A.8.8.5.3 LP-Gas Generator A-106
A.8.8.6 Generator Engine Cooling System A-106
A.8.9 Fire Protection and Detection Analysis and Design A-108
A.8.9.1 Fire Protection Design Criteria A-108
A.8.9.2 Fire Detection and Suppression Requirements A-108
A.8.9.3 Fire Protection Building Design Requirements A-108
A.8.10 Electrical Analysis and Design A-109
A.8.10.1 Design Criteria A-109
A.8.10.2 Power Supply A-109
A.8.10.3 Low Voltage Station A-109
A.8.10.4 Power Distribution Equipment A-109
A.8.10.4.1 Design Criteria A-109
A.8.10.4.2 Wiring A-110
A.8.10.5 Surge Protection A-110
A.8.10.5.1 Design Criteria A-110
A.8.10.6 Station Electrical System A-112
A.8.10.6.1 Design Criteria A-112
A.8.10.6.2 Lighting A-112
A.8.10.6.3 Back-up Power System A-113
A.8.10.6.4 Engine-Generator A-113
A.8.10.7 Grounding System A-114
A.8.10.7.1 Design Criteria A-114
A.8.10.7.2 General Requirements A-114
A.8.10.8 Lightning Protection A-115
A.8.10.8.1 Design Criteria A-115
A.8.10.8.2 General Requirements A-115
A.8.10.8.3 Air Terminals A-115
A.8.10.8.4 Conductors A-116
A.8.10.9 Submersible Motors A-116
A.8.10.10Motor Starters A-117
A.8.10.10.1 Soft Starters A-117
A.8.10.11Station Security A-119
A.8.11 Instrumentation and Control Analysis and Design A-119
A.8.11.1 System Description A-119

A.8.11.2 Control Equipment A-120
A.8.11.2.1 Station Control Center (SCC) A-120
A.8.11.2.2 Programmable Logic Controller (PLC) A-121
A.8.11.2.3 Generator Control and Monitoring A-122
A.8.11.2.4 Engine Control Functions A-124
A.8.11.2.5 Alternator Control Functions A-124
A.8.11.2.6 Control Interfaces for Remote Monitoring and Control A-125
A.8.11.3 Monitoring Equipment A-125
A.8.11.3.1 Water Level Monitors A-125
A.8.11.3.2 Submersible Pump Monitors A-126
A.8.12 Telemetry Analysis and Design A-126
A.8.12.1 Telemetry Network A-126
A.8.12.2 Communications Equipment A-126
A.8.12.2.1 Remote Terminal Unit A-126
A.8.12.3 Operational Testing A-128
A.8.12.3.1 Operational Readiness Test A-128
A.9 S-198 STRUCTURE A-128
A.9.1 Introduction A-128
A.9.1.1 Control Structure Design Objectives A-129
A.9.1.2 General Control Structure Description A-130
A.9.1.3 Reliability and Cost Considerations A-130
A.9.1.4 Life Cycle Cost (LCC) Analysis A-130
A.9.1.5 Design Life A-131
A.9.2 Geotechnical Engineering Analysis and Design A-131
A.9.2.1 Field Exploration and Laboratory Testing A-131
A.9.2.1.1 SPT Borings and Coring A-131
A.9.2.2 Laboratory Testing A-132
A.9.2.3 Existing Site Conditions A-132
A.9.2.3.1 Site Surface Conditions A-132
A.9.2.3.2 Regional Geology and Subsurface Conditions A-132
A.9.2.3.3 S198 Site Limestone Parameters A-133
A.9.2.3.4 Groundwater Conditions A-133
A.9.2.3.5 Corrosion Potential A-134
A.9.2.4 Design Evaluations A-134
A.9.2.4.1 General Geotechnical Site Suitability A-134
A.9.2.4.2 Summary of Generalized Design Parameters A-134
A.9.2.5 Geotechnical Analysis A-135
A.9.2.5.1 Slope Stability A-135
A.9.2.5.2 Structure Stability Criteria A-135
A.9.2.5.3 Approach Channel Erosion Potential A-135
A.9.2.6 Construction Recommendations A-136
A.9.2.6.1 Site Access and Preparation A-136
A.9.2.6.2 Excavations and Dewatering A-136
A.9.2.6.3 Structural Backfill A-137
A.9.3 Hydraulic Analysis and Design A-137
A.9.3.1 Hydrologic Background A-137

A.9.3.2 Location A-138
A.9.3.3 Hydrological and Hydraulic Data A-138
A.9.3.4 Structure Design Considerations A-139
A.9.3.5 System Operation A-140
A.9.3.6 Protection Elevation A-140
A.9.4 Civil Engineering Analysis and Design A-140
A.9.4.1 General A-140
A.9.4.1.1 Project Design Considerations and Criteria A-140
A.9.4.1.2 Equipment Maintenance A-141
A.9.4.1.3 Channel Maintenance A-141
A.9.4.1.4 Site Security A-141
A.9.4.1.5 Site Safety A-142
A.9.4.2 Approach Channel Design A-142
A.9.4.2.1 Channel Slopes A-142
A.9.4.2.2 Flow Velocity A-142
A.9.4.2.3 Scour Protection A-143
A.9.4.2.4 Design Stage A-143
A.9.4.3 Site Design A-144
A.9.4.3.1 General A-144
A.9.4.3.2 Site Drainage A-144
A.9.4.3.3 LP Gas Underground Tank A-144
A.9.4.3.4 Communication Antenna Pole A-144
A.9.4.3.5 In-Bank Stilling Well A-144
A.9.4.4 Construction Consideration A-145
A.9.4.4.1 Turbidity Control A-145
A.9.4.4.2 Maintenance of Operation of Existing Facilities A-145
A.9.5 Structural Engineering Analysis and Design A-145
A.9.5.1 Design Standards and Codes A-145
A.9.5.2 General Design Load Parameters A-146
A.9.5.3 Structural Stability A-147
A.9.5.4 Concrete Design Criteria A-147
A.9.5.5 Masonry Design Criteria A-148
A.9.5.6 Steel Design Criteria A-149
A.9.5.7 General Description of Control Structure A-149
A.9.5.7.1 Control Building A-149
A.9.5.8 Structural Reinforcement Design A-150
A.9.5.8.1 Substructure A-150
A.9.5.8.2 Control Building A-150
A.9.5.8.3 Sheet Piling System A-150
A.9.6 Mechanical Engineering Analysis and Design A-151
A.9.6.1 Project Background A-151
A.9.6.1.1 Control Structure Description A-151
A.9.6.1.2 Design Standards and Codes A-151
A.9.6.2 General Design A-151
A.9.6.2.1 General Arrangement A-151
A.9.6.2.2 Control Structure Geometric Criteria A-152

A.9.6.3 Gates and Auxiliary Equipment A-152
A.9.6.3.1 Design Considerations A-152
A.9.6.3.2 Design Life A-152
A.9.6.3.3 Gate Design A-153
A.9.6.4 Culvert Dewatering A-154
A.9.6.5 LP Gas Fuel System for the Emergency Generator A-154
A.9.6.5.1 LP-Gas Generator Exhaust System A-155
A.9.6.5.2 Piping A-155
A.9.6.5.3 Silencer A-155
A.9.7 Plumbing Analysis and Design A-156
A.9.8 Ventilation Design A-156
A.9.8.1 Design Standards and Criteria A-156
A.9.8.2 Outdoor Design Conditions A-156
A.9.8.3 Building Characteristics A-157
A.9.8.4 Ventilation Design A-157
A.9.8.5 Equipment A-159
A.9.8.5.1 Fans A-159
A.9.8.5.2 Fixed Wall Louvers A-159
A.9.8.5.3 LP-Gas Generator A-160
A.9.8.6 Generator Engine Cooling System A-160
A.9.9 Fire Protection and Detection Analysis and Design A-161
A.9.9.1 Fire Protection Design Criteria A-161
A.9.9.2 Fire Detection and Suppression Requirements A-161
A.9.9.3 Fire Protection Building Design Requirements A-162
A.9.10 Electrical Analysis and Design A-162
A.9.10.1 Design Criteria A-162
A.9.10.2 Power Supply A-162
A.9.10.3 Low Voltage Facility A-162
A.9.10.4 Power Distribution Equipment A-163
A.9.10.4.1 Design Criteria A-163
A.9.10.4.2 Wiring A-163
A.9.10.5 Surge Protection A-164
A.9.10.5.1 Design Criteria A-164
A.9.10.6 Electrical System Design A-165
A.9.10.6.1 Design Criteria A-165
A.9.10.6.2 Lighting A-166
A.9.10.6.3 Back-up Power System A-166
A.9.10.6.4 Engine-Generator A-167
A.9.10.7 Grounding System A-167
A.9.10.7.1 Design Criteria A-167
A.9.10.7.2 General Requirements A-167
A.9.10.8 Lightning Protection A-168
A.9.10.8.1 Design Criteria A-168
A.9.10.8.2 General Requirements A-168
A.9.10.8.3 Air Terminals A-169
A.9.10.8.4 Conductors A-169

A.9.10.9 Motors A-169
A.9.10.10Motor Starters A-170
A.9.10.11Facility Security A-170
A.9.11 Instrumentation and Control Analysis and Design A-171
A.9.11.1 System Description A-171
A.9.11.2 Control Equipment A-171
A.9.11.2.1 Control Center A-171
A.9.11.2.2 Generator Control and Monitoring A-171
A.9.11.2.3 Engine Control Functions A-173
A.9.11.2.4 Alternator Control Functions A-174
A.9.11.2.5 Control Interfaces for Remote Monitoring and Control A-174
A.9.11.3 Monitoring Equipment A-175
A.9.11.3.1 Water Level Monitors A-175
A.9.12 Telemetry Analysis and Design A-175
A.9.12.1 Telemetry Network A-175
A.9.12.2 Communications Equipment A-175
A.9.12.2.1 Remote Terminal Unit A-175
A.9.12.3 Operational Testing A-177
A.9.12.3.1 Operational Readiness Test A-177
A.10 HYDROLOGIC AND HYDRAULIC MODELING FOR ALTERNATIVE ANALYSIS (MODBRANCH) A-177
A.10.1 Overview and Introduction A-177
A.10.2 Model Selection and Utilization A-178
A.10.2.1 Model Calibration and Verification A-181
A.10.2.1.1 Model Inputs and Assumptions A-181
A.10.2.1.2 Model Uncertainty A-189
A.10.2.2 Base and Alternative Simulations A-191
A.10.2.2.1 Base Configurations A-191
A.10.2.2.2 Alternative Configurations A-195
A.10.2.2.3 Performance Measures (PMs) A-203
A.10.2.2.4 Discussion of Results A-215
A.10.3 References A-218
A.11 HYDROLOGIC AND HYDRAULIC MODELING FOR FPDA A-219
A.11.1 Overview A-219
A.11.2 Regional Modeling A-219
A.11.3 Sub-Regional Modeling A-219
A.11.3.1 Description of Models and Modeling Assumptions A-219
A.11.3.1.1 HEC-RAS Model A-220
A.11.3.1.2 ICPR Model A-220
A.11.3.2 ICPR Model Development and Modeling Assumptions A-221
A.11.3.2.1 Hydrologic Parameters A-221
A.11.3.2.2 Hydrologic Simulation A-225
A.11.3.2.3 Hydraulic Parameters A-225
A.11.3.3 Assumptions A-227
A.11.4 Modeling Results A-228
A.11.4.1 Dry Season with 225 cfs Water Pumped into the Header Channel A-228

A.11.4.2 Wet Season, 100-yr/6-hr PMP Storm with 38.7 in. Rainfall Plus 225 cfs Pumped into Header Channel A-229
A.11.4.3 Wet Season: 100-Yr/24-Hr Storm with A Total Depth of 18 In Rainfall, Plus 225 cfs Pumped Into The Header Channel A-231
A.11.4.4 Wet Season: Hurricane Storm As 100-Yr/24-Hr with A Total Depth of 38.7 In Rainfall, Plus 225 cfs Pumped In A-232
A.11.4.5 Conclusions A-233
A.12 HYDROLOGIC/HYDRAULIC MODELING FOR AEROJET CANAL A-233
A.12.1 Introduction A-233
A.12.2 ICPR Model Development and Modeling Assumptions A-234
A.12.2.1 ICPR Model Description A-234
A.12.2.2 Hydrologic Parameters A-234
A.12.2.3 Hydrologic Simulation A-235
A.12.2.4 Hydraulic Parameters A-239
A.12.2.5 Assumptions A-239
A.12.3 Modeling Results A-243
A.12.3.1 Water Elevation Profile along Aerojet Canal A-243
A.12.3.1.1 Mounding Water Analysis A-244
A.12.4 Conclusions A-245
A.12.5 C-110 and L-31E Canals Modeling A-245
A.13 INSTRUMENTATION AND CONTROL ANALYSIS AND DESIGN A-248
A.13.1 System Description A-248
A.13.2 Control Equipment A-249
A.13.2.1 Station Control Center (SCC) A-249
A.13.2.2 Programmable Logic Controller (PLC) A-250
A.13.2.3 Generator Control and Monitoring A-251
A.13.2.4 Engine Control Functions A-253
A.13.2.5 Alternator Control Functions A-253
A.13.2.6 Control Interfaces for Remote Monitoring and Control A-254
A.13.3 Monitoring Equipment A-254
A.13.3.1 Water Level Monitors A-254
A.13.3.2 Submersible Pump Monitors A-255
A.13.4 Telemetry Analysis and Design A-255
A.13.4.1 Telemetry Network A-255
A.13.4.2 Communications Equipment A-255
A.13.4.2.1 Remote Terminal Unit A-255
A.13.4.3 Operational Testing A-256
A.13.4.3.1 Operational Readiness Test A-256
A.14 RECREATIONAL USE OF PROJECT FEATURES A-257
A.15 REFERENCES A-258
A.16 MODBRANCH MODEL DOCUMENTATION REPORT A-261
A.17 CALIBRATION AND VERIFICATION OF THE MODBRANCH (MB_2006) NUMERICAL MODEL OF SOUTH FLORIDA A-315
A.18 SUMMARY OF VALUE ENGINEERING ACTIONS A-379
A.19 VALUE ENGINEERING STUDY REPORT A-385

LIST OF TABLES

Table A-1 Estimated Hydraulic Conductivity Values A-24
Table A-2 SPT Borings A-26
Table A-3 Groundwater Levels A-27
Table A-4 Stratigraphy Descriptions A-28
Table A-5 Corrosivity Testing Results A-29
Table A-6 S-200 - Geotech Design Parameters for Sheet Piles A-44
Table A-7 S-199 - Geotech Design Parameters for Sheet Piles A-44
Table A-8 S-198 - Geotech Design Parameters for Sheet Piles A-45
Table A-9: Boring Summary A-65
Table A-10 Observed Groundwater Elevations A-67
Table A-11 Corrosivity Tests A-67
Table A-12 Summary of Laboratory Testing Results A-68
Table A-13 C111 Stage Data - S177 HW (DBKEY 13154) A-73
Table A-14 Pump Station No.1 Design Stages A-73
Table A-15 C-111 Flow Data-S177 (DBKEY 13156) A-74
Table A-16 Pump Station Design Capacity A-74
Table A-17 C-111 Flow Data-S177 (DBKEY 13156) A-74
Table A-18 C-111 Flow Data-S177 (DBKEY 13156) A-75
Table A-19 Approach Channel Design Stages A-80
Table A-20 Discharge Channel Design Stages A-81
Table A-21 Channel Design Capacity A-81
Table A-22 Approach Channel Design A-82
Table A-23 Discharge Channel Design A-82
Table A-24 Pump Station Elevation Design Criteria A-93
Table A-25 Final Ventilation Requirements A-105
Table A-26 Suppression Voltage Ratings A-111
Table A-27 Boring Summary A-132
Table A-28 Observed Groundwater Elevations A-133
Table A-29 Corrosivity Tests A-134
Table A-30 Summary of Laboratory Testing Results A-135
Table A-31 S197 Stage Data - HW A-138
Table A-32 S197 Stage Data - TW A-138
Table A-33 S197 Data – Flow A-139
Table A-34 S18c Stage Data - HW A-139
Table A-35 S18c Stage Data - TW A-139
Table A-36 S18c Data - Flow A-139
Table A-37 S-198 Design Stages A-143
Table A-38 Elevation Design Criteria A-152
Table A-39 Preliminary Ventilation Requirements A-159
Table A-40 Suppression Voltage Ratings A-164
Table A-41 Sequence by Zone A-186

LIST OF FIGURES

Figure A-1 Project Components A-3
Figure A-2 S-200 and Frog Pond Detention Area A-11
Figure A-3 S-199 and Aerojet Canal Extension A-12
Figure A-4 Aeroject Canal Plugs A-13
Figure A-5 C-110 Canal Plugs A-14
Figure A-6 L-31E Canal Plugs A-15
Figure A-7 Existing Geometric Configuration A-31
Figure A-8 Case 2 and Case 3 Geometric Configurations A-32
Figure A-9 Seepage Existing Condition A-33
Figure A-10 Seepage Case 2 Conditon A-34
Figure A-11 Seepage Case 3 Condition A-35
Figure A-12 Detention Area Mounding Analysis A-36
Figure A-13 Slope Stability Analysis A-37
Figure A-14 Settlement Analysis A-38
Figure A-15 S-200 and S-199 General Location A-61
Figure A-16 Site Access A-70
Figure A-17 S-200 Site A-76
Figure A-18 S-199 Site A-77
Figure A-19 S-198 General Location A-129
Figure A-20 MODBRANCH Model Domain A-179
Figure A-21 MODBRANCH Grid A-180
Figure A-22 Extent of Topographic Data Sources with Model Domain A-182
Figure A-23 MODBRANCH Topography A-183
Figure A-24 MODBRANCH Model Geologic Layer Zones A-185
Figure A-25 Monthly Total Potential Evapotranspiration, 1978 ..... A-187
Figure A-26 Monthly Total Potential Evapotranspiration, 1989 ..... A-187
Figure A-27 Monthly Total Potential Evapotranspiration, 1995 ..... A-188
Figure A-28 Triangulated Irregular Network (TIM) Used to Estimate PET A-188
Figure A-29 MODBRANCH Existing Condition Base (ECB) Configuration A-192
Figure A-30 Configuration Differences in The Frogpond Area, ECB and IOR A-193
Figure A-31 Future Without CERP MODBRANCH Configuration A-194
Figure A-32 Pre-CERP Baseline MODBRANCH Configuration A-195
Figure A-33 Detail of Frog Pond Detention Area A-197
Figure A-34 Location of Cape Sable Seaside Sparrow Trigger Locations A-197
Figure A-35 "D" Features: S-198, L31E "Plug", and S-20 Operational Changes A-198
Figure A-36 Configuration Difference Between Alternative 2D Short and 2D Long .. A-199
Figure A-37 Linear Fit to Ground Elevations Along Aerojet Canal A-200
Figure A-38 Location of Existing and Proposed Plugs, MODBRANCH Configuration A-201
Figure A-39 Alternative 3D Configuration A-202
Figure A-40 Alternative 6D Configuration A-203
Figure A-41 Example of Post-Processed MODBRANCH Data in An Excel Spreadsheet A-205
Figure A-42 Cape Sable Seaside Sparrow (CSSS) Critical Habitat A-205
Figure A-43 Cape Sable Seaside Sparrow Indicator Regions, ... A-206

Figure A-44 Example of The CSSS Score A-207
Figure A-45 Wading Bird Indicator Regions A-208
Figure A-46 Wading Bird Habitat Units (Area-Weighted) A-209
Figure A-47 Frequency of Exceedance Curve, CSSS Area U2, 1978 (FwoCERP Base) A-211
Figure A-48 Primary Transects of Interest A-212
Figure A-49 Transect Between Shark River and Taylor Slough A-212
Figure A-50 Headwater of Taylor Slough Transects A-213
Figure A-51 Transects East of L31N Canal A-213
Figure A-52 Transects in Vicinity of The Spreader Canal A-214
Figure A-53 Hydrologic Connectivity Transects, West to East A-214
Figure A-54 Hydrologic Connectivity Transects, North to South A-215
Figure A-55 MODBRANCH Depth, Future Without CERP, 1978 (Average Year) A-216
Figure A-56 MODBRANCH Depth, Alt2D Short + Future Without CERP, 1978 (Average Year) A-217
Figure A-57 Frog Pond Detention Area Basin Boundaries A-222
Figure A-58 Frog Pond Detention Area Soil Type Map A-223
Figure A-59 Frog Pond Detention Area Land Use Map A-224
Figure A-60 Frog Pond Detention Area Icpr Node Link Diagram A-226
Figure A-61 Inflow And Outflow (Percolation) of The Header Channel Under Dry Season Conditions A-228
Figure A-62 Stage At The Header Channel Under Dry Season Conditions A-229
Figure A-63 Mounding Water at FPDA Through Percolation From Header Channel Under Dry Season Condition A-229
Figure A-64 Water Elevation at The Header Channel and Three Detention Pond Cells Under PMP Condition A-230
Figure A-65 Mounding Water at FPDA Through Percolation From The Header Channel Under PMP Condition A-230
Figure A-66 Water Elevation at The Header Channel and The Three Detention Pond Cells Under 100-Yr/24-Hr Storm Conditions A-231
Figure A-67 Mounding Water at FPDA Through Percolationfrom Header Channel Under 100-Yr/24-Hr Storm Conditions A-231
Figure A-68 Water Elevation at The Header Channel and The Three Detention Pond Cells Under Hurricane Storm Conditions A-232
Figure A-69 Mounding Water at FPDA Through Percolation From Header Channel Under Hurricane Storm Conditions A-232
Figure A-70 Proposed Basin Boundaries – Aerojet Canal A-236
Figure A-71 Soil Type– Aerojet Canal A-237
Figure A-72 Land Use – Aerojet Canal A-238
Figure A-73 Node Link – Aerojet Canal A-241
Figure A-74 Aerojet Plug Locations A-242
Figure A-75 Aeroject Canal with 200 cfs Pumped In A-243
Figure A-76 Aerojet Canal Flow Balance With 200 cfs Pumped In A-244
Figure A-77 Effects of Mounding At South End of Aerojet Canal With 200 cfs Pumped In. A-244
Figure A-78 C-110 Plug Locations A-246

Figure A-79 L-31E Plug Location A-247

A.0 ENGINEERING PART I

A.1 PROJECT BACKGROUND

A.1.1 Instructions to Readers

For this project, the South Florida Water Management District (SFWMD) performed Preconstruction Engineering and Design (PED) activities, including preparation of construction plans and specifications (execution documents) concurrently with the USACE Jacksonville District preparation of the Project Implementation Report (decision document).

This Engineering Appendix was prepared by a design-service consultant to the SFWMD and adopted for use herein. The content and format of this appendix reflects PED-phase conclusions and may significantly exceed the minimum level of project development for a PIR.

Discussions and /or agreements referenced herein should be understood to reflect agreement of between USACE Jacksonville District, the SFWMD, and their assigned consultants. References to "the District" should be understood to refer to the SFWMD.

This Engineering Appendix references multiple reports and other documents related to surveying and mapping, geotechnical investigations, hydrologic analyses, and site development. These reports serve as data sources for a "Basis of Design Report", intended to document the criteria, considerations and conclusions related to the technical analysis and design of project components. The primary references for this appendix are included in the ***REFERENCE SECTION A.15***.

A.1.2 Introduction

The C-111 Spreader Canal Western (Project) is located in southern Miami-Dade County in an area bounded by Everglades National Park, the Florida City-Homestead area, and Manatee Bay. The Project is being implemented under the South Florida Water Management District's (SFWMD) State Expedited Construction program in cooperation with the U.S. Army Corps of Engineers (USACE) Project Development Team (PDT). A "Dual Track" approach is being used to coordinate the ongoing planning efforts of the PDT with conceptual and preliminary design of the Western project components by the State Expedited Construction Team.

Objectives of the C-111 SC Western project include:

- Reduction or elimination of discharges through the S-197 structure during storm events;
- Improved hydration of the wetlands near the C-111 Canal alignment and in the eastern portion of the ENP, including Taylor Slough;
- Increased delivery of fresh water to Florida Bay via Taylor Slough.; and
- Maintenance of the current level of flood control protection provided by the C-111 Canal.

The PDT team decided in March 2008 to divide the Western project components into north and south sections with Ingraham Highway as the division boundary. The main north components include the Frog Pond Detention Area, the Header Distribution Channel, and Pump Station S-200 (see ***FIGURE A-1*** at the end of this section). The main south components include Pump Station S-199, the Aerojet Canal Extension, the plugs within the Aerojet, C-110, and L-31E Canals, and the water control structure S-198 (***FIGURE A-1***).

WRS Infrastructure & Environment, Inc. d/b/a WRScompass was selected by the SFWMD in March 2008 to complete the C-111 SC Western project design. The C-111 SC Western project components will incorporate the design details of the Preliminary Design Report (Brown and Caldwell, October 2007) with modifications. Planned design submittals include the North Intermediate Design Report, the South Preliminary Design Report, and the South Intermediate Design Report. The North and South designs will then be submitted together in the Pre-Final Design Report and Final Design Report.

A.1.3 Real Estate Utilized for Project

The Frog Pond Detention Area (FPDA); Aerojet Canal Modification; C-110 Canal Plugs; L-31E Canal Plug and the Control Structure S-198 of this project will be constructed, operated and maintained upon land and right-of-ways owned by the SFWMD. Refer to ***FIGURE A-1*** for the location of each project component (feature). Approximately 11,564.65 acres will be necessary in order to fully operate the project. Approximately 9,687.53 acres are owned in fee by the SFWMD with an additional approximately 131.06 acres owned in fee by Miami-Dade County. The State of Florida owns approximately 15 acres and Florida Power and Light Company owns approximately 955 acres. The remaining 776.06 acres are privately owned and will have to be acquired prior to project completion. The following is a summary of the engineering requirements relating to the determination of what lands are necessary for the function of each major project component.

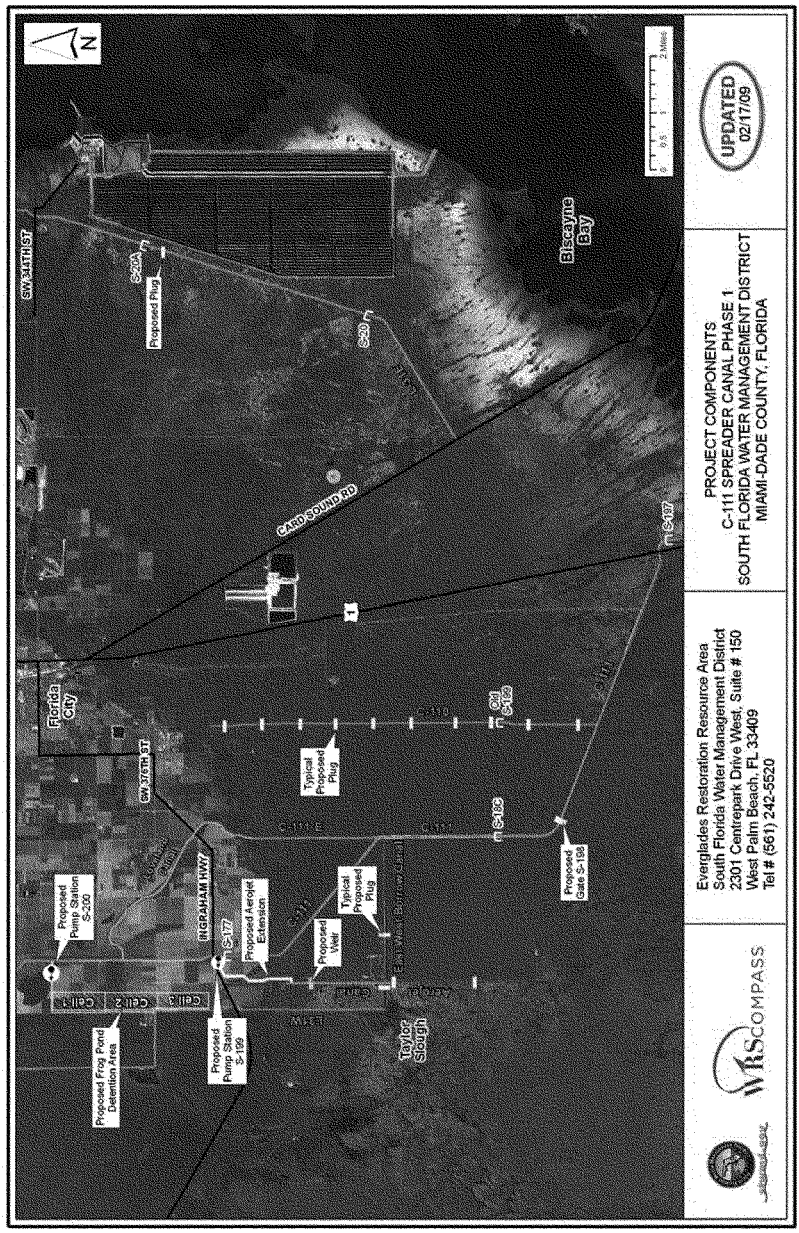


FIGURE A-1: PROJECT COMPONENTS

A.1.3.1 Frog Pond Detention Area

The Frog Pond Detention Area (FPDA) is a linear infiltration basin that will be located within the Frog Pond Lands to receive water from the C-111 Canal, via a pump station (S-200) and lined conveyance channel, in order to (1) reduce surface water flows in the C-111 Canal discharged to Manatee Bay by providing storage of water, (2) reduce seepage from Taylor Slough to the C-111 Canal by creating a hydraulic ridge between Taylor Slough and the C-111 Canal north of Ingraham Highway. See ***FIGURE A-2*** for location.

A.1.3.2 Aerojet Canal Modifications

The Aerojet Canal will be utilized as a linear infiltration basin within the Southern Glades to receive water from the C-111 Canal, via a pump station (S-199), and a conveyance channel system in order to (1) reduce surface water flows in the C-111 Canal discharged to Manatee Bay by providing storage of water, (2) reduce seepage from Taylor Slough to the C-111 Canal by creating a hydraulic ridge between Taylor Slough and the C-111 Canal south of Ingraham Highway. See ***FIGURE A-3*** and ***FIGURE A-4*** for locations of these features.

A.1.3.3 C-110 Canal Plugs

Earthen plugs will be constructed at key locations within the C-110 Canal in order to help restore pre-drainage hydroperiods within the Southern Glades. See ***FIGURE A-5*** for location.

A.1.3.4 L-31E Canal Plug

An earthen plug will be constructed within the L-31E Canal just downstream of S-20A in order to help restore pre-drainage hydroperiods within the Model Lands. See ***FIGURE A-6*** for location.

A.1.3.5 Control Structure S-198

A gated control structure will be constructed within the lower C-111 Canal, located between S-18C and the theoretical confluence of the C-111 Canal with a theoretical extension of the C-110 Canal. The proposed structure is intended to reduce current levels of seepage from the Model Lands to the lower C-111 Canal, while preserving existing levels of flood damage reduction. See ***FIGURE A-1*** for location.

A.2 SUMMARY OF PROJECT COMPONENTS

The SFWMD, as the Project Sponsor, conducted a series of workshops during the first quarter of 2008 to increase participation from the stakeholders in the development of design refinements to The Recommended Plan. The Recommended Plan will be used to complete the design of the Western phase for this Project.

The Project features north of Ingraham Highway are currently as follows:

- Pump Station S-200 with a total capacity of 225 cfs located on the west side of the c-111 canal at the same latitude as the northern boundary of the Frog Pond Detention Area;
- An above grade, concrete-lined, open channel to convey water from the S-200 discharge to the northwest corner of the Frog Pond Detention Area;
- The FPDA, an approximate 600-acre area located along the eastern boundary of the l-31W Canal with a perimeter levee subdivided by internal levees into three detention cells; and
- An above grade, unlined, open channel header distribution channel located along the western boundary of the FPDA with three weirs to allow water into the three cells of the detention area.

The C-111 SC Western project features south of Ingraham Highway are currently as follows:

- Pump Station S-199 with a total capacity of 225 cfs located on the west side of the C-111 Canal just south of Ingraham Highway and north of the existing S-177;
- An above ground, concrete-lined, open channel to convey water from S-199 to the proposed northern extension of Aerojet Canal;
- An above ground, unlined extension of the Aerojet Canal north and east to meet the C-111 Canal between Ingraham Highway and S-177;
- Earthen plugs and weirs in the Aerojet Canal, earthen plugs in the C-110 Canal, one earthen plug in the L-31E Canal; and
- A water control structure S-198 located on the C-111 Canal approximately 1.75 miles southeast of S-18C.

A.2.1 Pump Station S-200

Pump Station S-200 will be located on the west side of the C-111 Canal, north of the Ingraham Highway downstream of S-177. The purpose of this pump station is to convey water from the C-111 Canal to the Frog Pond Detention Area. The pump station will have a total capacity of 225 cfs. For operational flexibility, there will be three, 75 cfs electric motor driven axial flow submersible pumps. A diesel engine powered electric generator will provide the site with standby

electricity during power outages. All of the pumps at the pump station will have the capability to be operated remotely or automatically to increase efficiency and reduce operating costs. Operation of the pumping station will be in accordance with the Project Operations Manual (POM). See ***FIGURE A-2*** for location.

A.2.2 S-200 Conveyance Channel

The proposed S-200 conveyance channel is designed to convey water from the pump station discharge to the distribution channel within the detention area, a distance of approximately 4,500 feet. The conveyance channel will be concrete-lined and constructed above grade by removing the existing surficial soil material down to the top of limestone and constructing parallel containment levees above the limestone. The bottom and interior side slopes of the channel will be concrete lined. The bed width of the proposed channel is 20 feet with the bed elevation approximating the top of the limestone at about +3.0 feet NAVD88. The conveyance channel levees will have a 14-foot wide crest, per SFWMD design criteria, and a minimum top elevation of +9.0 feet NAVD88 as determined from wind set-up and wave run-up analyses. The levees will be constructed using a well graded mixture of silty sands and gravels excavated from identified borrow sites or other areas as designated by the SFWMD detention area (existing surficial soils). Internal and external channel side slopes will be 4H:1V. The levees will be designed to allow for vehicular traffic and will be connected to roadways around the pump station and levees around the detention area. Velocities in the channel will be maintained below 2.0 feet per second (fps) at the design pumping rate of 225 cfs. See ***FIGURE A-2*** for location.

A.2.3 Frog Pond Detention Area

The FPDA is designed to meet the requirements of a Low Hazard Potential Facility. The perimeter containment levee has an elevation of +9.0 feet NAVD88. The average height above existing ground elevation is about 5.5 feet. The preliminary design has accounted for worst case conditions including the avoidance of static water surface overtopping during the 6-hour Probable Maximum Precipitation (PMP) event and during a rainfall equivalent to the 1950 Hurricane Easy event with a Soil Conservation Service (SCS) Type III temporal distribution. The levee design, including 4H:1V side slopes in most cases, provides for a large factor of safety under post-construction, maximum depth, and rapid drawdown conditions. To create three internal cells (Cell S, Cell C and Cell N) within the detention area, two intermediate levees will be constructed within the facility. The two intermediate levees will also have crest widths of 14 feet and crest elevations of +9.0 feet NAVD88, similar to the perimeter levees. Side slopes will be set at 4H:1V on all sides. Because these levees will typically be accessed from the east, turnouts will be constructed at their western terminus to allow operation and maintenance vehicles to turn

around rather than having to back out. Like the perimeter levees, it is planned that the internal levees will be constructed of suitable material from on-site borrow sources or others areas as designated by the SFWMD. See ***FIGURE A-2*** for location.

A.2.4 Frog Pond Header Distribution Channel

The water distribution channel will be constructed inside the detention area immediately east of the western perimeter levee. As currently proposed, the distribution channel extends from the northern end of Cell N to the southern end of Cell S. The distribution channel has an existing western levee which varies in elevation from approximately 7.0 to 12.0 feet NAVD88 that will be adjusted to a minimum elevation of 9.0 feet NAVD88. The eastern berm is designed with weir sections as necessary to contain design flows and divert them into the detention area cells. The distribution channel bed width has been set at an average width of 180 feet over its entire length and has two weirs adjacent to the intermediate levee between Cell N and Cell C, and Cell C and Cell S. The crest elevation of these weirs will be 0.5' above adjacent existing ground elevations. As with the inlet channel, the water distribution channel will be constructed above grade by removing the approximate 0.5 foot of surficial soils to the top of limestone. The invert of the channel will follow the top of limestone which increases slightly in elevation from south to north. Flow passes into Cells N, C and S from the water distribution channel through 80 foot long weirs located near the midpoint of each cell berm. The weirs will be constructed with crest elevations 1.2 feet above adjacent ground elevations. The final location of the southern third of the header distribution channel could move approximately 200 ft. east of the location shown in ***FIGURE A-2,*** and the overall size of the southern cell size reduced to accommodate this change, in order to provide additional buffer to Everglades National Park. As there could be some possible westward seepage of water out of the detention area and associated cattail growth, a buffer in this area would reduce any effects on ENP to the west. Additionally, the existing L-31W Canal in this area necessitates physically moving the proposed detention area to the east. See ***FIGURE A-2*** for location.

A.2.5 Aerojet Canal Modifications

The northern limit of the existing Aerojet Canal presently lies approximately one mile south of Ingraham Highway. Although plugged at various locations, its overall length currently extends a distance of approximatley 4.6 miles. It is proposed to effectively extend the northern limit of the canal to a point approximately 2,300 feet south of State Road (SR) 9336 as an unlined above ground open channel, to construct a concrete-lined above ground channel between the northern canal extension and S-199, construct perimeter grading around all unlined portions of the canal north of the east-west borrow canal,

construct a new earthern weir with crest elevation 1.0' below adjacent natural ground, and convert all existing plugs over that same length to similar weirs.

The design concept for the Aerojet Canal is to receive water from the C-111 Canal via the S-199 pump station to create a groundwater mound that will reduce eastward migration of groundwater flow away from Taylor Slough. During the dry season, the Aerojet Canal will receive flows when the C-111 Canal experiences a rise in water level to elevation 3.8 ft NAVD88. Pumping to the Aerojet Canal will be halted if the water rises in the Cape Sable seaside sparrow Subpopulation D habitat to more than 10 centimeters above existing ground elevation at the trigger cell location denoted as 1293. See ***FIGURE A-3*** and ***FIGURE A-4*** for locations of these features.

A.2.6 Pump Station S-199

Pump Station S-199 will be located on the west side of the C-111 Canal, just south of Ingraham Highway and north of the existing S-177. The purpose of this pump station is to convey water from the C-111 Canal to the Aerojet Canal. The pump station will have a total capacity of 225 cfs. For operational flexibility, there will be three 75 cfs electric motor driven pumps. A diesel engine powered electric generator will provide the site with standby electricity during power outages. All of the pumps at the pump station will have the capability to be operated remotely or automatically to increase efficiency and reduce operating costs. Operation of the pumping station will be in accordance with the Project Operations Manual (POM). See ***FIGURE A-3*** for location.

A.2.7 S-199 Conveyance Channel

The proposed S-199 conveyance channel is designed to convey water from the pump station discharge to the proposed Aerojet Canal extension, a distance of approximately 4,440 feet. The conveyance channel will be concrete-lined and constructed above grade by removing the existing surficial soil material down to the top of limestone and constructing parallel containment levees above the limestone. The bottom and interior side slopes of the channel will be concrete lined. The bed width of the proposed channel is 20 feet with the bed elevation approximating the top of the limestone at about +2.0 feet NAVD88. The conveyance channel levees will have a 14-foot wide crest, per SFWMD design criteria, and a minimum top elevation of +8.0 feet NAVD88 as determined from wind set-up and wave run-up analyses. The levees will be constructed using a well graded mixture of silty sands and gravels excavated from identified borrow sites or other areas as designated by the SFWMD detention area (existing surficial soils). Internal and external channel side slopes will be 4H:1V. The levees will be designed to allow for vehicular traffic and will be connected to roadways around the pump station and levees. Velocities in the channel will be

maintained below 2.0 feet per second (fps) at the design pumping rate of 225 cfs. See ***FIGURE A-3*** for location.

A.2.8 Aerojet Canal Extension

The Aerojet Canal extension is designed to meet the requirements of a Low Hazard Potential Facility. The perimeter containment levee has an elevation of +8.0 feet NAVD88. The average height above existing ground elevation is about 5.5 feet. The preliminary design has accounted for worst case conditions including the avoidance of static water surface overtopping during the 6-hour Probable Maximum Precipitation (PMP) event and during a rainfall equivalent to the 1950 Hurricane Easy event with an SCS Type III temporal distribution. The levee design, including 4H:1V side slopes in most cases, provides for a large factor of safety under post-construction, maximum depth, and rapid drawdown conditions. See ***FIGURE A-3*** for location.

A.2.9 Aerojet Canal Plugs

The weirs to be constructed (and converted from existing earthen plugs) within the Aerojet Canal are designed to attenuate the flows from pump station S-199 and maximize hydraulic heads along the length of the feature. The elevated water level will create a hydraulic ridge that will serve to slow down the flow of surface and groundwater from Taylor Slough into the C-111 Canal. The weir plugs will be 100 feet in length and match the width of the canal at the respective locations. The top elevation of the weir plugs will be set at six (6) inches below average ground elevation in the vicinity of the plug. The upstream and downstream slopes of the plugs will be 4H:1V. See ***FIGURE A-4*** for location.

A.2.10 C-110 Canal Plugs

The C-110 Canal is located to the east of C-111E Canal and extents southward from S.W. 392nd Street to C-111 Canal, approximately 6.75 miles. The canal will be plugged at about 3,000-ft. intervals. The C-110 Canal plugs are proposed to reduce seepage from the marsh into the adjacent canal. The proposed plugs will be 100 feet in length and will match the width of the canal at the respective locations. The top elevation of the weir plugs will be set to match adjacent natural ground elevations in the vicinity of the plugs. The upstream and downstream slopes of the plugs will be 4H:1V. There are ten plugs proposed for this canal. See ***FIGURE A-5*** for location.

A.2.11 L-31E Canal Plug

This feature will be installed just south of S-20A on the L-31E Canal. The plug will reduce conveyance and increase water level stages in and around the canal.

The proposed plug in the L-31-E Canal is intended to raise the water level in the canal and the adjacent marsh. The plug will be 100 feet in length and match the width of the canal at the proposed location. The top elevation of the plug will be set to match adjacent natural grades. The upstream and downstream slopes of the plug will be 4H:1V. See ***FIGURE A-6*** for location.

A.2.12 Control Structure S-198

S-198 will be a gated spillway control structure constructed on the C-111 Canal approximately 1.75 miles southeast of S-18C. When closed, it will help reduce seepage from the adjacent marsh. When open, it will pass flood flows with only very minimal head losses. See ***FIGURE A-1*** for location.

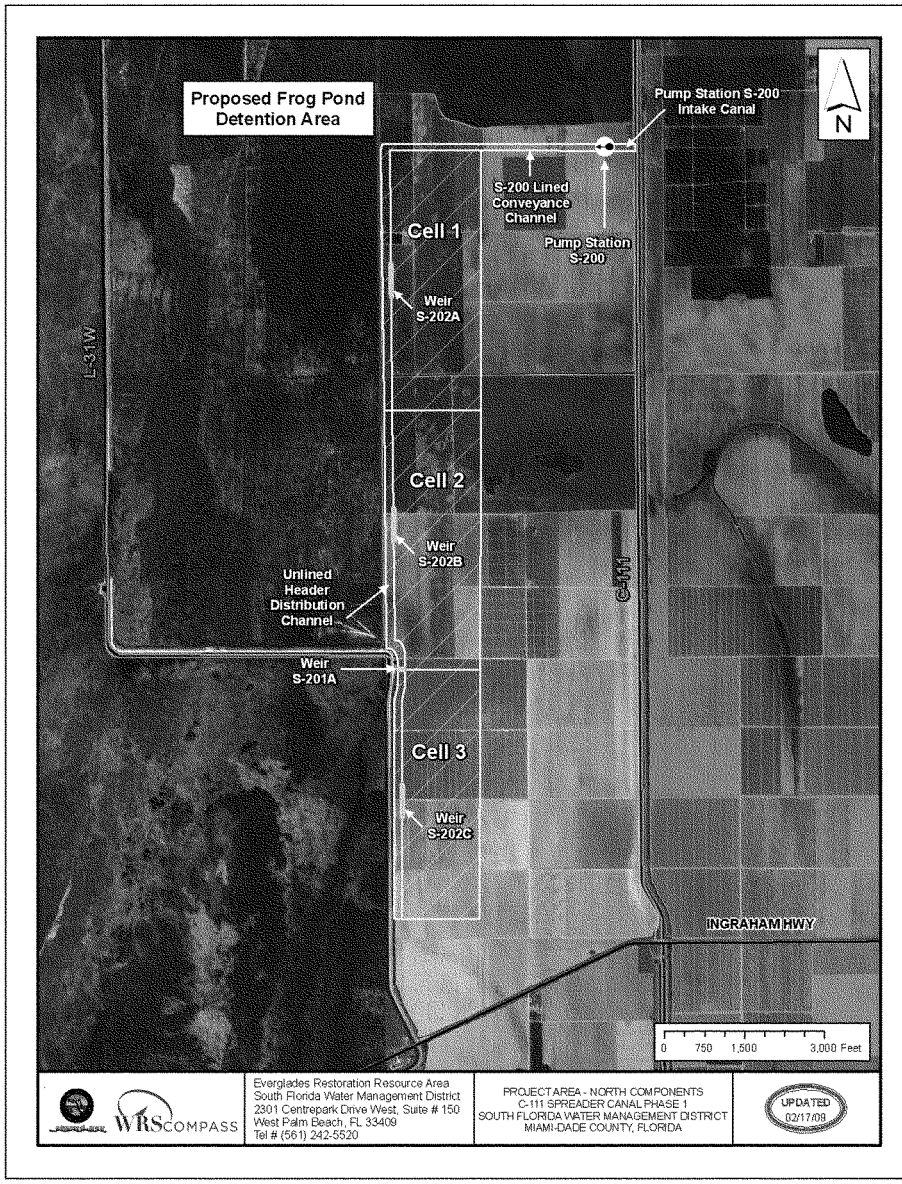


FIGURE A-2: S-200 AND FROG POND DETENTION AREA

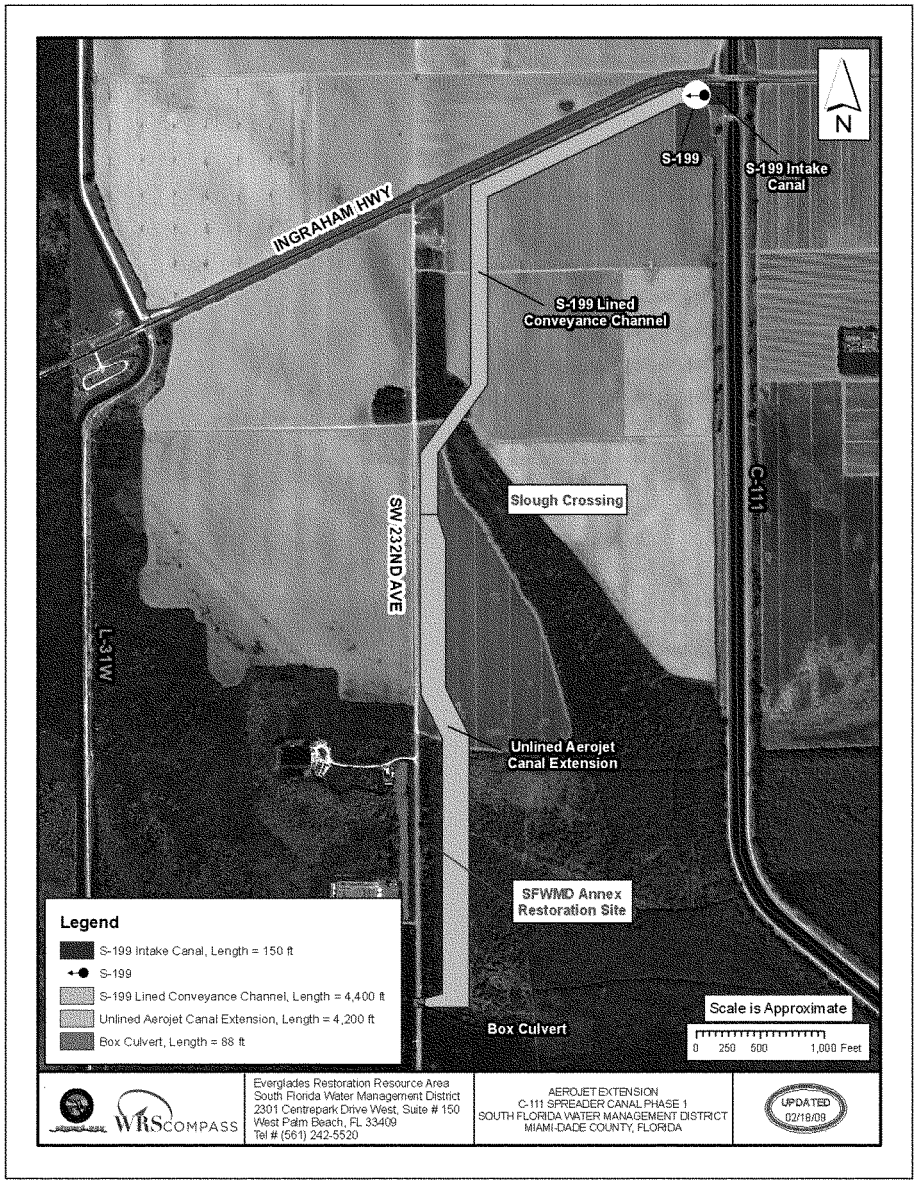


FIGURE A-3: S-199 AND AEROJET CANAL EXTENSION

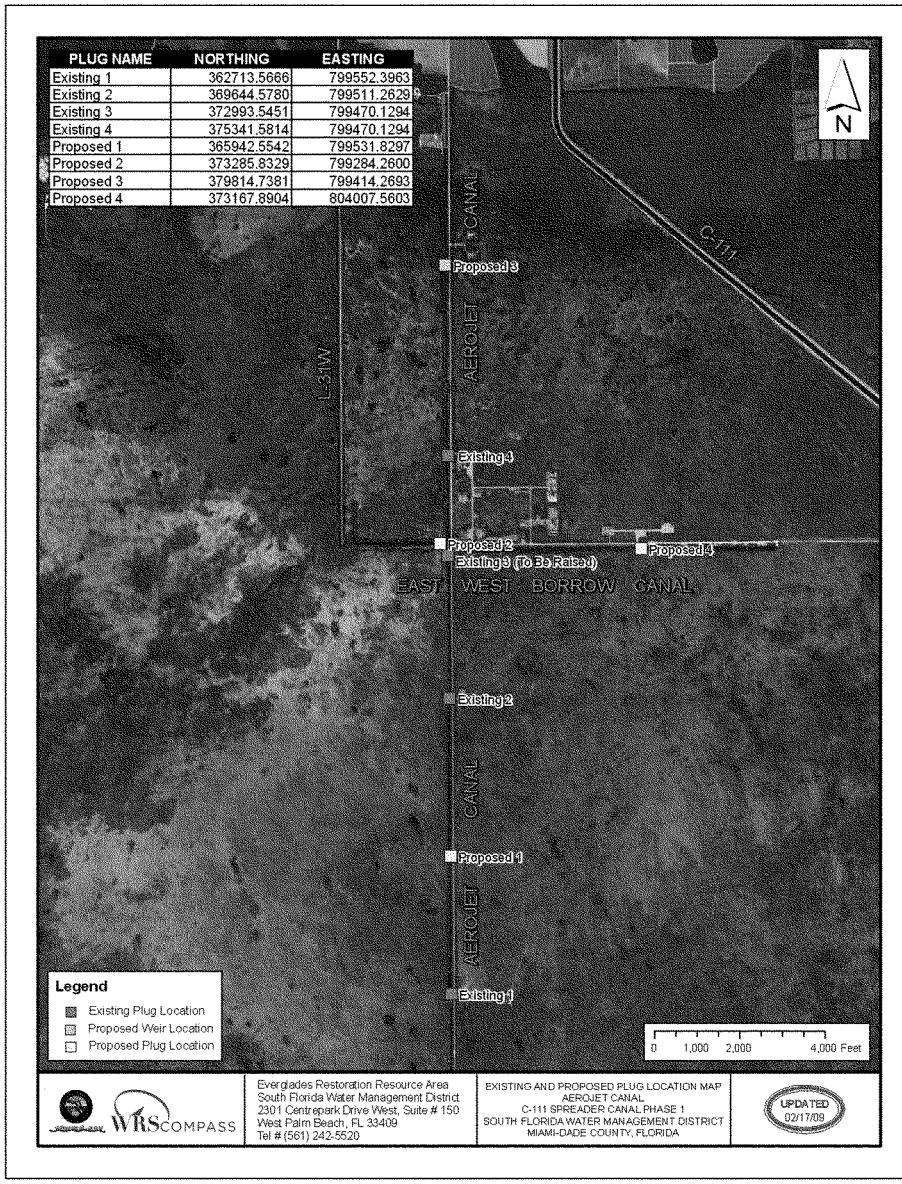
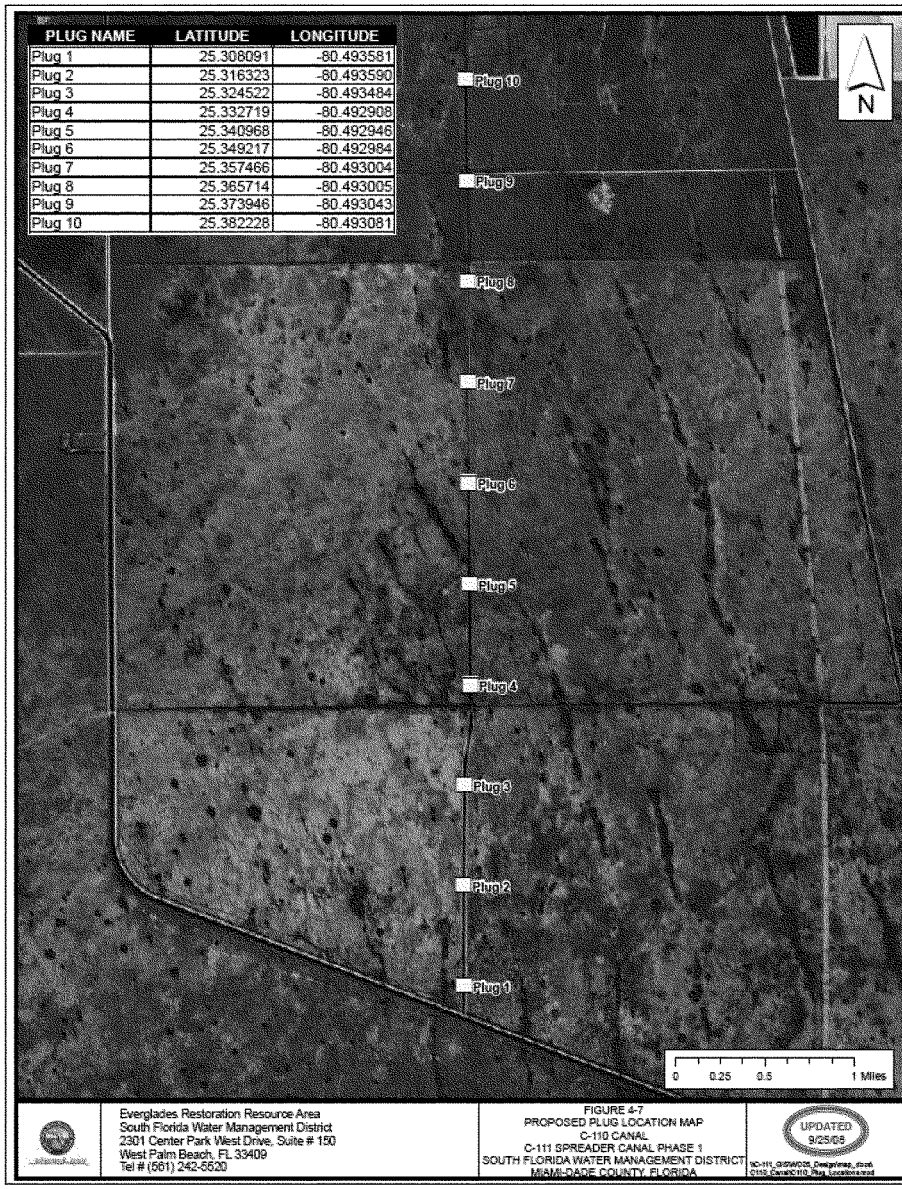


FIGURE A-4: AEROJET CANAL PLUGS



PLUG NAME	LATITUDE	LONGITUDE
Plug 1	25.308091	-80.493581
Plug 2	25.316323	-80.493590
Plug 3	25.324522	-80.493484
Plug 4	25.332719	-80.492908
Plug 5	25.340968	-80.492946
Plug 6	25.349217	-80.492984
Plug 7	25.357466	-80.493004
Plug 8	25.365714	-80.493005
Plug 9	25.373946	-80.493043
Plug 10	25.382228	-80.493081

FIGURE A-5: C-110 CANAL PLUGS

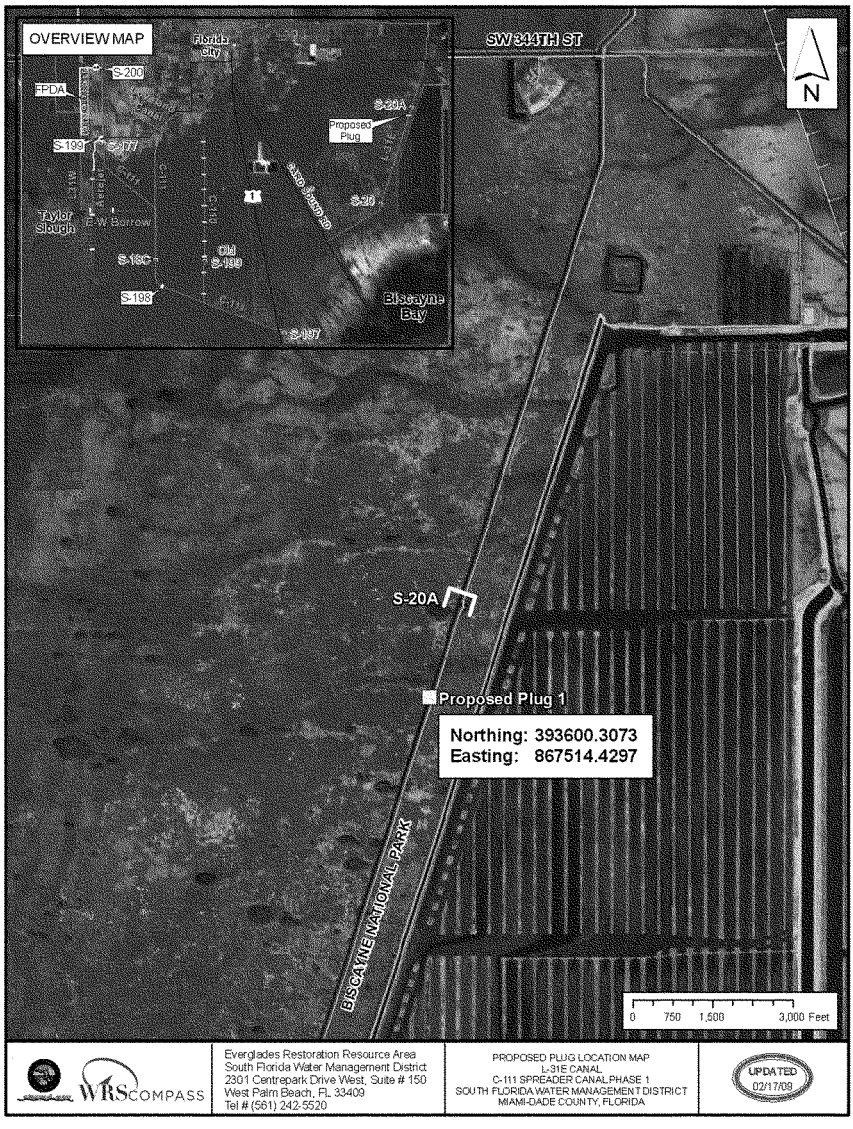


FIGURE A-6: L-31E CANAL PLUG

A.3 TOPOGRAPHIC AND BOUNDARY SURVEYS

A.3.1 Legal Description of Project Location

The C-111 Spreader Canal Project is located within a 100-square mile area in southern Miami-Dade County between the Everglades National Park (ENP) and the Florida City-Homestead area. From north to south in the project components are located in the following:

- Sections 30 and 31 of Township 57 South and Range 38 East;
- Sections 6 and 7 of Township 58 South and Range 38 East,
- Sections 18, 19, 30 and 31 of Township 58 South and Range 38 East, and
- Section 5 of Township 58 South and Range 40 East.

A.3.2 Historical Surveys

Three forms of survey data where reviewed for design purposes. The first set of data reviewed were published USGS topographic quadrangles of the project site. The second set of data was the USACE LiDAR Data. The third set of data was the survey work performed for the "Everglades Construction Project, C-111 Spreader Canal" by Weidener Surveying and Mapping, P.A. (WSM) under contract No. CN040935.

The following USGS 7.5-Minute Series Quadrangle maps where reviewed to assess the general elevation and to identify specific topographic features across the project site.

- Royal Palm Ranger Station Quadrangle (NGVD 29)
- Homestead Quadrangle (NGVD 29)
- Royal Palm Ranger Station SE Quadrangle (MSL)
- Glades Quadrangle (NGVD 29)

General elevations range from +10.0 – 0.0 feet (respective to their associated datum). Relief across the site is in a southwest to southerly direction, from the highest elevations to the lowest elevations.

LiDAR (Light Detection And Ranging) is being used in many applications when topographic information is needed for large areas. LiDAR is performed by a device mounted to an airborne platform that emits pulses of a focused infrared laser. The laser is reflected off of the ground surface and captured by a discriminator. The discriminator processes the elapsed time between transmitted and received signals and the distance from the ground surface to the platform is determined. The data is then processed further to generate surface models, elevation models and contours within a region. While LiDAR data is capable of covering large expanses of land in very little time, areas where heavy

vegetation exists require additional calibration techniques in order to produce accurate topographic information.

As noted in the BODR and the Frog Pond Detention Area Preliminary Design Report, LiDAR data was used as input to the hydraulic modeling. It has been known that the existing LiDAR data is approximately 0.76 feet higher in elevation than existing conventional survey data. It is recommended that additional calibration data be collected in order to perform final modeling analyses.

Conventional survey data was collected by WSM by utilizing a Global Positioning System (GPS) and a network of three control points. Topographic data was collected by WSM at various intervals around key areas. These areas are as follows;

- S-20 Spillway Structure
- Proposed Spreader Canal Alignment and Card Sound Intersection
- Proposed Spreader Canal Alignment and U.S. Highway 1 Intersection
- C-111 Canal Bridge at Ingraham Highway
- Proposed Pump Station at the Existing C-111 Canal and Proposed Spreader Canal Alignment Intersection
- Along Ludlum Slough
- At Geotechnical Boring Locations
- At Frog Pond Detention Area

More specifically the Weidener survey, a specific purpose survey, was conducted August 2007 to provide cross-sections, topographic details in various locations throughout the project site and the location of geotechnical borings. Collected data consists of survey information from the following areas:

1. The area known as the Frog Pond located north of Ingraham Highway adjacent to the eastern boundary of ENP located in Sections 30 and 31, Township 57 South, Range 38 East and Sections 6 and 7, Township 58 South, Range 38 East.
2. Pump Station S-200 a 1000ft X 1000ft grid located in Section 6, Township 58 South, Range 38 East.
3. The area between Ingraham Highway and the Fish Farm located in Section 7, Township 58 South, Range 38 East.
4. The area of the Fish Farm facilities (the southernmost is abandoned) located in Sections 7 and 8, Township 58 South, Range 38 East.
5. Three cross-sections at 8800-ft intervals along the Aerojet Canal along the centerline profile starting south of the southernmost fish farm – located in Sections 18, 19, 30 and 31, Township 58 South, Range 38 East.

A.3.3 Recent Project Specific Surveys

Miller Legg, a sub-consultant to WRS compass in support of the C-111 SC project, conducted a specific purpose survey September 2008, not a boundary survey, to provide cross-sections, profiles, topographic details in various locations and the locations of geotechnical borings.

More specifically, the following areas were surveyed as described:

1. Pump Station S-200 Site–a 500 ft x 200 ft area with shots taken on 25 ft x 25 ft grids. Included is a cross-section of the C-111 Canal in an area located approximately 3 miles north from the bridge over the C-111 Canal on Ingraham Highway in Section 30, Township 57 South, Range 38 East.
2. Pump Station S-199 Site–a 400 ft X 400 ft area with shots taken on 25 ft x 25 ft grids. The area is located south and east from the edge of pavement of the intersection of Ingraham Highway and SW 232nd Avenue in Section 7, Township 58 South, Range 38 East.
3. The west bank of C-111 Canal at the bridge, a 300 ft x 300 ft area with shots taken on 50 ft x 50 ft grids. Included is a cross-section of the C-111 Canal on the west bank below the bridge of the canal on Ingraham Highway in Section 7, Township 58 South, Range 38 East.
4. Along the proposed Aerojet Canal Extension to S-199, a 4300 ft x 4300 ft area with shots taken on 50 ft x 50 ft grids. The area is located south and west from the edge of pavement of the intersection of Ingraham Highway and 232nd Avenue in Section 7, Township 58 South, Range 38 East.
5. The proposed C-111 Canal water control structure (S-198), a 350 ft x 500 ft area with shots taken on 25 ft x 25 ft grids. Also, included is a cross-section of the C-111 Canal in Section 10, Township 59 South, Range 38 East.
6. L-31E Canal cross-sections, two sections taken approximately 7000 ft south of the intersection of SW 360th Street and the Levee Road in Section 5, Township 58 South, Range 40 East.
7. Cross-sections taken along the entire lengths of both the Aerojet and C-110 Canals at specific locations with profiles along the apparent center of the canals taken at 500-ft intervals and including survey of drainage structures.

A.4 GEOTECHNICAL STUDIES

A.4.1 General Purpose

The purpose of the geotechnical studies was to develop subsurface information concerning the site from data associated with core borings and other subsurface evaluations. The information will be used to evaluate the soils and rock for

adequacy of canal and embankment construction, canal seepage, and foundation design for the pump station and water control structure.

A.5 GEOLOGY

A.5.1 Regional Geology

The regional geology of South Florida generally consists of near subsurface Recent- Holocene and Pleistocene deposits (0 to 100 feet) overlying Miocene (100 to 1,000 feet), Oligocene (1,000 to 1,200 feet), Eocene (1,200 to 2,800 feet) and Paleocene (2,800 feet and below) deposits.

Eastern Miami-Dade County area is underlain by the Biscayne Aquifer that is composed chiefly of permeable sandy limestone and sand that range in age from late Miocene through Pleistocene and extends along the eastern coast of Florida from Miami-Dade County to Palm Beach County. The upper materials consist of oolitic Miami Limestone and sands of the Fort Thompson, Anastasia, or Key Largo formations together forming the Biscayne Aquifer, one of the most permeable in the United States. The upper Miami Oolite Formation is typically mantled by a surface layer of organic peats and silty marls.

The Miami Limestone consists of sandy, oolitic limestone, and the saltwater facies of the Fort Thompson Formation, which is comprised of fossiliferous saltwater limestone and has likely deteriorated due to freshwater solutioning. Due to the intrusion of salt water, which naturally occurs along the coast, the ground water at the project site is anticipated to be saline, thus preventing further solutioning. Openings created by solutioning are generally filled with sand and are not continuous for any considerable lateral extent. These openings and natural joints are the conduits responsible for high permeabilities in the formations. The jointing in the near-surface Miami Limestone is typically vertical and cuts in the rock generally do not expose significant bedding planes. Beneath the upper Recent to Pleistocene deposits, are the deep-seated Miocene Tamiami and Hawthorn formations, and the Tampa formations. Below the deep-seated Miocene deposits, Oligocene Deposits consist of Suwannee Limestone. Beneath the Suwannee Limestone of the Oligocene period, limestones of the Avon Park, Lake City and Oldsmar formations can be found down to depths of 3200 feet.

A.5.2 Soil Survey

The U. S. Department of Agriculture, Soil Conservation Service (USDA, SCS) publication entitled "Soil Survey of Dade County Area, Florida" issued January 1996, shows the project areas to be underlain by soil units defined as:

- Biscayne gravelly marl, drained
- Krome very gravelly loam

- Biscayne marl
- Biscayne marl, drained
- Chekika very gravelly loam
- Biscayne-Rock outcrop complex
- Pennsuco marl
- Perrine marl

The above soil units are described as follows:

- Biscayne gravelly marl, drained: This unit is described in SCS as a very shallow, nearly level, poorly drained soil. Typically, the surface layer is about 7 inches of dark gray gravelly marl that has a texture of silt loam. It is underlain by hard, porous limestone having less than 20 percent solution holes that are 4 to 12 inches deep and 6 to 18 inches wide and contain very dark grayish brown silty clay.
- Krome very gravelly loam: This unit is described in SCS as a very shallow, nearly level, moderately well drained soil. Typically, the soil is dark brown very gravelly loam about 7 inches thick. Hard, porous limestone bedrock is at a depth of about 7 inches. Solution holes in the limestone extend to a depth of about 10 inches. They contain silty clay loam or silty clay. The water table in areas of the Krome soil is within the limestone bedrock. It is at a depth of 40 to 60 inches in most years. Permeability is moderate.
- Biscayne marl: This unit is described in SCS as a very shallow or shallow, nearly level, very poorly drained soil. It is ponded for 2 to 4 months in most years. Typically, the surface layer is about 5 inches of gray marl that has a texture of silt loam. Below this, to a depth of about 17 inches, is gray or grayish brown marl that has a texture of silt loam. Hard, porous limestone bedrock is at a depth of about 17 inches. The water table in the Biscayne marl remains at or above the surface for 2 to 4 months during most years, receding to as deep as 20 inches during dry periods. Permeability is moderate.
- Biscayne marl, drained: This unit is described in SCS as a very shallow or shallow, nearly level, poorly drained soil. Typically, the surface layer is about 5 inches of gray marl that has a texture of silt loam. The underlying layer, to a depth of about 15 inches, is gray and light gray marl that has a texture of silt loam. Hard, porous limestone bedrock is at a depth of about 15 inches. It has scattered small solution holes containing very dark gray, no calcareous mucky silt loam. The water table in the Biscayne marl drained remains within 10 inches of the surface for 4 to 6 months during most years, receding to as deep as 20 inches during dry periods. Permeability is moderate.
- Chekika very gravelly loam: This unit is described in SCS as a very shallow, nearly level, somewhat poorly drained soil. Typically, the surface

layer is dark grayish brown very gravelly loam about 5 inches thick. Hard, porous limestone bedrock is at a depth of about 5 inches. Solution holes in the limestone extend to a depth of about 9 inches. They contain silt loam or silty clay loam. The water table in areas of the Chekika soil is within the limestone bedrock. It is at a depth of 12 to 36 inches in most years. Permeability is moderate.

- Biscayne-Rock outcrop complex: This unit is described in SCS as consisting mainly of Biscayne marl intermingled with areas of Rock outcrop. The Biscayne soil and Rock outcrop occur as areas so intermixed or so small that mapping them separately is impractical. Typically, the surface layer of the Biscayne soil is about 4 inches of grayish brown marl that has a texture of silt loam. Hard, porous limestone bedrock is at a depth of about 4 inches. It has solution holes that contain silty clay or clay. The water table in the Biscayne soil is below the surface for the majority of most years, but the soil can be briefly ponded during extremely wet periods. Permeability is moderate.

Pennsuco marl: This unit is described in SCS as deep, nearly level, very poorly drained soil. Typically, the surface layer is about 4 inches of light brownish gray marl that has a texture of silt loam. The underlying layer, to a depth of about 46 inches, is light gray marl that has a texture of silt loam. Soft, porous limestone bedrock is at a depth of about 46 inches.

Perrine marl: This unit is described in SCS as moderately deep, nearly level, very poorly drained soil. Typically, the surface layer is about 4 inches of grayish brown marl that has a texture of silt loam. The underlying layer, to a depth of about 29 inches, is light gray and light brownish gray marl that has a texture of silt loam. Soft, porous limestone bedrock is at a depth of about 29 inches.

A.5.3 Topography

A review of the C-111 Spreader Canal Western project Topographic Survey conducted by Weidner Survey and Mapping (now Miller-Legg), dated August 13, 2007, reveals that the approximate ground elevation within the Detention Area site varies between about +2.4 and +3.8 feet with respect to North American Vertical Datum of 1988 (NAVD88).

The United States Geological Survey (USGS) Quadrangle Maps for Royal Palm Ranger Station, Florida, dated 1956 (and photo-revised 1973) and for Royal Palm Ranger Station SE, Florida, dated 1967 indicate that the approximate ground elevation with respect to Mean Sea Level (MSL) and National Geodetic Vertical Datum of 1929 (NGVD) for the project features as follows:

- Pump Station S-200 and Aerojet Canal area varies between about 3.4 and 4.4 ft NAVD88 (+5 and +6 feet MSL and NGVD)
- S-198 Structure vicinity area about 2.4 ft NAVD88 (+4 feet NGVD)

The approximate conversion equation, National Geodetic Vertical Datum (NGVD) to NAVD88 is; NAVD88 = NGVD29 – 1.59 feet

A.5.4 Historical Surface Water and Groundwater Data

RADISE, in Geotechnical Report-Frog Pond Detention Area (April 2008) reviewed historical surface water and groundwater elevations information obtained from the SFWMD DBHYDRO database. Data retrieved by RADISE from the DBHYDRO web site was in the NGVD29 and converted in NAVD 88 using the conversion equation above.

A.5.4.1 Historical Surface Water Data

The Detention Area site is surrounded by the C-111, L-31W and C-113 Canals. The C-111 Canal runs north-south in direction and is located near the eastern boundary of the Detention Area site. The L-31W Canal runs north-south in direction and is located immediately west of the Detention Area site. The C-113 Canal is east-west in direction and located northeast of the property boundary.

Information obtained from the SFWMD DBHYDRO database indicates that control structures S-176, S-174, S-332D, and S-175 are located on C-111, L-31W and C-113 Canals. RADISE reviewed historical surface water elevations of these canals at the corresponding water structures.

- Spillway structure S-176 is located on the Canal C-111 at Levee L-31V. During the years 1988 through 2007, upstream surface water elevations ranged between 0.0 and +5.4 feet NAVD88 and downstream surface water elevations ranged between -0.2 and +5.0 feet NAVD88.
- Spillway structure S-174 is located at Levee L-31W, near its junction with C-111 Canal. During the years 2003 through 2007, upstream surface water elevations ranged between +1.4 and +5.3 feet NAVD88 and downstream surface water elevations ranged between +0.5 and +5.1 feet NAVD88.
- S-332 Pump Station is located on the L-31W Canal. During the years 2000 through 2007, upstream surface water elevations ranged between +0.4 and +5.0 feet NAVD88 and downstream surface water elevations ranged between +0.5 and +5.1 feet NAVD88.
- Culvert structure S-175 is located on the L-31W Canal near U.S. Highway 27. During the years 1992 through 2007, upstream surface water elevations ranged between +0.3 and +5.0 feet NAVD88 and downstream surface water elevations ranged between -0.9 and +4.0 feet NAVD88.

A.5.4.2 Historical Groundwater Data

Two SFWMD groundwater monitoring wells FRGPD2_G and FROGP_G are located within the Detention Area.

- During the years 1996 through 2007, reported groundwater elevation data at the FRGPD2_G well ranged between +0.3 and +4.4 feet NAVD88.
- During the years 1984 through 2007, reported groundwater elevation data at the FROGP_G well ranged between +0.3 and +4.7 feet NAVD88.

A.5.5 U.S. Geologic Survey Published Data

Groundwater elevation data presented on the "Hydrogeology of the Surficial Aquifer System, Dade County, Florida" map published by the U.S. Geological Survey (USGS) (dated 1991) indicates that groundwater levels in the project vicinity are between -0.5 and +1.5 feet NAVD88.

A.5.6 Permeability Data

WRScompass has reviewed the following literature and geotechnical reports of projects near the project vicinity to understand subsurface permeability conditions. Summarized information from these reports is presented in the subsequent sections.

- The United States Army Corps of Engineers (USACE) Central and South Florida Project Supplement 7–Design Memo, Permeability Investigations by Well Pumping Tests, dated February 1953. The pump well was drilled into the aquifer for a total depth of 50 feet. The test results indicate that the permeability varies between 5.4 x 10-3 to 4.3 x 10-1 feet/sec.
- The U.S. Geological Survey for the south Miami-Dade County area indicates that the Biscayne Aquifer has a documented transmissivity in the range of 500,000 to 2,000,000 square feet per day (ft2/day).
- The "Draft Feasibility Report and Supplemental Environmental Impact Statement (SEIS), obtained from CERP web site, indicates that several permeability tests were performed in Miami-Dade County. The permeabilities given for the cap rock were 50 and 200 ft/day in the vertical and horizontal directions, respectively. The permeabilities assumed for the Biscayne Aquifer were 5,000 and 20,000 ft/day in the vertical and horizontal directions, respectively.
- Biscayne Bay Coastal Wetlands and C-111 Spreader Canal Conceptual Model, Technical Memorandum (Task 1) prepared by U.S. Army Engineer Research Development Center, obtained from CERP web site. "The average permeability (hydraulic conductivity) of limestone formation over most of the area is tens of thousands of feet per day, possibly exceeding an

average of 40,000 ft/day." *TABLE A-1* presents Estimated Hydraulic Conductivity Values as:

TABLE A-1: ESTIMATED HYDRAULIC CONDUCTIVITY VALUES

Geologic Unit	Hydraulic Conductivity range (ft/day)
Everglade Peat	0.1 to 10
Lake Flirt Marl	0.1 to 10
Miami Oolite	10,000 to 40,000
Ft. Thompson Formation	100 to 20,000
Anastasia Limestone	100 to 20,000

A.6 GEOTECHNICAL ENGINEERING EVALUATION

A.6.1 Existing Geotechnical Data Review

Three geotechnical reports prepared by RADISE International were reviewed. The reports are as follows:

- "Report of Geotechnical Services for Basis of Design, C-111 Spreader Canal Project", Contract No. CN-040935 dated March 14, 2006
- "Draft Geotechnical Report, Proposed Frog Pond Detention Area" dated September 14, 2007
- "Geotechnical Report, Frog Pond Detention Area" dated April 11, 2008

These reports present such data as: existing site conditions, review of topography, soil surveys, surface and groundwater data (including infiltration tests), field explorations, subsurface conditions (muck probes, SPT borings, rock core borings and test pits), laboratory data and a geotechnical engineering evaluation.

In general, the existing reports present sufficient geotechnical data with respect to the C-111 Canal, C-111 Spreader Canal and the Frog Pond Detention Area. The existing report does not have geotechnical data collected along the alignment of the Aerojet Canal, L-31W Canal or at any proposed borrow areas. It should be noted that proposed borrow areas and the engineering properties of their material will be addressed in a future Technical Memorandum.

A total of thirty (30) Standard Penetration Test (SPT) borings, nine (9) rock core borings, one hundred and thirteen (113) muck probes and fifteen (15) test pits were conducted by RADISE across the North and South project sites under a previous work order. The SPT borings ranged from thirty (30) feet to one hundred and ten (110) feet below the existing grade. Rock core borings were

advanced from the ground surface to depths of up to fifty-three (53) feet below grade. The muck probes were pushed until the extent of soft material was encountered (a maximum of 34 inches) and test pits excavated to determine stratigraphy, surficial layer thickness and stability of open pit walls.

During the drilling operations, logs for each boring were maintained. The boring logs contain such information as; depth of boring, number of blows per every 6-inch advancement of the drill rod, field classification of soil recovered and depth of apparent water table. Soil samples were collected and brought back for laboratory analyses. The following tests were performed on samples to properly identify engineering properties associated with the soils encountered during the drilling operations;

- Moisture Content
- Sieve Analysis
- Permeability
- Organic Content

With respect to the core samples collected from the core borings, a percent recovery ratio (REC) and the Rock Quality Designation (RQD) were determined and selected samples were then tested for:

- Unconfined Compressive Strength
- Splitting Tensile Strength
- Specific Gravity

WRScompass also reviewed the existing surface water data, groundwater data and the test results from the infiltration tests performed by RADISE. The surface water and groundwater data was compiled from data obtained from the SFWMD DBHYDRO website by RADISE and is presented in the project Geotechnical Report and the infiltration test data collected from one (1), large scale infiltration test and three (3) double-ring infiltrometer tests.

A.6.2 SPT and Rock Core Borings

SPT and rock core borings were performed by RADISE to assess the soil characteristics at the locations of the project features.

Boring locations were established jointly by the SFWMD, WRS and RADISE. Because of the existing geotechnical data previously collected within the Frog Pond Detention Area (FPDA), only two borings were conducted. These two borings, CP08-C111S-CB-0040 and CP08-C111S-CB-0040A where performed at the proposed location of Pump Station S-200. All SPT and rock core borings were drilled using 3 and 6 inch diameter casings, respectively. Rock core borings were located within 15 feet of the SPT borings. After completion of drilling

activity each boring was properly grouted. Individual SPT and core boring profiles plotted using AutoCAD and gINT are included in the Geological report. Shorter boring numbers used in the tables and the associated project feature is shown below.

TABLE A-2: SPT BORINGS

CERP Boring No.	Corresponding Boring No.	Boring type	Feature
CP08-C111S-CB-0037	CB-0037	SPT	Aerojet Canal
CP08-C111S-CB-0037A	CB-0037A	Rock core	
CP08-C111S-CB-0038	CB-0038	SPT	
CP08-C111S-CB-0038A	CB-0038A	Rock core	
CP08-C111S-CB-0039	CB-0039	SPT	
CP08-C111S-CB-0039A	CB-0039A	Rock core	
CP08-C111S-CB-0040	CB-0040	SPT	Pump Station No.1
CP08-C111S-CB-0040A	CB-0040A	Rock core	
CP08-C111S-CB-0041	CB-0041	SPT	Pump Station No.2
CP08-C111S-CB-0041A	CB-0041A	Rock core	
CP08-C111S-CB-0042	CB-0042	SPT	S-197B structure
CP08-C111S-CB-0042A	CB-0042A	Rock core	

A.6.2.1 SPT Borings

The subsurface exploration at the site included SPT borings performed in general accordance with ASTM D 1586.

- Three SPT Borings were drilled to a depth of 20 feet below the existing grade along the Aerojet Canal.
- Three SPT Borings were drilled to a depth of 75 feet below the existing grade at the proposed three structures locations.

Samples recovered from the borings were field classified, placed in moisture-proof jars and returned to the laboratory for review and classification by a geotechnical engineer.

A.6.2.2 Rock Core Borings

The subsurface exploration at the site also included rock core borings performed in general accordance with ASTM D 2113-99 procedures.

- Three rock core borings were drilled to a depth of about 23 feet below the existing grade along the Aerojet Canal.
- Three rock core borings were drilled to a depth of about 53 feet below the existing grade at the three proposed structures locations.

Retrieved rock cores were placed within wooden compartmentalized boxes. The wooden compartmentalized boxes were then transported to the RADISE laboratory for photographing, classification and testing. The percent recovery ratio (REC) and the rock quality designation (RQD) were measured in RADISE's laboratory by a geotechnical engineer.

Detailed rock coring times with respect to depth are shown on gINT and AutoCAD boring logs.

A.6.3 Groundwater

Groundwater levels recorded in the boreholes upon completion of drilling activities are as follows:

TABLE A-3: GROUNDWATER LEVELS

Boring No.	Groundwater Depth (ft)
CB-0037	4.2
CB-0038	2.5
CB-0039	3.4
CB-0040	4.4
CB-0041	4.7
CB-0042	3.7

A.6.4 Visual Classification

The samples obtained from SPT borings were visually examined and classified in accordance with the Unified Soil Classification System (ASTM D 2487) and geologic nomenclature. Undisturbed limestone samples obtained from core borings were visually examined according to geologic nomenclature, drilling time, measured REC and RQD data. The stratification of each stratum is described below.

- Localized Man-Made Fill: This was a variable mixture of crushed limestone, silt sands and scattered organics with varying thickness along the existing access roads (Stratum 1).

- Organic Soils: Surficial soils exposed to the ground surface generally consist of organic silt to fibrous peat (Stratum 2).
- Silty Sand (Marl): 0.3 to 1.5 feet thick silty sands with limestone fragments generally found over the limestone formation (Stratum 3).
- Limestone Formation: Variation in limestone formation was found during drilling activity and generally consists of vuggy limestone with various sized voids and limestone with sand zones to well-cemented limestone.

Due to the variation in limestone formation, limestone was further divided into two different strata described as well-cemented vuggy limestone with various sized voids (Stratum 4) and weakly to moderately cemented limestone with low plasticity silt to calcareous silt, trace to some shell fragments (Stratum 5).

- Sandy Soil: Underneath the limestone formation relatively clean sands to silty sands exist. These soils extend to the maximum depths explored (Stratum 6).

Tabulated generalized descriptions of the stratigraphy are shown below:

TABLE A-4: STRATIGRAPHY DESCRIPTIONS

Stratum No.	Description
1.	Gray, brown gravel size LIMEROCK with silty sand (Fill)
2.	Dark brown ORGANIC SILT with some fibrous peat (PT)
3.	Gray, brown slightly silty SAND to sandy SILT with limerock fragments (SP-SM, SM, ML) (Marl)
4.	Gray, brown, tan vuggy LIMESTONE with various size of voids
5.	Gray, brown LIMESTONE with low plasticity silt to calcareous silt, trace to some shell fragments
6.	Brown, gray fine to medium SAND with silt (SP, SP-SM, SM)

A.6.5 Soil Testing

A.6.5.1 Soil Index Property

Selected samples of the soil recovered from the borings were tested for its index properties to aid in their classification. The following tests were performed accordingly:

- Moisture Content Tests (ASTM D 2261)
- Gradational Properties Tests (sieve analysis ASTM D 422)

- Percent of material passing through Sieve No. 200 (ASTM D 1140)
- Organic Content(ASTM D 2974)
- Atterberg limits (ASTM D 4318)

A summary of laboratory test results is presented in Geotechnical Report Information–C-111 Spreader Canal Phase 1 (RADISE, September 2008). Gradational properties test results are also shown graphically.

A.6.5.2 Corrosivity Test

Three soil samples of the subsoils recovered from the structure borings were analyzed for corrosion parameters that include pH, chloride content, sulfate content and resistivity.

The corrosivity/aggressivity potential of the soils are classified according to criteria utilized by the Florida Department of Transportation for bridge substructures and other steel reinforced concrete structures in direct contact with soil.

TABLE A-5: CORROSIVITY TESTING RESULTS

Boring No.	Composite Sample Depth (feet)	Corrosion Parameters				Corrosivity/ Aggressivity Potential
		pH	Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)	
CB-0040	4.0 – 6.0	8.85	6500	4.7	10	Slightly Aggressive
CB-0041	4.0 – 6.0	9.11	6800	7.6	6.2	Slightly Aggressive
CB-0042	2.0 – 3.7	9.30	7300	5.3	7.3	Slightly Aggressive

A.6.6 Rock Testing

Recovery Ratio and Rock Quality Designation were performed on all the rock core samples. Splitting tensile strength tests and Unconfined Compression strength tests were performed on select rock core samples.

A.6.7 Subsurface Evaluation

The borings disclosed a generally consistent stratigraphy across the project site. Surficial soils that are soft (marl) were anticipated based on USDA/SCS literature. However, surficial soft soils were not encountered in few borings. This is due to the fact that the borings were performed on/around roadways and access roads (paved and unpaved). These areas have been modified for the

roadway construction. About 3 to 4 feet of soft soils were found on the canal banks along Aerojet Canal near the boring locations.

Subsurface conditions from the borings at different project features indicate that, in general about 1.5 to 4 feet of overburden soils exist over limestone that has thickness varying between 43 to 56 feet. The limestone is underlain by fine to medium grained sands that are present to the maximum explored depth of 75 feet below the existing ground surface. Drillers recorded drilling fluid circulation losses in the limestone formation in some of the borings. These drilling fluid losses are representative of zones of porosity in the limestone. Based on the laboratory test results of the retrieved rock core samples, the void ratio of the tested rock samples was found to be as high as 0.33 (33 percent). Since the tests were performed on intact samples, RADISE anticipates the in-situ void ratio of the limestone layer to be much higher at certain locations.

The base of the limestone layer is believed to be the bottom of the Biscayne Aquifer. The thickness of the Biscayne Aquifer is reported to be in the range of 40 to 60 feet.

A.6.8 FPDA Seepage Evaluation

A.6.8.1 General Description and Background

An analysis of the seepage related impacts of the project configuration and operational policies for the proposed Frog Pond Detention Area was conducted by WRScompass.

In order to best meet the project objectives, the Western project requires the ability to withdraw water from the C-111 Canal at a rate of 200 cfs and to divert that water into a concrete lined channel for approximately 4,500 feet. At this point the water is then conveyed into an unlined header channel to the south. The intent of the header channel is to distribute water into three detention areas, cell N, cell C and cell S. For this purpose, a cross section was generated across the southern portion of the FPDA from west to east and encompasses the L-31W Canal, the FPDA header channel and the FPDA.

A graphical representation of this cross section was input into SEEP/W and a numerical model was then created and results analyzed. SEEP/W is a finite element software program utilized for analyzing groundwater seepage and excess pore-water pressure dissipation problems. For this project, only steady-state conditions were analyzed.

A.6.8.2 Cases Analyzed

Three cases where analyzed in order to determine the seepage impacts on the existing and proposed features. The first case models the existing system while the second and third cases model the proposed system under different water stage scenarios.

Case 1–This case includes a cross section of the existing condition at the project site. Geometric data was digitized off of existing site plans and topographic surveys and the cross section was created. This cross section is approximately 1,500-feet long, running from the west to the east and looking north. It should be noted that this represents an average of the geometric constraints in the south cell of the FPDA. This section was chosen because of the proximity of the L-31W Canal to the proposed features. Water surface elevations were downloaded from the DBHYDRO and corrected to NAVD88. The mean stage elevation of the L-31W Canal at structure S-322 was determined to be 2.92-feet, NAVD88. ***FIGURE A-7*** below presents the geometric configuration of the Case 1 scenario.

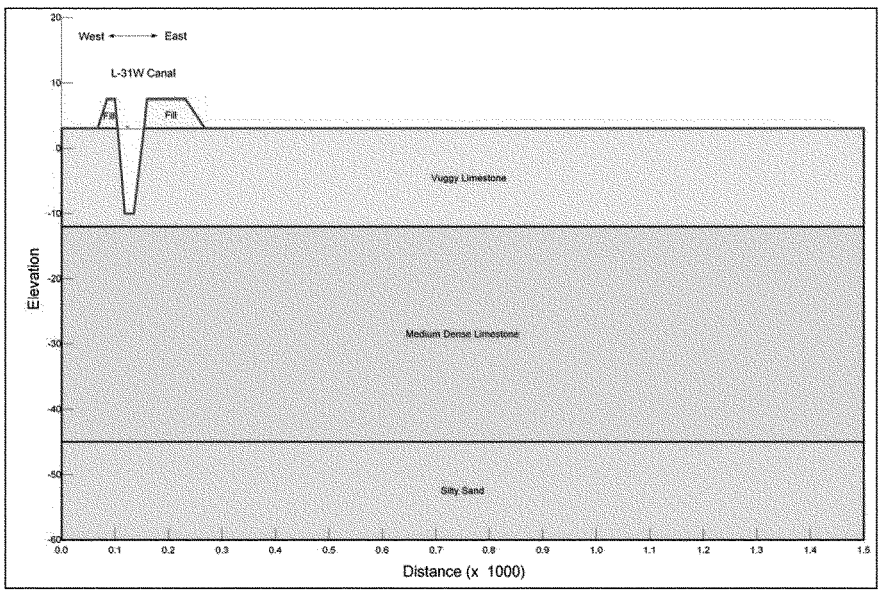


FIGURE A-7: EXISTING GEOMETRIC CONFIGURATION

Case 2–For the Case 2 model, the proposed features were added to the geometry of the Case 1 figure above. Under this scenario, the L-31W Canal was kept at its

mean stage elevation of 2.92 feet NAVD88 and the header channel section of the FPDA was flooded to a depth of 4.2 feet NAVD88. This was determined from the ICPR model runs which are discussed in ***SECTION 4.4*** of this report.

Case 3–The geometry for Case 3 is similar to that of Case 2 except that a boundary condition of water surface elevation +3.2 NAVD88 was modeled across the detention area. This condition is a result of the Case 2 model run and reflects a steady-state (long term) condition that could be expected due to seepage across the site. ***FIGURE A-8*** below presents the geometric configuration of the Case 2 and 3 scenarios.

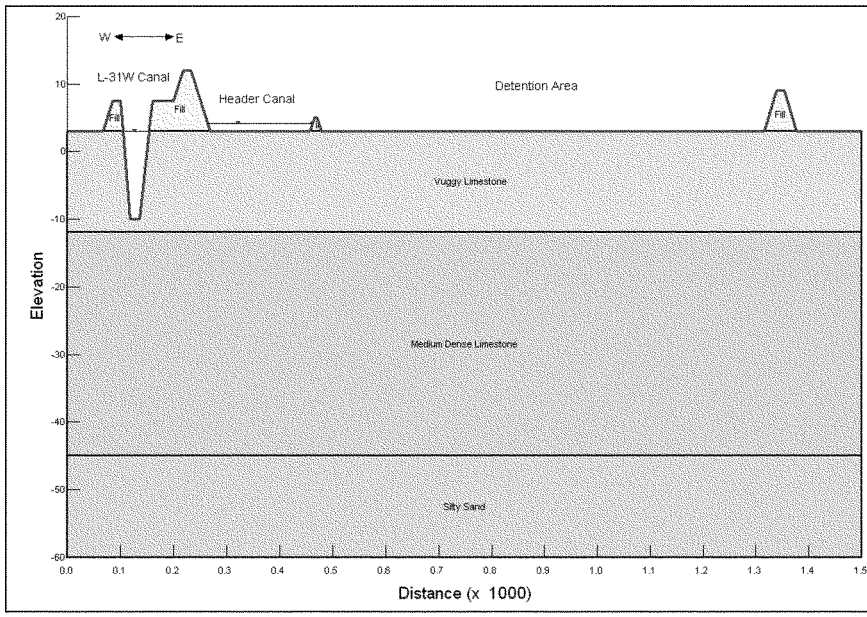


FIGURE A-8: CASE 2 AND CASE 3 GEOMETRIC CONFIGURATIONS

A.6.8.3 Seepage Analysis Results

Case 1 Results - Three model runs were conducted. The first Case shows that the L-31W Canal has the potential to act as a groundwater sink when the stage elevation in the canal drops below the surrounding groundwater elevation. Alternately, the L-31W Canal has the potential to act as a groundwater source when the stage elevation in the canal rises to or above the surrounding groundwater elevation. This is shown in ***FIGURE A-9*** below. These specific results model the condition of the L-31W stage at elevation 2.92 feet NAVD88.

It should be noted that this model depicts the subsurface soils to be saturated to grade. Model runs can show that, under steady-state conditions, the surrounding water table elevation is affected by fluctuating stage elevations in the L-31W Canal and that the canal has the potential to act as a sink or a source contingent on these conditions.

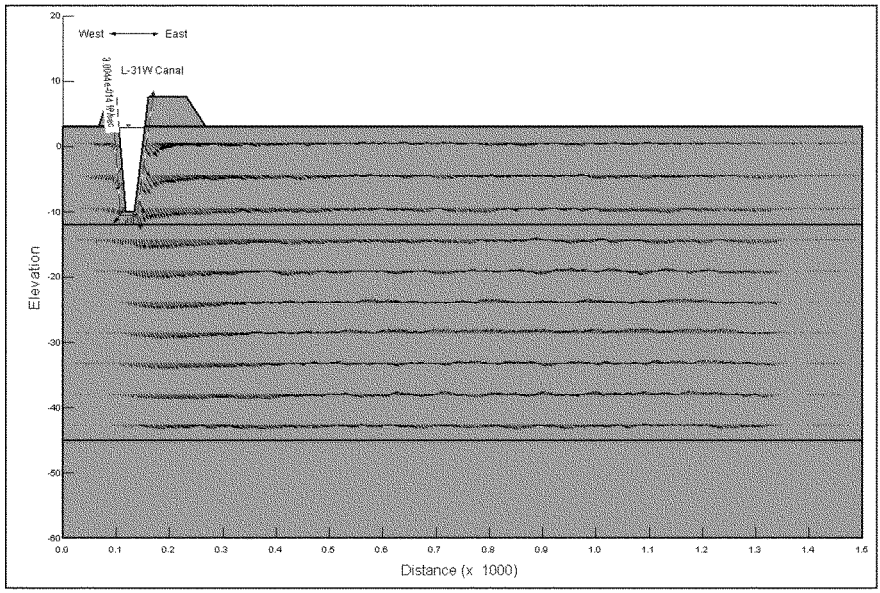


FIGURE A-9: SEEPAGE EXISTING CONDITION

The results from the analysis above were incorporated into the next two model runs for Cases 2 and 3.

Case 2 Results–This case analyzed the proposed system with an unlined header channel. The water surface in the header channel was maintained at 4.2 feet NAVD88. It should be noted that this analysis included only seepage impacts on the system and that the flow regimes for this system are presented in Section 4.4 of this report. This analysis shows that a hydraulic mound is created under the header channel with impacts to the L-31W Canal and the detention area. Under this scenario head contours are generated and are plotted on the figure below. The L-31W Canal stage elevation has increased slightly and a groundwater mound has been created under the unlined header channel.

Based on the figure below, one can see that a groundwater mound has been created approximately 1,400-feet to the east of the existing L-31W Canal. These results are then incorporated into the final case analyzed. ***FIGURE A-10*** below presents the geometric configuration of the Case 2 scenario.

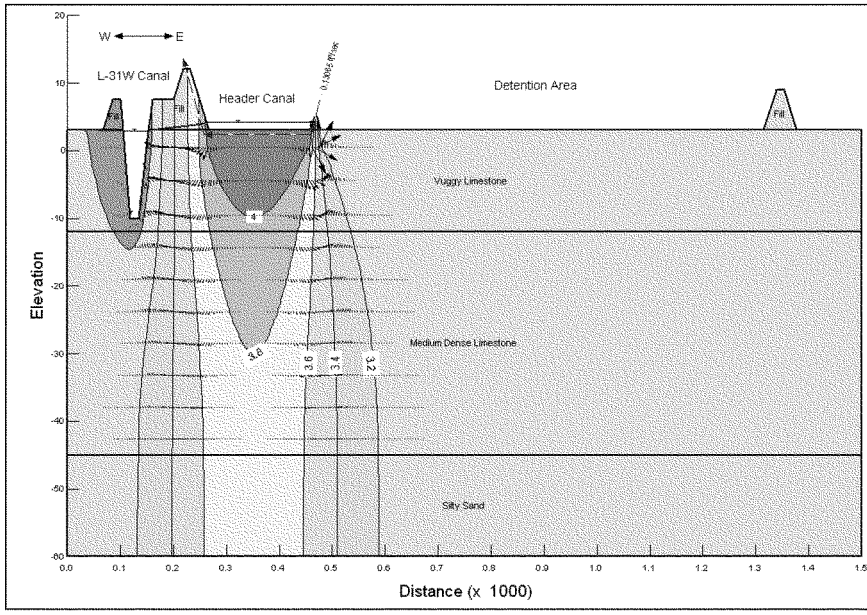


FIGURE A-10: SEEPAGE CASE 2 CONDITION

Case 3 Results - This case analyzed the proposed system with an unlined header channel and water impounded in the detention area at elevation 3.2 feet NAVD88. The water surface in the header channel was maintained at 4.2 feet NAVD88. It should be noted that the analysis included only seepage impacts on the system and that the flow regimes for this system are presented in Section 4.4 of this report. This analysis shows that a hydraulic mound is created under the header channel with impacts to the L-31W Canal and the detention area.

In this case, the groundwater mound has been extended to the east past the geometric extents of the model. One can see in ***FIGURE A-11*** below that the head contour has been extended to approximately the middle of the detention area. ***FIGURE A-11*** below presents the geometric configuration of the Case 3 scenario.

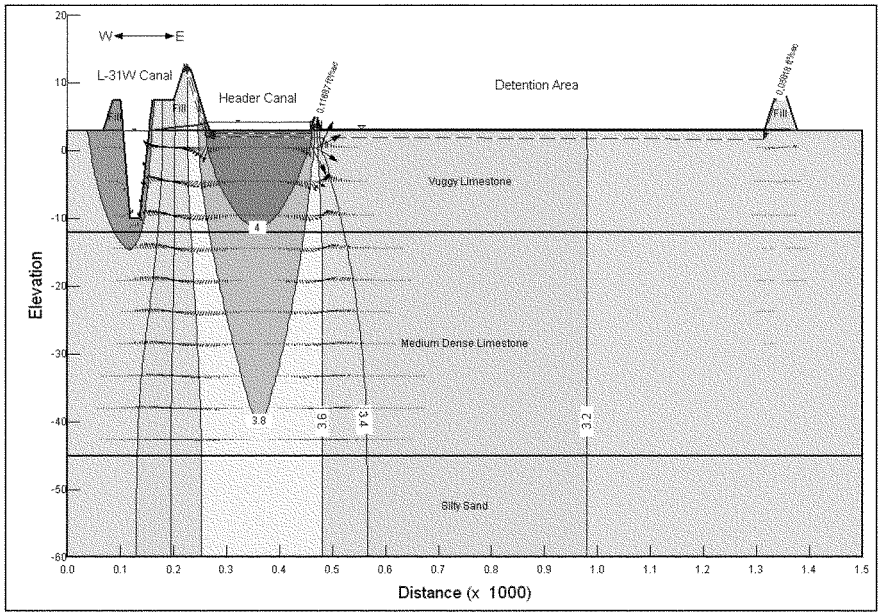


FIGURE A-11: SEEPAGE CASE 3 CONDITION

From the results of the three cases that were analyzed, a plot was generated. This plot is presented below as ***FIGURE A-12***. This plot presents a graphic representation of the total head in feet that is built up under varying boundary conditions across Frog Pond Detention Area on a "west to east" cross section. The first condition (the red line) represents a steady-state analysis of the existing conditions with the L-31W Canal staged at 2.92 ft NAVD88. The blue line condition assumes that only the header channel is holding water (at el 4.2 ft NAVD88). The green line includes the header channel staged at 4.2 ft NAVD88, and the detention area staged at 3.2 ft NAVD88. As one can see, as water is staged in the header channel, a head is built up and is eventually conveyed to the east. It should be noted that these model runs where performed under steady-state conditions.

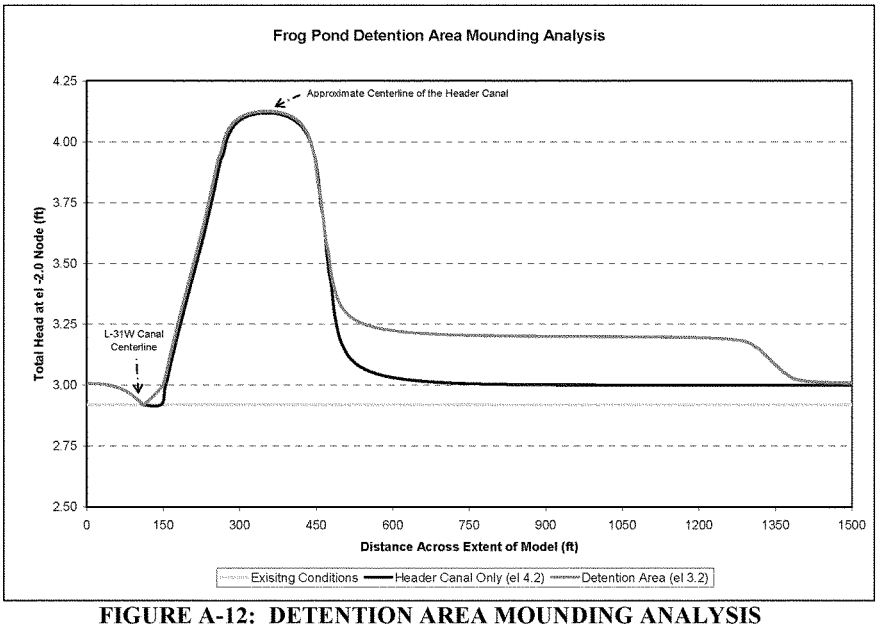


FIGURE A-12: DETENTION AREA MOUNDING ANALYSIS

A.6.9 FPDA Slope Stability Analyses

A.6.9.1 General Description and Background

SLOPE/W developed by GEO-SLOPE International, Ltd. was used to verify the slope stability results previously computed and presented by Brown and Caldwell.

The computation for the Factor of Safety (FS) against slope instability was performed using the Morgenstern-Price, Bishop, Janbu and Ordinary Methods. Derived geotechnical design parameters were utilized in the modeling and slope stability analysis. Variables utilized in the analysis are soil and rock properties, slope geometry, water levels and critical failure surface limits. The analyses were performed with the phreatic line in the levee obtained from water surface at design freeboard and from the seepage analysis.

A.6.9.2 Slope Stability Analysis Results

A steady-state seepage model was utilized to determine the FS for the perimeter levee of the Frog Pond Detention Area. After being filled with water for a long time, pore pressures are determined by steady-state seepage conditions where

gravitational flow conditions govern. The downstream slope stability is critical for the steady-state seepage condition.

FIGURE A-13 below presents the slope stability results along with critical FS and multiple slip surfaces. The critical factor of safety is 5.767 and is indicated on the figure below with the green cross hair icon. The slip surface associated with this FS is indicated by the green shaded areas.

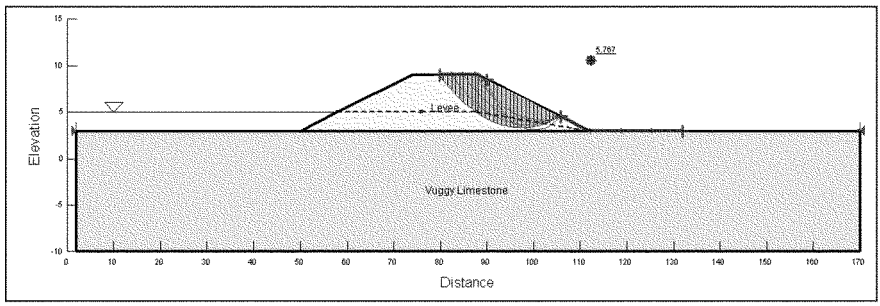


FIGURE A-13: SLOPE STABILITY ANALYSIS

It should be noted that the results of this analysis were compared to values presented by Brown and Caldwell in the BODR and Preliminary report and are found to be comparable to those values.

A.6.10 Settlement Analyses

Prior to the placement of the levee fill material, existing surficial soft soils will be removed and the levee will be built over the limestone. Therefore, only elastic settlement of the levee is expected as a result of the levee weight itself and compaction. End of construction settlement due to the elastic settlement of the eastern and northern levees is estimated to occur over a period of about one month from the placement of the fill material for levee construction.

Experience indicates that 5 percent settlement is a reasonable estimate for levees built from borrow material obtained from the canal excavation and stock pile material. Based on the approximate 6-feet of levee height, we estimate the total settlement beneath levees will not typically exceed about 3 inches for the average subsurface condition. Due to the granular nature of the fill, the elastic settlement should be a sole function of levee height, compaction effort and traffic during construction. This settlement is expected to occur almost instantaneously.

A settlement analyses was carried out utilizing GeoSlope International's Sigma/W software program to determine steady-state settlement results. SIGMA/W is a finite element software product that can be used to perform stress and deformation analyses of earthen structures. The results for settlement located at the center of the levee are shown in ***FIGURE A-14*** below as displacement in inches versus elevation in feet, NAVD. One can interpret that settlement, based on the results, is minimal and in accordance with previously reported results.

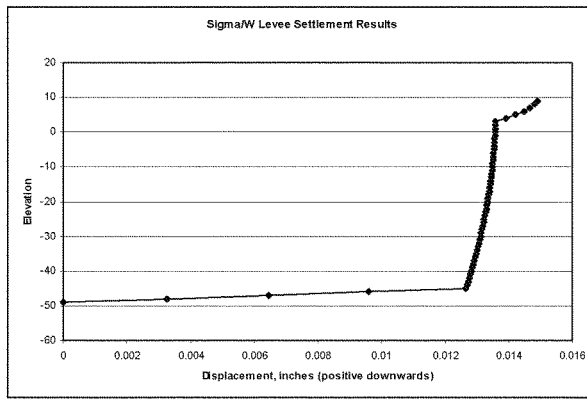


FIGURE A-14: SETTLEMENT ANALYSIS

A.6.11 Construction Recommendations

This section provides general recommendations for the construction of the canal, water control structure and pump station including recommendations for general site preparation and excavation. Construction of the proposed features requires that the contractor recognize the nature of the proposed construction, limiting ground conditions, and operational characteristics of the proposed system.

A.6.11.1 Site Access and Work Surface Preparation

Current access to the site is provided by existing unpaved and paved roads. Preparation of work surfaces to receive fill, fill placement, and equipment mobility in proposed canal and pump station excavation areas will present major considerations to the earthworks contractor.

Constructability reviews with various earthwork contractors experienced with similar construction in the area, indicates that canal and pump station areas can be effectively/economically drilled and blasted.

Any presence of surficial soft soils will pose problems to the movement of heavy backhoes, bulldozers, compactors, and other construction equipment around the project site. Additionally, the generally high groundwater levels will further complicate site access particularly during the wet season and after significant rainfall events.

Site preparation activities will include preparation of canal alignment areas and the potential construction of limited necessary temporary access roadways to and from work areas. Clearing and grubbing will be required at construction areas.

A.6.11.2 General Excavations

Clearing of vegetation is required prior to any excavation. Excavations will be required for canal and pump station construction. Based on the subsurface exploration, it is anticipated that construction will include significant amounts of blasting to facilitate excavations. The excavation of the limestone formation (Strata 4 and 5) will likely require blasting. Blasting will be required to fracture the in-situ limestone and the fractured limestone can be excavated by draglines or backhoe equipment. Excavation of Strata 1, 2 and 3 can be performed with conventional heavy equipment. However, Stratum 6 begins at 45 feet deep below the existing ground surface and therefore will not be excavated for this project.

To prevent sloughing of any fill and surficial soft material, cut slopes in Strata 1, 2 and 3 should be 3H:1V or flatter. Excavations should strictly follow all provisions of the current OSHA regulations for minimum slopes and other requirements for construction beneath the ground. If minimum slopes cannot be maintained then sheet pile supporting systems should be provided to properly protect personnel working within the excavation. All such retention systems should be designed, signed and sealed by an engineer qualified to design such systems.

The borings performed for this project did not encounter evidence of significant cavities or voids. However, these features are common in the limestone underlying most of southern part of the Florida. If these features are found during the excavation then the backfilling of voids and remediation to allow construction will need to be handled on a case by case basis. Remediation techniques will vary widely based on the location and size of the feature.

A.6.11.3 Blasting

Constructability reviews with various earthwork contractors, experienced with similar construction in the area, indicates that flyrock can be considerably controlled by the following:

- Blasting performed with 3 to 5 feet of water surcharge over the blasting area.
- Canal side slopes designed to be closer to vertical than gradually sloped.

A.6.11.4 Dewatering for Structures

The excavation for pump stations S-200 and S-199 and their associated intake canals will require dewatering. Generally, at the time of drilling the borings, groundwater levels ranged from 2.4 to 3.8 feet below the existing ground surface. However, excavation of canals may be completed in the wet without dewatering or the contractor may attempt to dewater with large surface stationed pumps.

Excavation of the pump station site may be completed with a series of well points or a well-based dewatering system which should be capable of lowering the groundwater level to 4 feet below the foundation grade. In light of subsurface conditions, the pump station excavation may require sheet pile cutoff walls around the excavation site and during the construction of the pump station. A combination of sheet pile cutoff wall and a dewatering system will be required to enable earthwork construction in a dry condition. The sheet pile walls should be installed after any blasting but prior to the excavation.

Well points or a well-based dewatering system should be capable of lowering the groundwater level below the foundations subgrade. Pumping wells and well points outside the excavation area may be effective and do not interfere excavation. Backup power systems should be provided for all dewatering systems so that long delays and heave of the excavation bottom due to pump failures can be avoided.

A.6.11.5 Select Fill Composition, Placement, and Compaction

Fill and backfill required for construction of pump stations and structures should consist of Select Fill. This Select Fill should consist of clean, granular materials that are free of debris, cinders, combustibles, roots, sod, wood, cellulose, organic material and materials subject to termite attack. The fines content (i.e., material passing U.S. Standard Number 200 sieve) should be not more than 12 percent by weight. Select fill composition should meet the Unified Soil Classification System (ASTM D2487) designations as GW, GM, SW, SP and SP-SM.

The fill should be placed at a moisture content within 2 percent of its Modified Proctor (ASTM D 1557) determined optimum in level lifts whose thickness does not exceed 12 inches. Each fill lift should be stable, unyielding and uniformly compacted to 95 percent of the ASTM D 1557 maximum dry density. In areas where heavy equipment cannot be operated for compaction, the fill should be placed in 6 inch thick level lifts and uniformly compacted to 98 percent of Standard Proctor (ASTM D 698) maximum dry density.

A.6.11.6 On Site Material

Surficial soils Strata 3, generally consisting of silty material that may be suitable as a select fill, if mixed with the excavated and processed material so that fines content is less than 12 percent. Fill material Strata 1 may be used if it meets the requirement of select fill composition. Strata 4 and 5 consist of limestone formation may be used as the source for the fill material for structural and embankment fill. Limestone materials when excavated will contain some oversize particles (i.e. those with the largest dimension exceeding 18 inches) due to the cemented nature of the carbonate rock. To make a select backfill material, excavated limestone material may be needed to pass through a crusher or broken down by track rolling with a heavy bulldozer.

A preliminary shrinkage factor on the order of 20 to 30 percent needs to be applied to the in-place volume of the materials to be excavated to account for levee material compaction, voids in the in-situ limestone and also waste due to the oversized materials (limestone boulders).

A.6.11.7 Canal Excavation

Canal systems will involve excavations to be made through the surficial soils. The design team should design side slopes of 3H:1V for the existing soft material. Side slopes of 1.5H:1V to 2.5H:1V through limestone are safe for normal operating and dewatered conditions.

The surficial soils excavated along the canal alignment may not be suitable as fill material unless mixed-in with other materials to produce a composition of Select Fill. The excavation of moderately to well-cemented limestone formation will require blasting to facilitate economical construction. Blasting of the limestone formation will likely result in flyrock and vibrations can produce adverse impacts on nearby farming activity and traffic on roadways. Detailed methodology of blasting was explained in above blasting section.

A.6.11.8 Pump Stations and Water Control Structures

The surficial soils at the pump station site generally consist of 1.5 to 4 feet thick layer of surficial soils underlain by a 45-60 feet thick layer of limestone

formation. The limestone formation is underlain by relatively clean sands to the boring termination depth of 75 feet. These conditions are not expected to impose any significant constraints on the planned construction.

A.6.11.8.1 Site Preparation

Prior to the start of construction, all surficial soils shall be removed from the entire construction area of the pump station.

RADISE understands that the foundations will be cast over contractor designed plug slab and both foundation and plug slab will be rock anchored. The well cemented limestone layer is suitable to support proposed mat foundation system with normal ground improvements. The normal ground improvement includes roller compaction of any loose excavated soils at the foundation bottom grade followed by construction of a plug slab.

Installation of rock anchor may require pre-drilling to allow penetration of anchor to the required depth below grade for support. The annular space between the hole and the anchor should be thoroughly grouted to fix the anchor tips in place.

Pump station excavation should be performed in accordance with recommendations listed in previous excavation and dewatering sections. All excavations required to construct the pump station should strictly follow all provisions of the current OSHA regulations for minimum slopes and other requirements for construction beneath the ground. 1.5H:1V minimum slope should be required for limestone slope stability.

RADISE recommends prior to any excavation, all slopes should be designed, signed and sealed by a Practicing Engineer registered in the State of Florida. The design slopes should be verified by the project Geotechnical Engineer to meet the design criteria specified in the geotechnical report.

Sheet piles may encounter refusal at ground surface due to the presence of a well cemented limestone layer. This will make it difficult to install a uniform wall and leads to stability and interlocking problems. Installations of sheet piles may require pre-splitting to allow penetration to the required depth below grade for support. Limestone can be slotted by trenching or other methods along the sheet pile alignment followed by driving of the sheet pile sections.

The trench should be excavated to required depth, and then the sheet pile should be placed into the trench. After placing of the sheet pile, annular space between the trench wall and the pile should be thoroughly grouted to fix the sheet pile tips in place.

Anchored sheet pile walls should be tied back to the backfill soil or rock with deadmen, rock anchors, or other grouted anchors depending on the nature of the existing backfill. However, these piles also have the same limitations of tip penetration.

A.6.11.8.2 Seepage Control

Due to the presence of vuggy limestone and the difference in water head condition there are probable chances of under seepage. Therefore, it is recommended that the foundation slabs should be surrounded by a toe trench. These toe trenches should be at least 3 feet deep and at least 2 feet wide. Toe trenches are helpful in cutting off seepage along the pump station foundation slabs. These trenches should be equipped with the dewatering pumps to maintain water level within these trenches. When the foundation concrete reaches 75 percent of design strength then these trenches should be filled with the concrete. If further assurance against seepage is desired, another cutoff trench can be designed at the centerline of the pump station foundation.

Seepage barriers should also be designed along the perimeter of the suction and discharge basin foundation slabs. These seepage barriers should be designed as walls extending laterally at least 4 feet and 3 feet deep. These walls or barriers should be poured monolithically with the pump station walls so that the seepage path immediately adjacent to the walls is sufficiently lengthened to discourage seepage along this plane. Extra care should be taken to thoroughly compact soils around these seep shields to help prevent seepage effects.

A.6.11.8.3 Foundation Design

- Mat Foundation: The proposed pump station structure may be supported on a reinforced concrete mat foundation that is designed for an allowable soil pressure of 1,000 and 2,000 pounds per square foot (psf) for the suction and discharge basins, respectively, and a modulus of subgrade reaction of 200 pounds per cubic inch (pci).
- Slab Uplift: The uplift pressure is expected to act along the base of the foundation. Under certain operational circumstances the structure may be exposed to uplift forces due to unbalanced hydrostatic forces.
- The foundation of the pump station should be designed to resist the bending stresses associated with buoyant uplift pressures which are expected to occur when the structure is emptied for maintenance. Resistance to uplift loads may be calculated using the dead weight of the structure plus the weight of soil backfill which overlies the portion of the foundation that extends laterally beyond the exterior walls of the structure. The weight of soil backfill should be computed using moist and buoyant unit weights of 120 and 60 pounds per cubic foot (pcf), respectively.

- Foundation Settlement: Based on the pump station foundation bottom elevation, the foundation bottom will be over well-cemented limestone, therefore RADISE expects minimal settlement of pump station foundation.

A.6.11.8.4 Driven Sheet Piles

SPT borings for this project were drilled with an automatic hammer drilling rig. The automatic hammer SPT N-Values (NAUTO) were converted to safety hammer SPT N-Values (NES) using the conversion equation obtained from FDOT Soils and Foundation Handbook, NES = 1.24 x NAUTO. This is because the design soil parameter correlations are based on the safety hammer SPT N-Value.

Geotechnical design parameters were derived for the driven sheet piles for the structures and were based on field data, laboratory data, established empirical correlations based on SPT N-values and RADISE's experience. Average SPT N-values for appropriate stratum for each of the structures were developed from the data obtained from the relevant boring.

TABLE A-6: S-200 - GEOTECH DESIGN PARAMETERS FOR SHEET PILES

Stratum No.	Boring depth (ft - ft)	Average N_{AUTO}	Average N_{ES}	Recommended Values			
				Friction Angle (Degrees)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion (pcf)
1	0 – 1.5	18	22	34	120	128	0
4	1.5 – 45	51	63	44	113	124	10,000
6	45 - 75	41	51	41	138	146	0

TABLE A-7: S-199 - GEOTECH DESIGN PARAMETERS FOR SHEET PILES

Stratum No.	Boring depth (ft - ft)	Average N_{AUTO}	Average N_{ES}	Recommended Values			
				Friction Angle (Degrees)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion (pcf)
1	0 - 2	63	78	34	120	128	0
4	2 - 40	59	73	46	119	128	10,000
5	40 - 45	12	15	32	135	143	10,000
6	45 - 75	25	31	36	129	132	0

TABLE A-8: S-198 - GEOTECH DESIGN PARAMETERS FOR SHEET PILES

Stratum No.	Boring depth (ft - ft)	Average N_{AUTO}	Average N_{ES}	Recommended Values			
				Friction Angle (Degrees)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion (pcf)
1	0 - 4	23	29	35	127	131	0
5	4 - 20	17	21	33	110	124	10,000
4	20 - 60	54	67	45	118	128	10,000
6	60 - 75	21	26	35	124	129	0

A.6.11.9 Below Grade Wall

Sometimes below-grade walls of the structure such as underground tanks and pipe trenches may need to be designed to resist earth pressure exerted by the granular backfill, equipment surcharge loads and unbalanced hydrostatic forces. In such cases, lateral resistance provided by the soil behind the concrete should be calculated using the following parameters:

- Moist Soil Unit — Weight 120 pounds per cubic foot
- Buoyant Soil Unit — Weight 60 pounds per cubic foot
- Effective Cohesion — 0 pounds per square foot
- Angle of Internal Friction — 30 degrees
- Angle of Wall Friction — 18 degrees

- Earth Pressure Coefficients:
- Active (ka) — 0.33
- Passive (kp) — 3.00
- At-Rest (ko) — 0.50

Shearing resistance at the base of the wall footings should be calculated using a friction factor of 0.55.

Selection and placement of fill material should be in accordance with section "Fill Composition, Placement and Compaction". Fill should be placed when retaining wall gains 75 percent of design compressive strength.

A.6.11.10 Shallow Foundation

A shallow foundation system may be used to support on-grade for any electric and generator building. A shallow foundation system may consist of conventional spread footings. The footings should bottom within compacted fill or in the densified sands and should be proportioned for an allowable bearing pressure of 2,500 pounds per square foot (psf).

To assure an adequate factor of safety against a shearing failure in the subsoils:

- Footings should be based at a depth of at least 18 inches below lowest adjacent grade;
- Continuous footings should be no less than 18 inches wide; and
- Isolated footings should be at least 24 inches wide.

The recommended bearing pressure refers to dead and normal live loads and reflects a net increase in pressure over and above that due to the overburden soils. The bearing pressure may be increased by 25 percent for total loads, including wind forces.

Total settlement should be less than 1 inch and differential settlements between adjacent foundations should be less than ½ inch.

A.6.11.11 Erosion Protection

Based on our experience with other STA projects, no erosion protection is required for levee interior/exterior slopes. However, most of the STAs had some erosion protection which was primarily achieved by dressing the side slopes of the levee with the borrowed muck along the canal excavation alignments followed by grass seeding. We recommend similar optional erosion protection for the levee side slopes. However, erosion protection will be needed at structure locations and on the side slopes of the canals at bend locations.

Erosion protection will be designed taking storm and hurricane events into consideration. We recommend placement of rubble riprap at structure locations and on the side slopes of the canals at bend locations for erosion protection. If the anticipated flow velocities are minimal (2.5 feet per second), standard rubble riprap in accordance with USACE EM 1110- 2-1911, Section 5-30 or equivalent may be used. For flow velocities greater than 2.5 feet per second, rip-rap shall be designed taking into consideration stability, bed degradation (altered run-off), depth and rock size.

A.7 ENGINEERING OF EMBANKMENTS AND CANALS

A.7.1 General

This section will discuss the project design features, design considerations, and construction methods that will be employed for the embankments, weirs, plugs, channels, and canals proposed south of Ingraham Highway. This exercise will also aid in the development of the project cost estimate by lending clarity to line item costs.

A.7.2 Proposed Plan

The C-111 SC Western project features north of Ingraham Highway are currently as follows:

- Pump Station S-200 with a total capacity of 225 cfs located on the west side of the C-111 Canal at the same latitude as the northern boundary of the Frog Pond Detention Area;
- An above grade, concrete-lined, open channel to convey water from the S-200 discharge to the northwest corner of the Frog Pond Detention Area;
- The FPDA, an approximate 600-acre area located along the eastern boundary of the l-31W Canal with a perimeter levee subdivided by internal levees into three detention cells; and
- An above grade, unlined, open channel header distribution channel located along the western boundary of the FPDA with three weirs to allow water into the three cells of the detention area.

The C-111 SC Western project features south of Ingraham Highway are currently as follows:

- Pump Station S-199 with a total capacity of 225 cfs located on the west side of the C-111 Canal just south of Ingraham Highway and north of the existing S-177;
- An above ground, concrete-lined, open channel to convey water from S-199 to the proposed northern extension of Aerojet Canal;
- An above ground, unlined extension of the Aerojet Canal north and east to meet the C-111 Canal between Ingraham Highway and S-177;
- Earthen plugs and weirs in the Aerojet Canal, earthen plugs in the C-110 Canal, one earthen plug in the L-31E Canal; and
- A water control structure S-198 located on the C-111 Canal approximately 1.75 miles southeast of S-18C.

A.7.2.1 Pump Station S-200

Pump Station S-200 will be located on the west side of the C-111 Canal, north of the Ingraham Highway downstream of S-177. The purpose of this pump station is to convey water from the C-111 Canal to the Frog Pond Detention Area. The pump station will have a total capacity of 225 cfs. For operational flexibility, there will be three, 75 cfs electric motor driven axial flow submersible pumps. A diesel engine powered electric generator will provide the site with standby electricity during power outages. All of the pumps at the pump station will have the capability to be operated remotely or automatically to increase efficiency and reduce operating costs. Operation of the pumping station will be in accordance with the Project Operations Manual (POM).

A.7.2.2 S-200 Conveyance Channel

The proposed S-200 conveyance channel is designed to convey water from the pump station discharge to the distribution channel within the detention area, a distance of approximately 4,500 feet. The conveyance channel will be concrete-lined and constructed above grade by removing the existing surficial soil material down to the top of limestone and constructing parallel containment levees above the limestone. The bottom and interior side slopes of the channel will be concrete lined. The bed width of the proposed channel is 20 feet with the bed elevation approximating the top of the limestone at about +3.0 feet NAVD88. The conveyance channel levees will have a 14-foot wide crest, per SFWMD design criteria, and a minimum top elevation of +9.0 feet NAVD88 as determined from wind set-up and wave run-up analyses. The levees will be constructed using a well graded mixture of silty sands and gravels excavated from identified borrow sites or other areas as designated by the SFWMD detention area (existing surficial soils). Internal and external channel side slopes will be 4H:1V. The levees will be designed to allow for vehicular traffic and will be connected to roadways around the pump station and levees around the detention area. Velocities in the channel will be maintained below 2.0 feet per second (fps) at the design pumping rate of 225 cfs.

A.7.2.3 Frog Pond Detention Area

The FPDA is designed to meet the requirements of a Low Hazard Potential Facility. The perimeter containment levee has an elevation of +9.0 feet NAVD88. The average height above existing ground elevation is about 5.5 feet. The preliminary design has accounted for worst case conditions including the avoidance of static water surface overtopping during the 6-hour Probable Maximum Precipitation (PMP) event and during a rainfall equivalent to the 1950 Hurricane Easy event with a Soil Conservation Service (SCS) Type III temporal distribution. The levee design, including 4H:1V side slopes in most cases, provides for a large factor of safety under post-construction, maximum depth, and rapid drawdown conditions. To create three internal cells (Cell S, Cell C and Cell N) within the detention area, two intermediate levees will be constructed within the facility. The two intermediate levees will also have crest widths of 14 feet and crest elevations of +9.0 feet NAVD88, similar to the perimeter levees. Side slopes will be set at 4H:1V on all sides. Because these levees will typically be accessed from the east, turnouts will be constructed at their western terminus to allow operation and maintenance vehicles to turn around rather than having to back out. Like the perimeter levees, it is planned that the internal levees will be constructed of suitable material from on-site borrow sources or others areas as designated by the SFWMD.

A.7.2.4 Frog Pond Header Distribution Channel

The water distribution channel will be constructed inside the detention area immediately east of the western perimeter levee. As currently proposed, the distribution channel extends from the northern end of Cell N to the southern end of Cell S. The distribution channel has an existing western levee which varies in elevation from approximately 7.0 to 12.0 feet NAVD88 that will be adjusted to a minimum elevation of 9.0 feet NAVD88. The eastern berm is designed with weir sections as necessary to contain design flows and divert them into the detention area cells. The distribution channel bed width has been set at an average width of 180 feet over its entire length and has two weirs adjacent to the intermediate levee between Cell N and Cell C, and Cell C and Cell S. The crest elevation of these weirs will be 0.5' above adjacent existing ground elevations. As with the inlet channel, the water distribution channel will be constructed above grade by removing the approximate 0.5 foot of surficial soils to the top of limestone. The invert of the channel will follow the top of limestone which increases slightly in elevation from south to north.

Flow passes into Cells N, C and S from the water distribution channel through 80 foot long weirs located near the midpoint of each cell berm. The weirs will be constructed with crest elevations 1.2 feet above adjacent ground elevations.

A.7.2.5 Aerojet Canal Modifications

The northern limit of the existing Aerojet Canal presently lies approximately one mile south of Ingraham Highway. Although plugged at various locations, its overall length currnetly extends a distance of approximatley 4.6 miles. It is proposed to effectively extend the northern limit of the canal to a point approximately 2,300 feet south of State Road (SR) 9336 as an unlined above ground open channel, to construct a concrete-lined above ground channel between the northern canal extension and S-199, construct perimeter grading around all unlined portions of the canal north of the east-west borrow canal, construct a new earthern weir with crest elevation 1.0' below adjacent natural ground, and convert all existing plugs over that same length to similar weirs.

The design concept for the Aerojet Canal is to receive water from the C-111 Canal via the S-199 pump station to create a groundwater mound that will reduce eastward migration of groundwater flow away from Taylor Slough. During the dry season, the Aerojet Canal will receive flows when the C-111 Canal experiences a rise in water level to elevation 3.8 ft NAVD88. Pumping to the Aerojet Canal will be halted if the water rises in the Cape Sable seaside sparrow Subpopulation D habitat to more than 10 centimeters above existing ground elevation at the trigger cell location denoted as 1293.

A.7.2.6 Pump Station S-199

Pump Station S-199 will be located on the west side of the C-111 Canal, just south of Ingraham Highway and north of the existing S-177. The purpose of this pump station is to convey water from the C-111 Canal to the Aerojet Canal. The pump station will have a total capacity of 225 cfs. For operational flexibility, there will be three 75 cfs electric motor driven pumps. A diesel engine powered electric generator will provide the site with standby electricity during power outages. All of the pumps at the pump station will have the capability to be operated remotely or automatically to increase efficiency and reduce operating costs. Operation of the pumping station will be in accordance with the Project Operations Manual (POM).

A.7.2.7 S-199 Conveyance Channel

The proposed S-199 conveyance channel is designed to convey water from the pump station discharge to the proposed Aerojet Canal extension, a distance of approximately 4,440 feet. The conveyance channel will be concrete-lined and constructed above grade by removing the existing surficial soil material down to the top of limestone and constructing parallel containment levees above the limestone. The bottom and interior side slopes of the channel will be concrete lined. The bed width of the proposed channel is 20 feet with the bed elevation approximating the top of the limestone at about +2.0 feet NAVD88. The conveyance channel levees will have a 14-foot wide crest, per SFWMD design criteria, and a minimum top elevation of +8.0 feet NAVD88 as determined from wind set-up and wave run-up analyses. The levees will be constructed using a well graded mixture of silty sands and gravels excavated from identified borrow sites or other areas as designated by the SFWMD detention area (existing surficial soils). Internal and external channel side slopes will be 4H:1V. The levees will be designed to allow for vehicular traffic and will be connected to roadways around the pump station and levees. Velocities in the channel will be maintained below 2.0 feet per second (fps) at the design pumping rate of 225 cfs.

A.7.2.8 Aerojet Canal Extension

The Aerojet Canal extension is designed to meet the requirements of a Low Hazard Potential Facility. The perimeter containment levee has an elevation of +8.0 feet NAVD88. The average height above existing ground elevation is about 5.5 feet. The preliminary design has accounted for worst case conditions including the avoidance of static water surface overtopping during the 6-hour Probable Maximum Precipitation (PMP) event and during a rainfall equivalent to the 1950 Hurricane Easy event with an SCS Type III temporal distribution. The levee design, including 4H:1V side slopes in most cases, provides for a large factor of safety under post-construction, maximum depth, and rapid drawdown conditions.

A.7.2.9 Aerojet Canal Plugs

The weirs to be constructed (and converted from existing earthen plugs) within the Aerojet Canal are designed to attenuate the flows from pump station S-199 and maximize hydraulic heads along the length of the feature. The elevated water level will create a hydraulic ridge that will serve to slow down the flow of surface and groundwater from Taylor Slough into the C-111 Canal. The weir plugs will be 100 feet in length and match the width of the canal at the respective locations. The top elevation of the weir plugs will be set at six (6) inches below average ground elevation in the vicinity of the plug. The upstream and downstream slopes of the plugs will be 4H:1V.

A.7.2.10 C-110 Canal Plugs

The C-110 Canal is located to the east of C-111E Canal and extents southward from S.W. 392nd Street to C-111 Canal, approximately 6.75 miles. The canal will be plugged at about 3,000-ft. intervals. The C-110 Canal plugs are proposed to reduce seepage from the marsh into the adjacent canal. The proposed plugs will be 100 feet in length and will match the width of the canal at the respective locations. The top elevation of the weir plugs will be set to match adjacent natural ground elevations in the vicinity of the plugs. The upstream and downstream slopes of the plugs will be 4H:1V. There are ten plugs proposed for this canal.

A.7.2.11 L-31E Canal Plug

This feature will be installed just south of S-20A on the L-31E Canal. The plug will reduce conveyance and increase water level stages in and around the canal. The proposed plug in the L-31-E Canal is intended to raise the water level in the canal and the adjacent marsh. The plug will be 100 feet in length and match the width of the canal at the proposed location. The top elevation of the plug will be set to match adjacent natural grades. The upstream and downstream slopes of the plug will be 4H:1V.

A.7.2.12 Control Structure S-198

S-198 will be a gated spillway control structure constructed on the C-111 Canal approximately 1.75 miles southeast of S-18C. When closed, it will help reduce seepage from the adjacent marsh. When open, it will pass flood flows with only very minimal head losses.

A.7.3 Site Preparation

A.7.3.1 North Project Components

The existing site is utilized for agricultural purposes and, therefore, largely devoid of large trees and shrubs. Any remaining trees and shrubs will be cleared and grubbed to depths adequate for removing roots. Surficial soils will be excavated to the top of the in-situ limestone layer and stockpiled for possible use in the construction of the perimeter levees. The levees will be constructed directly on top of the existing limestone which will be exposed.

A.7.3.2 South Project Components

Clearing and grubbing will be needed at all locations; however, the level of effort will vary with the site. Most of the work will take place within existing water bodies and, therefore, the required turbidity barriers and sediment containment procedures will be implemented. Where surficial soils are deemed adequate they may be used in the construction of the embankments and weir plugs.

A.7.4 Site Access/Entrance Road

A.7.4.1 North Project Components

Access to the project site will be from Ingraham Highway. The southeast corner of the Frog Pond Detention Area is located approximately 330 feet north of Ingraham Highway along the C-111 Canal and approximately 3430 feet west of the C-111 Canal. S-200 servicing the Frog Pond Detention Area is accessible from Ingraham Highway and approximately 2.8 miles north of Ingraham Highway along the C-111 Canal. Access roads will be widened and maintained during the construction. After construction the roads will be repaired in order to provide permanent access to the site. The site will also be accessible from the L31W Canal road.

A.7.4.2 South Project Components

Access to the Aerojet Canal and S-199 construction locations will be at various points along SW 232nd Avenue. Similarly, access to S-198 and the C-110 Canal will be along the C-111 Canal south of Ingraham Highway.

A.7.5 Disposal/Borrow

Disposal and stockpile areas will be created within the project area.

A.7.6 Embankments

A.7.6.1 North Project Components

A.7.6.1.1 Levee Height

In support of the preliminary design for the Frog Pond Detention Area, Brown and Caldwell, Inc. determined the freeboard and minimum elevations of the external containment levees under the design specifications of Acceler8 Design Criteria Memorandum 2 (DCM-2). The purpose of these analyses was to provide information to the design team regarding the impact of the footprint and configuration of the Frog Pond Detention Area on the required height of the containment levees. For that purpose, the analyses examined a range of conditions appropriate for Low Hazard Potential (LHP) and High Hazard Potential (HHP) facilities. The Frog Pond Detention Area is being designed and operational criteria are being established to maintain it as a LHP facility. Consistency with a LHP classification was determined using procedures outlined in DCM-2. The analyses are documented in the Draft Technical Memorandum - Wind Set-up and Wave Run-up Analyses for the Frog Pond Detention Area, Miami-Dade County, Florida, dated August 2007.

The hazard potential classification analysis considered average water depths and wind speeds for both low and high hazard potential classifications with no dominant wind direction. The wave characteristics, the wind set-up/set-down heights and wave run-up were determined under fetch limited conditions using numerical methods (Runge-Kutta's method and the trapezoidal rule). As a result of the analysis, top of levee elevations of at least +8.8 feet NAVD88 were found to be required for the perimeter levees to satisfy DCM-2 design criteria for freeboard. A minimum top elevation of +9.0 feet NAVD88 has been recommended by Brown and Caldwell, Inc., reviewed and accepted by the SFWMD for the design of all perimeter levees.

A.7.6.1.2 S-200 Intake Canal Embankments

These embankments will be approximately 200 feet long from the C-111 Canal to the S-200 intake. They will be constructed on both sides of the intake canal above the limestone layer with 4H:1V slopes both on the internal and external slopes. The top width of the embankments will be 14 feet. Top elevation will be +7.0 ft NAVD88.

A.7.6.1.3 FPDA Eastern and Southern Perimeter Levees

The proposed eastern and southern levees will have a 14-foot wide crest pursuant to SFWMD design criteria and a top elevation of +9.0 NAVD88 as a result of the wave run-up analyses described previously. The average ground

elevation along the proposed alignment of the eastern levee is +3.4 feet NAVD88 and along the southern levee is +3.0 feet NAVD88. Levee side slopes were established at 4H:1V on both the internal and external slopes. To facilitate vehicle movement, turn outs will be located along the eastern and northern levees at intervals of approximately 2,500 feet in accordance with SFWMD design criteria.

A.7.6.1.4 FPDA Northern Perimeter/ S-200 Conveyance Channel Levees

The northern perimeter levee also functions as one side of the S-200 Conveyance Channel levee. These levees will also have a 14-foot wide crest pursuant to SFWMD design criteria and a top elevation of +9.0 NAVD88 as a result of the wave run-up analyses. The average ground elevation along the proposed alignment of the levees is +3.7 feet NAVD88. Levees side slopes were established at 4H:1V on both the internal and external slopes. Approximately 3.5 feet depth of the channel side slopes will be concrete lined to prevent seepage from the conveyance channel.

A.7.6.1.5 FPDA Western Perimeter Levee

There is an existing levee along the western side of the proposed detention area. This levee will be incorporated into the design to form the western levee of the detention area. The existing levee north of the L-31W Canal has a crest elevation slightly below +9.0 feet NAVD88 with side slopes approximating 3H:1V. The average ground elevation ranges from about +2.5 to +3.5 feet NAVD88 along the western side of the detention area. In this section, the existing levee will be upgraded to provide a minimum crest width of 14 feet, a minimum elevation of +9.0 NAVD88 and internal side slopes of 4H:1V. The external side slope will remain at 3H:1V. The existing levee will be modified using surficial soils excavated from within the footprint of the detention area.

In the southern areas adjacent to the L-31W Canal, the existing levee elevation varies from +9.0 to +12.0 feet NAVD88. An approximate 50-foot wide bench exists between the toe of the levee and the top of bank of the adjacent L-31W Canal. This bench width between the toe of the levee and the top of the L-31W Canal will be maintained and any levee modifications will be carried out on the inside slope of the levee. Modifications may include widening or otherwise upgrading the crest of the levee to facilitate its use by maintenance vehicles. Vertical transitions from lower levee elevations to higher levee elevations will be modified to obtain the desired 4H:1V side slope.

A.7.6.1.6 Frog Pond Header Distribution Channel Berm

The header channel berm runs north-south, approximately 180 feet east of the western perimeter levee, separating the header distribution channel from the

cells. This berm will have a crest width of 5 feet, top elevation of +5.0 ft NAVD88, and side slopes of 4H:1V. The average ground elevation along the proposed alignment of the berm is +3.0 feet NAVD88. The berm will also have broad crested weirs at its mid point intersections with the cells. These weirs will allow water to pass from the header distribution channel to the cells.

A.7.6.1.7 FPDA East-West Intermediate Levees

The east-west intermediate levees divide the detention area into three cells, the north cell (Cell N), the central cell (Cell C), and the south cell (Cell S). These intermediate levees will have crest widths of 14 feet, top elevation of +9.0 ft NAVD88, and side slopes of 4H:1V. The average ground elevation along the proposed alignment of the levee separating Cell N and Cell C is +3.3 feet NAVD88. The average ground elevation along the proposed alignment of the levee separating Cell C and Cell S is +2.9 feet NAVD88.

A.7.6.1.8 Levee Fill

Fill for the construction of the perimeter and intermediate levees will be suitable material from on-site borrow sources or others areas as designated by the SFWMD. Soils will be a well graded mixture of silty sands and gravels as that found in the detention area (existing surficial soils).

A.7.6.1.9 Bench

An approximate 50-foot wide bench exists between the toe of the western levee and the top of bank of the adjacent L-31W Canal. This bench width between the toe of the levee and the top of the L-31W Canal will be maintained and any levee modifications will be carried out on the inside slope of the levee. There will not be any additional levee benches created within the Frog Pond Detention Area.

A.7.6.1.10 Seeding and Sodding

Seeding and sodding will be provided throughout the project area as required to adequately protect side slopes and other unstable areas from erosion. Other bank protection methods will be evaluated for more economical alternatives to sodding.

A.7.6.2 South Project Components

Fill for the embankments along the channel and canals will be a combination of select fill and soils excavated from the project site. In addition, excess fill from the north component Frog Pond Detention Area may be available for use for embankment and plug building. Soils will be a well graded mixture of silty sands and gravels.

Seeding and sodding should be provided throughout the project area as required to adequately protect side slopes and other unstable areas from erosion. Other bank protection methods will be evaluated as a more economical alternative to sodding.

A.7.6.2.1 S-199 Intake Canal Embankments

These embankments will be approximately 200 feet long from the C-111 Canal to the S-199 intake. They will be constructed on both sides of the intake canal above the limestone layer with 4H:1V slopes both on the internal and external slopes. The top width of the embankments will be 14 feet. Top elevation will be +7.0 ft NAVD88.

A.7.6.2.2 S-200 Conveyance Channel Embankments

These embankments will be constructed with geometries of 4H:1V slopes both internal and external, 14 feet top width at a minimum elevation of +8.0 ft NAVD88. The channel will be concrete lined following the slope of the embankment to elevation +6.0 ft NAVD88. The concrete bottom elevation will be +3.0 ft NAVD88.

A.7.6.2.3 Aerojet Extension Channel Embankments

These embankments will be constructed with geometries of 4H:1V slopes both internal and external, 14 feet top width at elevation +8.0 ft NAVD88.

A.7.6.2.4 Aerojet Canal Berms

Embankments will be placed at strategic locations along the Aerojet Canal. The purpose of the embankments will be two fold, (i) to contain flows generated from S-199 within the banks of the canal and (ii) to aid in holding the elevated stages in the canal to provide the mounding effect desired. The typical embankment will have internal and external slopes of 4H:1V and a top width of 5.0 feet. With the maximum mounding stage for the 100-yr, 24-hr storm event of 3.5 ft NAVD88 the proposed top elevation will be 4.5 ft NAVD88.

A.7.7 Canal Plugs (South Project Components)

A.7.7.1 Aerojet Canal Plugs

The proposed weirs and plugs in the Aerojet Canal are designed to attenuate the flows from S-199 and effectively raise the water level in the canal. The raised water level will create a hydraulic mound that will serve to minimize the flow of surface and groundwater from Taylor Slough into the C-111 Canal. The plugs will be 100 feet long and match the width of the canal at the respective locations. The top elevation of the weir will be set at six (6) inches below average ground

elevation in the vicinity of the weir. Slope on the water sides of the plugs will be 4H:1V. There are four (4) plugs proposed for the Aerojet Canal.

A.7.7.2 C-110 Canal Plugs

The plugs in the C-110 Canal are proposed to raise the water level in the canal and in effect raise the water table in the lands surrounding the canal. The plugs will be 100 feet long and match the width of the canal at the respective locations. The top elevation of the plug will be set at the average ground elevation in the vicinity of the plug. Slope on the water sides of the plugs will be 4H:1V. There are 10 weir plugs proposed for this canal.

A.7.7.3 L-31E Canal Plug

Similar to the plugs in the Aerojet and C-110 canals, the plug in the L-31E Canal is proposed to raise the water level in the canal and in effect raise the water table in the lands surrounding the canal. The plug will be 100 feet long and match the width of the canal at the proposed location just south of Structure S-20A. The top elevation of the weir plug will be set at the average ground elevation in the vicinity of the plug. Slope on the water sides of the plug will be 4H:1V.

A.7.8 Canals and Channels

A.7.8.1 North Project Components

A.7.8.1.1 S-200 Intake Canal

The proposed intake canal will convey water from the C-111 Canal to S-200, a distance of approximately 200 feet. The intake canal will be constructed by removing the existing surficial soil material excavating through the limestone layer to elevation -5.5 ft NAVD88. The canal will have a 10.0 foot wide bottom and side slopes of 2H:1V through the limestone layer, average top elevation +2.5 ft NAVD88. Above the limestone layer the slope will transition to 4H:1V. The embankment top elevation will be +7.0 ft NAVD88 reflecting the maximum stage of +4.0 ft NAVD88 plus 3.0 feet of freeboard. To avoid scouring, velocities in the channel will be maintained at or below 2.0 feet per second (fps) at the design pumping rate of 225 cfs.

A.7.8.1.2 S-200 Conveyance Channel

The proposed lined inlet channel will convey water from the pump station discharge to the distribution header channel within the detention area, a distance of approximately 4,500 feet. The inlet channel will generally be constructed above grade by removing the existing surficial soil material down to the top of limestone and constructing parallel containment levees above the

limestone. The inlet channel will be lined for its full length with 6.0-inch-thick concrete to elevation 6.0 ft NAVD88. The side slopes will be 4H:1V to match the embankments. The width of the proposed lined channel is 25 feet with the bottom elevation approximating the top of the limestone at about +2.0 feet NAVD88 plus 6 .0 inches. Velocities in the channel will be maintained at or below 2.0 feet per second (fps) at the design pumping rate of 225 cfs.

A.7.8.1.3 Frog Pond Header Distribution Channel

The header distribution channel will be constructed inside the detention area immediately east of the western containment levee. As currently proposed, the distribution channel extends from the northern end of Cell N to the southern end of Cell S. The distribution channel was designed with a constant elevation of the header channel berm of 5.0 feet NAVD88 and a western perimeter levee that has a minimum top elevation of 9.0 feet NAVD 88. The distribution channel bed width has been set at an average width of 180 feet over its entire length. As with the inlet channel, the water distribution channel will be constructed above grade by removing surficial soils to the top of limerock. The invert of the channel will follow the top of limestone which decreases slightly in elevation from north to south. The distribution channel will be unlined.

A.7.8.2 South Project Components

A.7.8.2.1 S-199 Intake Canal

The proposed intake canal will convey water from the C-111 Canal to S-199, a distance of approximately 200 feet. The intake canal will be constructed by removing the existing surficial soil material excavating through the limestone layer to elevation -5.5 ft NAVD88. The canal will have a 10.0 foot wide bottom and side slopes of 2H:1V through the limestone layer, average top elevation +2.5 ft NAVD88. Above the limestone layer the slope will transition to 4H:1V. The embankment top elevation will be +7.0 ft NAVD88 reflecting the maximum stage of +4.0 ft NAVD88 plus 3.0 feet of freeboard. To avoid scouring, velocities in the channel will be maintained at or below 2.0 feet per second (fps) at the design pumping rate of 225 cfs.

A.7.8.2.2 S-199 Conveyance Channel

The proposed lined inlet channel will convey water from the pump station discharge to the Aerojet Extension Channel, a distance of approximately 4,440 feet. The inlet channel will generally be constructed above grade by removing the existing surficial soil material down to the top of limestone and constructing parallel containment levees above the limestone. The inlet channel will be lined for its full length with 6.0-inch-thick concrete to elevation 6.0 ft NAVD88. The side slopes will be 4H:1V to match the embankments. The width of the proposed

lined channel is 25 feet with the bottom elevation approximating the top of the limestone at about +2.0 feet NAVD88 plus 6 .0 inches. Velocities in the channel will be maintained at or below 2.0 feet per second (fps) at the design pumping rate of 225 cfs.

A.7.8.2.3 Aerojet Extension Channel

The Aerojet Extension Channel will receive flows from S-199 through the conveyance channel and direct the flows to the north end of the existing Aerojet Canal, over a distance of approximately 4,200 feet. The channel will be constructed above the limestone layer. The geometry of the channel will be 4H:1V side slopes with 20 feet bottom width. The average grade of the limestone layer along the proposed alignment of the channel is approximately +2.5 ft NAVD88 therefore the average bottom elevation of the channel with the 6 inch concrete lining will be +3.0 ft NAVD88. With a flow depth of 2.5 feet and a concrete freeboard of 1.0 foot plus an additional 2.0 feet of vegetated freeboard the minimum top of levee elevation will be +8.0 ft NAVD88. The Aerojet Extension Channel will be unlined.

A.7.9 Earthwork Volumes

Earthwork Volumes were calculated based on the design discussed in the preceding sections of this report.

A.7.9.1 North Project Components

As discussed previously, the detention areas will be excavated to the limestone layer. Based on soil probes done and noted in the Geotechnical Report the average depth of the surficial soils is approximately 8.25 inches (0.7 ft). For ease of calculation it will be assumed that the entire footprint of the detention area including the inlet channel will be cleared. The western levee already exists and, therefore, the cut volume will be calculated from the inside toe of the western levee. The total area to be excavated is approximately 600 acres which will generate approximately 655,000 cubic yards of material to be moved. Typically undisturbed soils in this area will have a shrinkage factor of 20 to 30 percent, however the area to be excavated has been cultivated, therefore, a factor of 10 to 15 is more appropriate. Using a shrinkage factor 15 percent the excavated volume will be approximately 769,000 cubic yards.

Fill volumes were calculated for the construction of the perimeter levees, intermediate levees, and weirs within the north-south levees. The perimeter levee sections will have slopes of 4H:1V, top elevation of 9.0 ft NAVD88, and crest width 14 feet. The intermediate levee volumes will be computed based on slopes of 4H:1V, top elevation of 5.0 ft-NAVD88, and crest width of 5 feet. In the scheme and scale of the overall volumes the volumetric difference that the weirs

will reflect is insignificant and therefore will be calculated with the same geometry as the header channel berm. With a shrinkage factor of 20 to 30 percent (use 25 percent) and an additional 15,000 cubic yards for Pump Station S-200, the total fill volume is approximately 299,000 cubic yards.

A.7.9.2 South Project Components

A.7.9.2.1 Cut Volumes

As previously discussed, the embankments will be constructed above the limestone layer. Based on soil probes and as noted in the Geotechnical Report, the average depth of the surficial soils is approximately 0.5 ft. For ease of calculation it will be assumed that the entire footprints of all the embankments will be excavated to the limestone layer. The total area to be excavated is approximately 35 acres which will generate approximately 47,200 cubic yards of material. Typically, undisturbed soils in this area will have a shrinkage factor of 15 percent. Using a swell factor of 25 percent, the excavated volume will be approximately 54,200 cubic yards.

A.7.9.2.2 Fill Volumes

Fill volumes were calculated for the construction of the embankments and weir plugs. All fill calculation will be based on the structure design discussed in previous sections. With a shrinkage factor of 25 percent and an additional 92,600 cubic yards needed for Pump Station S-199, the total fill volume is approximately 108,000 cubic yards.

A.7.10 Relocations

A.7.10.1 North Project Components

There are electrical utilities along the west perimeter levee that will require relocation. The SFWMD will be responsible for the relocation. The cost of the removal/relocation is included in the Opinion of Probable Construction Cost.

A.7.10.2 South Project Components

There are electrical utilities along the west side of SW 232nd Avenue that may be affected by the Aerojet Extension construction. The SFWMD will be responsible for the relocation. The cost of the removal/relocation is included in the Opinion of Probable Construction Cost.

A.8 PUMP STATIONS S-200 AND S-199

A.8.1 Introduction

The following Basis of Design Report (BODR) addresses the proposed water supply pump stations S-200 and S-199 of the C-111 Spreader Canal Project - Western (Project). The intent of this Project is to improve the quantity, timing, and distribution of the water delivered to the Florida Bay via Taylor Slough by establishment of a hydraulic ridge between Taylor Slough and the C-111 Canal to reduce seepage from the slough. This ridge will be created by diverting C-111 Canal flows into two linear infiltration basins. The FPDA infiltration basin will be constructed downstream of control structure S176 and will consist of an approximate 510 acre reservoir that is partitioned into three detention cells. The maximum stage within the cells will be 2.5 ft. above existing grade. The second basin is the Aerojet Canal. The existing canal berms will be raised to allow the increase in stage to a maximum 2.5 ft. above the existing grade. Each infiltration basin will be supplied by water diverted from the C-111 Canal by a 225 cfs capacity pump station.

The ultimate Project objective is to evaluate system wide responses to the operation of the basins is to aid in the conceptual development of a plan to reduce and eventually eliminate the point source discharge of the C-111 canal to the Florida Bay in conjunction with the re-hydration of the coastal areas drained by this flood control system. The plan will not reduce the flood protection benefits now afforded by the current infrastructure.

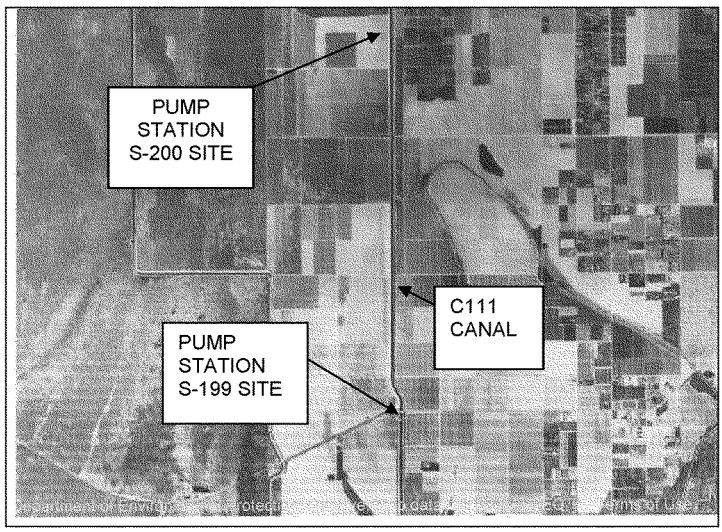


FIGURE A-15: S-200 AND S-199 GENERAL LOCATION

A.8.1.1 Pump Station Design Objectives

The design priority is to deliver two facilities that address the Project objectives and satisfy the SFWMD minimum design criteria and O&M requirements at a reasonable cost. In general, the primary design and construction objectives for the pump stations shall:

- Satisfy the design and operational criteria as defined by the SFWMD
- Provide a reliable facility capable of operation during extreme storm events
- Ensure efficient operation to minimize energy costs
- Require robust structural and mechanical systems to provide a long service life
- Provide remote/automated operation to reduce operating costs
- Ensure minimum maintenance costs by use of appropriate corrosion-resistant materials and coating systems and the proper site and building design
- Provide a design that addresses operator and public safety
- Ensure facilities to be designed to address vandalism

A.8.1.2 General Pump Station Description

S-200: The pump station shall be located in south Miami/Dade County immediately west of C-111 Canal north of the control structure S-177. The purpose of the Pump Station No.1 is to convey water west from the C-111 Canal to the Frog Pond Detention Area. The station will consist of a reinforced concrete rectangular intake substructure. A reinforced concrete and masonry control building located adjacent to the intake shall be provided to house the electrical, control, and communication equipment. Steel sheet pile wingwalls will be provided to direct flows into the intake and from the discharge chamber. The approach channel/forebay shall be transitioned to limit turbulent flow and shall have erosion protection to address the high velocity flows near the entrance of the intake. The pumps shall be protected by a trash rack and automated rake. Each pump shall have its own intake bay and each bay shall be capable of being dewatered. Both stations shall have (3) 75 cfs axial flow submersible pumps. Facilities for energy dissipation and erosion protection shall be provided at the point of discharge to ensure stability to the channel side slopes. Manual/auto/remote control shall be provided in accordance with SFWMD standards and operational criteria. Backup generator power shall be provided for building service and system control in the event of a power outage.

S-199: The pump station shall be located in south Miami/Dade County immediately west of C-111 Canal north of the control structure S-177. Pump Station No.2 will convey water from the C-111 Canal to a proposed canal that connects to the existing Aerojet Canal. The station will consist of a reinforced

concrete rectangular intake substructure and a reinforced concrete and masonry control building located adjacent to the intake shall be provided to house the electrical, control, and communication equipment. Steel sheet pile wing walls will be provided to direct flows into the intake and from the discharge chamber. The approach channel/forebay shall be transitioned to limit turbulent flow and shall have erosion protection to address the high velocity flows near the entrance of the intake. The pumps shall be protected by a trash rack and automated rake. Each pump shall have its own intake bay and each bay shall be capable of being dewatered. Both stations shall have (3) 75 cfs axial flow submersible pumps. Facilities for energy dissipation and erosion protection shall be provided at the point of discharge to ensure stability to the channel side slopes. Manual/auto/remote control shall be provided in accordance with SFWMD standards and operational criteria. Backup generator power shall be provided for building service and system control in the event of a power outage.

A.8.1.3 Reliability and Cost Considerations

This pump stations are for water supply, not flood protection, and therefore are not considered emergency facilities. Auxiliary or redundant systems will be minimized. However, dependability will be a consideration during the design and equipment selection process since it relates to the quality of the constructed facility. Equipment is primarily specified on the basis of reliability under emergency conditions, again to ensure a quality installation. The equipment selected will be rugged, reliable, and well suited for the service. The stations should be of a robust design that is sized to house and support the equipment to ensure a long service life. A back-up power generator will be provided to service the building and communications systems only.

A.8.1.4 Life Cycle Cost (LCC) Analysis

The engineering regulation ER 1110-2-8159, "Engineering and Design-Life Cycle Design and Performance" defines the engineering policies for selection of all systems, components, and materials for civil works projects on the basis of their long term performance. This regulation requires the design engineer for civil works projects to use life cycle design as the basis for selection of all project elements such as materials, structural systems, mechanical equipment, and site appurtenances. The Hydraulic Institute has recently published a guide entitled "Pump Life Cycle Costs" for LCC analysis of pumping systems. Life cycle cost analysis is an important and increasingly standard method to compare alternatives of major hydraulic facilities during the conceptual development of the project.

A.8.1.5 Design Life

There are a number of USACE references in regard pump station service life. According EM-1110-2-3104, EM-1110-2-3105, and the SFWMD Major Pumping Station Engineering Guidelines, the design life of a pump station is 50 years. It is anticipated the mechanical equipment will required rehabilitation or replacement at least once during the 50 year service life. The pumps will operate intermittently and with proper preventative maintenance, should have a 25 year service life. Pump equipment shall be designed and manufactured to ensure a long service life for the non-wear components. Communication electrical and communication equipment also typically have a 25 year life although the rapid advancements in communications systems often require modifications prior to this service period.

A.8.2 Geotechnical Engineering Analysis and Design

RADISE International, Riviera Beach, FL. completed geotechnical field investigations to support pump station design activities. The objectives of the geotechnical investigations and analyses were to:

- Collect representative geotechnical data from engineering borings
- Perform laboratory testing of collected samples
- Perform engineering analyses of encountered site conditions and proposed station designs
- Perform an evaluation of the station designs to provide adequate factors of safety and provide for long term stability

The Geotechnical Report submitted on July 18, 2008 provides details of all geotechnical investigations carried out.

A.8.2.1 Field Exploration and Laboratory Testing

A.8.2.1.1 SPT Borings and Coring

The field investigation program performed (2) borings at each pump station site. The results were presented in the Geotechnical Report. One rock core boring and one STP boring within (15) ft. of each other were taken at each pump station site.

Borings were completed using a truck-mounted rotary drill using rotary wash methods. Steel casing was used to stabilize the boreholes as needed. The rock borings were performed generally in accordance with ASTM D 2113-99. Sampling and penetration testing of the subsoils was accomplished using the Standard Penetration Test (SPT) method (ASTM D1586). SPT sampling was performed continuously from the ground surface extending to a depth of 75 feet

below grade, and at 5-foot intervals thereafter. Completed boreholes were grouted to the ground surface using a neat cement grout.

Each collected sample was visually classified in the field in general accordance with ASTM D2487.

TABLE A-9: BORING SUMMARY

Boring Designation	Boring Type	Site	Depth (feet)
CB0040	SPT	S-200	75
CB0040A	Rock Core	S-200	53
CB0041	SPT	S-199	75
CB0041A	Rock Core	S-199	53

A.8.2.2 Laboratory Testing

Laboratory testing was performed on the soil and rock samples recovered in the borings, to determine material classification and engineering properties. Data from laboratory results are presented in the Geotechnical Report.

A.8.2.3 Existing Site Conditions

A.8.2.3.1 Site Surface Conditions

The Pump Station S-200 site lies approximately 15,150 ft north of control structure S-177 and approximately 200 ft. west of the C-111 Canal. The station will supply water to the FPDA infiltration basin to be built to the west of the C-111 Canal. The average elevation of this region varies from approximately +2.5 to +5.0 feet (NAVD88).

The Pump Station S-199 site lies approximately 150 ft north of control structure S-177 and approximately 200 ft. west of the C-111 Canal. The station will supply water to the Aerojet Canal infiltration basin. The average elevation of this region varies from approximately +2.5 to +5.0 feet (NAVD88).

A.8.2.3.2 Regional Geology and Subsurface Conditions

The subsurface conditions at the pump station sites can be generalized to include two layers based on information provided by the completed geologic borings. These layers include:

- Layer I: Organic Silt with Peat (PT)–This layer consists of a thin surface layer of organic silt with dark brown fibrous peat.

- Layer II: Silty Sand (Marl) (SP-SM, SM, ML)-This layer varies in thickness from 0.3 to 1.5 feet.
- Layer III: Limestone-Underlying the marl, is generally vuggy limestone with numerous voids, weakly to well cemented limestone with silt lenses, and low plasticity silt, and calcareous silt and clay with limestone fragments, and shell with some well cemented limestone.

Unconfined compressive strength tests for the two core samples taken from the S-200 site were performed for the Geotechnical Report. The test indicated 1559 psi for the single result from the S-200 site. The core boring performed at the S-200 site returned an average percent recovery of 24.2 percent.

Unconfined compressive strength tests for the two core samples taken from the S-199 site were performed for the Geotechnical Report. The tested range varied between 537 and 3012 pounds per square inch (psi) for S-199 site. The core boring performed at the S-199 site had an average recovery of 48 percent.

The rock quality designations (RQDs) ranged from 0 percent to 76 percent for the two pump station sites.

The typical subsurface profile at the pump station sites can be summarized as follows:

- Organic peats and marls is zero to 2 feet thick below prevailing ground surface
- Moderately to well cemented limestone/sandy limestone 40 to 50 feet thick
- Groundwater 4.4 to 4.7 feet below existing grade

The engineering data are summarized as below:

A.8.2.3.3 S-200 and S-199 Site Limestone Parameters

S-200 Site:
- SPT N-Value - 18 to greater than 100+ bpf
- Percent recovery from coring-18 to 100% (average 58 percent)
- RQD-0 to 67 percent (average 24.2 percent)
- Dry Unit Weight-79.1 to 130.0 pounds per cubic foot (pcf)
- Unconfined compressive strength–1559 psi

S-199 Site:
- SPT N-Value - 14 to greater than 100+ bpf
- Percent recovery from coring - 40 to 100% (average 48%)
- RQD - 0 to 76% (average 17.9%)
- Dry Unit Weight - 110.5 to 142.6 pounds per cubic foot (pcf)
- Unconfined compressive strength – 537 to 3012 psi

A.8.2.3.4 Groundwater Conditions

Groundwater at each site was reported in the borings at depths that ranged from approximately 4.4 to 4.7 feet below ground surface. Groundwater elevations are summarized in ***TABLE A-10.*** This range of groundwater levels is consistent with historically reported groundwater levels in this vicinity.

Groundwater levels at the sites will fluctuate due to operation of control structures and adjacent canals, as well as a result of the change in seasons. The range of groundwater elevations reported during field investigation likely represents a higher bound as the borings were performed during the wet season. During the wet season, it is expected that ground water could be temporarily ponded at or above the surface or be very close to the ground surface.

Groundwater levels were measured and recorded for all borings. The measured water levels are presented on the boring logs, which are summarized in the table below.

TABLE A-10: OBSERVED GROUNDWATER ELEVATIONS

Boring Designation	Depth to Groundwater (ft)
CB0040	4.4
CB0041	4.7

A.8.2.3.5 Corrosion Potential

Factors used as indicators of the corrosion potential of soil include soil pH balance and concentration of sulfate and chloride ions. Generally, a pH less than seven (7) indicates an acidic soil environment, potentially corrosive to buried metal and concrete. Sulfate and chloride ion concentrations greater than 1,000 to 300 parts per million (ppm) respectively indicate soil that is potentially corrosive to buried metal and concrete. Soil resistivity less than about 10,000 ohm-cm indicate soils that are potentially corrosive to buried metals.

TABLE A-11: CORROSIVITY TESTS

Boring Designation	Sample Depth (ft)	pH	Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)	Corrosivity Aggressive Potential
CB0040	4.0 - 6.0	8.85	6500	4.7	10	Slightly Aggressive
CB0041	4.0 - 6.0	9.11	6800	7.6	6.2	Slightly Aggressive

The results of chemical testing indicated that the materials tested have a slight to moderate potential for corrosion to buried metal and concrete based on pH, sulfate and chloride ion concentrations, and soil resistively.

A.8.2.4 Design Evaluations

A.8.2.4.1 General Geotechnical Site Suitability

Based on the results of the geotechnical field investigations and physical laboratory testing program, the sites are considered suitable for all components of the project. The predominantly strong subsurface conditions encountered in the borings are well-suited for the foundation support of properly designed structure. The permeability of the limestone is highly variable and controlled by solutioning and jointing systems in the rock. While the strong, well cemented subsurface materials are desirable for the support of the proposed structure and stability of the canal side slopes, these materials present a challenge for excavation and dewatering.

A.8.2.4.2 Summary of Generalized Design Parameters

Based on results obtained from the physical laboratory tests performed on the collected soil samples and data from existing reports, the unconfined compressive strength and split tensile strength of subsurface material were determined. These parameters are summarized in ***TABLE A-12***.

TABLE A-12: SUMMARY OF LABORATORY TESTING RESULTS

Boring	Sample Depth (ft)	Unconfined Compressive Strength (psi)
Unconfined Compression Test for soil samples from S-200 Site		
PS1-CB-0040A	42±	1559
Unconfined Compression Test for soil samples from S-199 Site		
PS2-CB-0041A	15±	1540
PS2-CB-0041A	20±	537
PS2-CB-0041A	40±	3012
PS2-CB-0041A	43±	1602

A.8.2.5 Geotechnical Analysis

A.8.2.5.1 Slope Stability

The stratigraphy of the design cross-section of the approach and discharge channels consisted of well-cemented limestone underlain by a moderately cemented limestone. The soil parameters are based on the field testing program

as described in the Geotechnical report. From review past canals constructed in the area, the canals constructed in the moderate to well-cemented limestone are not at risk for slope failure even with steeply sloped sides of 0.5H:1V. The performance to date of the existing canals with 0.5H:1V side slopes confirms the proposed side slopes should be adequate.

A.8.2.5.2 Structure Stability Criteria

The stations will be evaluated and sized to provide a suitable margin of safety between the overall forces and combinations of loads that can cause unsatisfactory resistance to flotation, sliding, overturning, or bearing failure. The required factors of safety for stability were designated for "critical" structures that are new and thus have "ordinary site information" (EC 1110-2-2100).

A.8.2.5.3 Approach Channel Erosion Potential

Cemented limestone is generally considered erosion resistant for the flow conditions anticipated for this project. Although the porosity and vugginess of the limestone may result in lower than expected RQDs, the material is moderately to well cemented. SFWMD canals have typically been constructed without erosion protection in soils that are weaker than those observed at the proposed sites. Based on field observations, the existing C-111 Canal in the adjacent areas have performed well with respect to erosion. It was concluded that the approach channels for the stations can be constructed without erosion protection measures except in the near vicinity of the proposed pump stations.

While it is assumed that normal flow velocities in unprotected channels will not exceed 2.5 fps, flow velocities can be expected to be higher around the control structures. Consequently, erosion control measures in the form of riprap generated from on-site excavations is provided in these localized areas. Stone protection for the channels and embankment slopes upstream and downstream of hydraulic structures are typically sized using the procedures given in USACE EM 1110-2-1601 Hydraulic Design of Flood Control Channels. The charts and tables of this design document apply to high energy discharges and require significant interpretation for application to the relatively low velocities of the hydraulic structures of this Project. Typically for low velocity flows, construction of a 24 inch thick blanket of riprap is provided with a minimum 12 inch thickness of bedding stone. A filter fabric placed on the subgrade is normally required. In areas where higher velocities or turbulence is expected, the riprap and bedding stone thicknesses are increased and/or the standard gradation is changed. The extent of the stone protection is typically to that point upstream and down where flow velocities or turbulent conditions are diminished to non-erosive velocities. For sandy soils this allowable velocity is typically taken as 1.5 to 2.0 fps.

An important aspect of the erosion protection and site design is the need to provide stable transitions to the structure entrances. This site design therefore will consider the smooth transition of the water flow into and from the structure.

A.8.2.6 Construction Recommendations

This section provides general recommendations for the construction of the project including recommendations for general site preparation, excavation, dewatering, pump stations and other structures.

A.8.2.6.1 Site Access and Preparation

Site preparation activities will include preparation of channel alignment areas and the potential construction of necessary temporary access roadways to and from work areas. Channel alignment preparation will include the clearing and grubbing of existing grasses, brush and low vegetation. Both sites are clear of heavy vegetation.

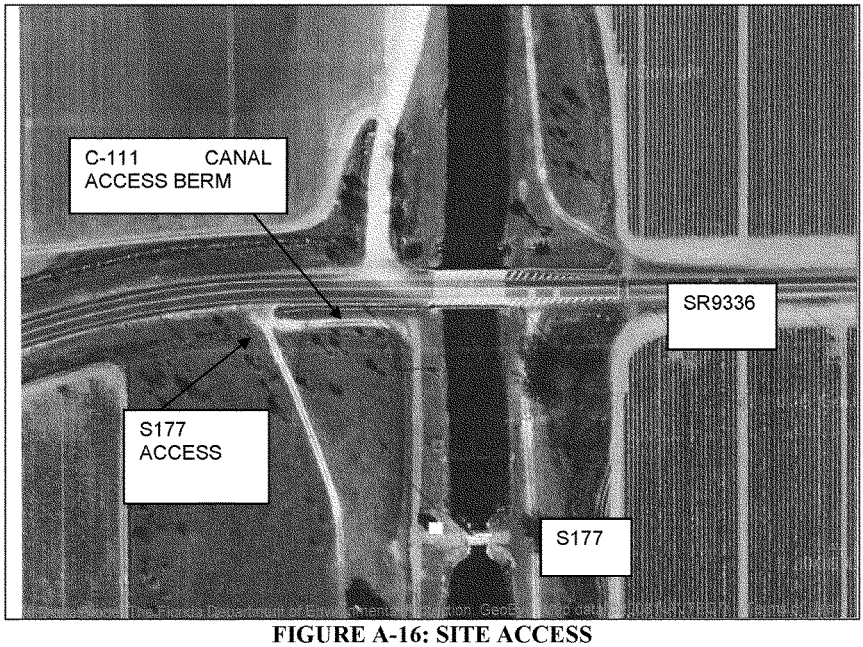


FIGURE A-16: SITE ACCESS

A.8.2.6.2 Excavations and Dewatering

Excavation will be required for channels and for the substructure of the pump stations. Due to the cemented nature of the rock, excavations into the in-situ limestone may potentially require blasting or specialized techniques or equipment to fracture the cemented limestone to allow for excavation by dragline or backhoe equipment. Typically, in South Florida, limestones with SPT N Values less than about 30 to 35 BPF can be excavated by large mechanical backhoes. In areas where SPT N values exceed 30 to 35 BPF, specialized equipment/techniques, blasting or ripping is required to pre-fracture the rock prior to excavation.

Excavations for channels should be completed in the wet without dewatering. Fill material excavated in a wet condition, will need to be stockpiled and drained prior to re-use.

Excavations for the pump station structure will extend to depths 30± feet below the ground surface. To facilitate their construction and to minimize dewatering, it will be necessary that excavations be sheet piled and tremie-sealed.

A.8.2.6.3 Structural Backfill

It is assumed the excavated materials from the structure sites will provide adequate and acceptable structural backfill. However, for the discharge channel construction, there will not be enough excavated material to construct the berms. Therefore material will required to be borrowed from off-site to complete the work or the canal excavation expanded to produce the necessary fill. The structural backfill should consist of cohesiveless soils. The structural backfill should be placed in horizontal layers not exceeding 12 inches in loose thickness and compacted to not less than 95 percent relative density determined in accordance with ASTM D4253-00 and D4254-00.

Backfilling against structures should be allowed only after the concrete has attained majority of its design strength (typically 75 percent is specified) and sufficient portion of the structure is in place to resist the lateral load. It is further recommended that the filling take place simultaneously on opposite sides of the structure such that fill conditions on opposite sides do not vary by more than 5 feet in height.

The use of heavy equipment adjacent to the structures will be carried out with substantial care within a prescribed allowable offset distance, typically 3 feet from the wall. To avoid excessive wall loadings due to backfilling, (i.e., generating much larger effective horizontal wall forces), specifications should require either limiting the compacting equipment size or type and/or also providing a minimum 3-foot offset distance from the wall. The wall backfill

specifications should define the actual density required within a narrow + 2 pcf of maximum dry density per ASTM D698 within the stated distance from the structure.

Compaction equipment should consist of self-propelled vibratory rollers in open areas and wheeled compactors/hand-operated vibrating plates for closer and confined work areas adjacent to the walls.

In-place testing of each compacted lift should be required. For larger areas, typically one test per 2,500 square feet is required for either self-propelled or hand operated machines. Areas where it is not practical to perform density tests, may be considered for acceptance by the Geotechnical Engineer's representative based on a firm and unyielding surface during the proof rolling, or compaction process.

A.8.3 Hydraulic Analysis and Design

A.8.3.1 Pump Station Hydrologic Background

The project's first phase shall divert C-111 Canal discharges via a lined canal and S-200 to the FPDA infiltration basin west of the C-111 Canal and north of control structure S177. The basin will be composed of (3) detention cells that will be designed for a maximum water stage of 2.5 feet above the approximate existing grade of 3.5 ft. NAVD88. Flows to the cells will be over weirs both into the cells as well as the header canal feeding the cells. The maximum crest elevation of the weirs is set at 7.5 ft. NAVD29 (5.91 NAVD88).

The second component of this first phase is the diversion of C-111 Canal flows at the headwater to control structure S177 to the Aerojet Canal via a proposed canal connection and S-199. The Aerojet Canal berms will be improved to elevate the canal stage to a maximum of 2.5 ft. above existing grade similar to the FPDA infiltration basin. A series of weirs will be constructed along the canal, again similar to the header canal of the FPDA infiltration basin.

Both pump stations are to operate in tandem to maintain similar hydraulic heads in the two infiltration basins. Each station will have three (3) 75 cfs pumps that will have similar start/stop criteria based on the stage elevation within the infiltration basin. The maximum stage is set a 2.5 ft. above the existing grade. The existing grade is assumed to be approximately 3.5 ft. NAVD88 at both basin locations. An addition pump shut-down criteria is 10 centimeter ponding depth within the Cape Sable seaside sparrow habitat area as measured at a predetermined monitoring site.

The project will not lessen the flood protection currently provided by the C-111 Canal. Therefore this first project phase shall include the continued use of the

C-111 Canal for peak flood discharges. The ultimate project goal is the degradation of the C-111 Canal eliminating this point source discharge.

A.8.3.2 Location

The approach channel to S-200 connects directly to the C-111 Canal approximately 15,150 ft north of the control structure S-177. The channel intersects the C-111 Canal at right angles and flows to the west to the intake of S-200.

The approach channel to S-199 connects directly to the C-111 Canal approximately 150 ft north of the control structure S-177. The channel intersects the C-111 Canal at right angles and flows to the west to the intake of S-199.

A.8.3.3 Hydrological and Hydraulic Data

Pool stages were established from the SFWMD modeling provided for the Project and review of historic record stage data from the SFWMD database DBHYDRO. The information provided by the SFWMD did not define the design stage for the station which had to be established by review of the record data in conjunction with the Project's proposed civil works. The inflow (suction pool) and discharge (upper pool) conveyance canal conditions are summarized in the tables below. The protection elevation was assumed to be elevation 10.59 ft NGVD29 or approximately 9.0 ft NAVD88.

TABLE A-13: C111 STAGE DATA - S177 HW (DBKEY 13154)

STAGE	FEET (NAVD)	FEET (NGVD)
MINIMUM	0.11	1.7
MAXIMUM	3.97	5.56
MEAN	1.92	3.51

Add 1.59 ft. for conversion to NGVD29 datum.

TABLE A-14: PUMP STATION NO.1 DESIGN STAGES

DESIGN STAGE	FEET (NAVD)	FEET (NGVD)
DESIGN DISCHARGE POOL STAGE*	7.0	8.59
DESIGN SUCTION POOL STAGE	0.5	2.09
LOW WATER SHUT-OFF STAGE**	0.0	1.59

* assumes 1.0 ft above proposed weir crest.
** assumes 0.5 ft. loss across trash rack.
Add 1.59 ft. for conversion to NGVD29 datum.

A.8.3.4 Pump Station Capacity

The three (3) 75 cfs pump arrangement for each station was selected by the SFWMD based on their hydrologic modeling. The results of these studies indicated that this selected pump capacity provided the most effective flexibility to evaluate the regional effects of the operation of the infiltration basins. These pump stations will be used for environmental restoration with no flood control functions. No standby pumping capacity was provided.

Review of the SFWMD DBHYDRO record flow data for control structure S177, for the period of record from 1981 through 2008, indicated:

TABLE A-15: C-111 FLOW DATA-S177 (DBKEY 13156)

FLOW	CFS
MINIMUM	0.0
MAXIMUM	1766
MEAN	164

TABLE A-16: PUMP STATION DESIGN CAPACITY

PUMP STATION NUMBER	CUBIC FEET PER SECOND	GALLONS PER MINUTE
PUMP STATION S-200	225	100,987
PUMP STATION S-199	225	100,987

TABLE A-17: C-111 FLOW DATA-S177 (DBKEY 13156)
Cumulative Frequency

VALUE (CFS)	TIME EQUALED OR EXCEEDED
1,412	20
1,059	66
706	269
353	1,075
0	6,482

TABLE A-18: C-111 FLOW DATA-S177 (DBKEY 13156)
Duration Curve

VALUE (CFS)	TIME IN PERCENTAGE OF INDICATED PERIOD
1,071	1.0
652	5.0
500	10.0
301	20.0
62	50.0
0	80.0

A.8.3.5 Pumping System Operation

It is assumed the pump stations will normally be automatically operated by stage monitors within the infiltration basins. The stations will also have the capability to be operated manually or remotely via the SFWMD's SCADA communication facilities. Remote operation will be required for pump shut-down given maximum ponding in the Cape Seaside sable sparrow site. Operational objectives include alternating the operation of the 75 cfs pumps at the lower canal stages since operation within this canal stage range could be continuous at certain times of the year. The pump start sequence identified in the following table is an assumed schedule that most probably will be adjusted by the SFWMD with some period of operating experience. Note, for the "pumps all off" stage will be based on the maximum allowable infiltration basin stage that was assumed to be 2.5 ft. above the existing grade of 3.5 ft. = 6.0 ft NAVD88.

The pumps have a low water shut-off stage in the intake of 0.0 ft. This represents the minimum submergence water level above the pump bell as recommended by ANSI/HI 9.8 Intake Standard. This stage assumes a 0.5 ft. head differential from the pump design low water canal stage of 0.5 ft. NAVD88 across the trash rack due to blockage.

The pump discharge pipe inverts were set 0.5 ft above the assumed design high water stage in the discharge canal and will have an automatic shut-off. This invert elevation prevents the re-cycling of water back through the pumps. The automatic shut-off is recommended in case a potential problem in the discharge canal occurs. These problems may include a blockage of the outlet or a restriction preventing the free gravity discharge or possibly wet conditions that have caused a high canal stage. Please note, backflow prevention devices such as flap gates are not desired by the SFWMD, so the pump station discharge arrangement requires the discharge piping inverts to be set above the maximum discharge pool stage.

A.8.4 Civil Engineering Analysis and Design

A.8.4.1 General

A.8.4.1.1 Project Design Considerations and Criteria

The SFWMD has over its history adopted a number of standard construction requirements for their civil works. These criteria generally were taken from the Central & South Florida Flood Control Project (C&SFFC Project) designed and constructed by the USACE. This project started in the early 1950's through 1980's constructed the primary water supply and flood protection infrastructure of the SFWMD. The pump station sites must satisfy a number of SFWMD criteria.

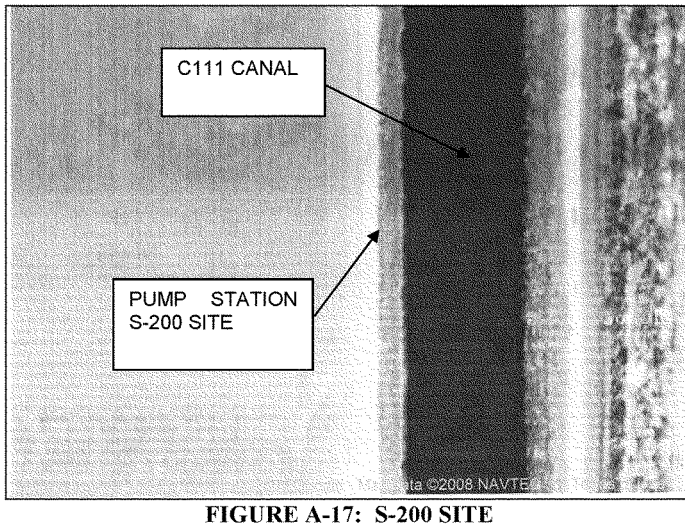


FIGURE A-17: S-200 SITE

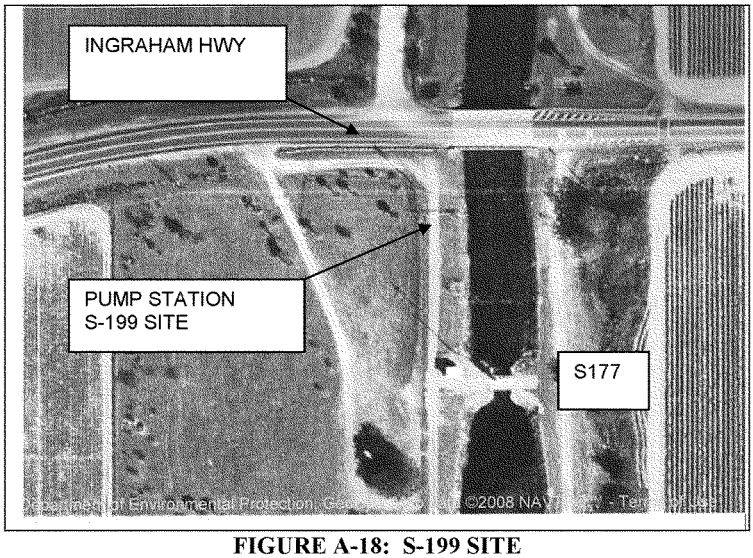


FIGURE A-18: S-199 SITE

A.8.4.1.2 Equipment Maintenance

For removal of the pumps or other auxiliary equipment for major maintenance the site design for each station must:

- Provide adequate area for the set-up of a crane to remove and load the pump to a flat-bed truck.
- Provide a minimum of 18 ft. of service bridge clearance for heavy equipment traffic over the structure.
- The service bridge must be designed for HS-25 truck loading.
- The substructure design must address a 500 psf surcharge soil loading for the possible crane set-up and operation close to the structure.
- Provide sufficient lay-down area for the pump, rack, or other auxiliary equipment.

A.8.4.1.3 Channel Maintenance

The approach and discharge channels for each station also have a number of site design considerations:

- 40 ft. wide maintenance berms are provided each side of the approach and discharge channels typically for wide top widths where the entire canal can not be reached from one side.

- The maintenance berms should have a minimum 3 foot freeboard above the maximum design stage of the channel.
- Provide access ramps to the channel's maintenance berms.
- All ramps have minimum 10 ft. width and a slope not greater than 10H:1V.
- A weed barrier is provided at the entrance to the approach channel. The barrier is angled relative to the channel centerline so the floating weeds and debris gather on the maintenance berm bank for collection and disposal. The barrier also serves as a safety barrier preventing boats from approaching the station.
- All stone protection provided should extend up the bank to an elevation above the maximum design high water.

A.8.4.1.4 Site Security

The pump station sites shall have the following security features:

- Standard SFWMD 6 ft. high non-climbable chain link security fence around the perimeter of the pump station site with 14 ft. wide double leaf swing gates at the entrances to the site or ramp locations.
- Pump reduction gears and/or motor drives housed within a secure pump operation building.
- Non-climbable and locking roof ladders as per SFWMD standards for roof heights less than 20 ft. Greater roof height require a protection cage for the ladder with a lockable door.

A.8.4.1.5 Site Safety

The pump station sites shall have the following safety features to protect the public as well as the SFWMD operations personnel:

- Safety float barrier (weed barrier) across the approach channel.
- Handrail around the discharge chamber, along wing walls or any other area where there is a significant difference in elevation that has personnel access.
- SFWMD standard bollards placed around the LP gas fuel tank, corners of buildings, and at the trash conveyor to protect these items.

A.8.4.2 Approach Channel Design

A.8.4.2.1 Channel Slopes

To provide efficient conveyance to and from the stations, the site design for each station will use a trapezoidal cross section, with a straight alignment and flat canal bottom for the approach and discharge canals. In this limerock geology a

stable cut section can be as steep as 0.5H:1V as evidenced by a number of existing C&SFFC Project canals in the south Miami-Dade County area. However, the traditional excavation side slope of 2H:1V will be used.

Embankment slopes are typically 2H:1V in this region as is the case for the L-1E Levee. Vegetation growth on this rock fill is usually sparse, and there is occasionally slope erosion. However, in general, the embankments are stable and become well cemented with age and resistant to surface erosion. 3H:1V is the standard embankment slope required by the SFWMD for bank maintenance and shall be used in the design.

During a pre-review meeting held 09-13-08, the SFWMD directed the WRS to use a 4H:1V embankment side slope. The discharge channel is to be lined with a 6 inch thick concrete liner with a bottom elevation of +3.5 ft NAVD.

A.8.4.2.2 Channel Alignment

It is proposed the approach channel for S-200 and S-199 be 200 ft. in length from the C111 Canal centerline to the entrance of the intake. The Pump Station No.1 centerline location relative to the C111 Canal stationing or other established control will be determined by WRS. Layout of the proposed station site plan will be from the topographic survey and the centerline alignment provided on this plan.

A.8.4.2.3 Flow Velocity

For the rock geology of the Project site, unlined canals are specified for the pump station approach channels. Typically 2.0 fps maximum flow velocity is assumed for the sizing of the canal cross sections. This is a conservative value that applies to medium sandy soils. Low flow velocity to minimize erosion increases canal cross sections and Project costs. For this application the flow velocity can be safely increased to 2.5 fps. At the structure the bottom width will transition from the intake or discharge chamber width and elevation to the design bottom width and elevation of the channels. The canal cross section, however, will need to be enlarged to provide borrow material for construction of the containment berms. It is assumed that over excavation of the channels will be more economic than hauling material from an off-site source.

A.8.4.2.4 Scour Protection

The transition of the flow into the pump rectangular intake and flow from the discharge chamber are in large part addressed by the structure wing walls. Primarily at the discharge chamber at the region of the outlet of the discharge pipes, there is considerable turbulence that requires some distance for the flow jets to spread and develop into a uniform and more steady state flow pattern.

The discharge and intake structure width is 34 ft. to satisfy the intake width requirements. The -4.0 ft NAVD88 depth of the discharge chamber with a potential maximum stage of +7.0 ft. NAVD88 for the pump stations provides a significant pool to dissipate these discharge flow jets. On the intake side of the station due to the required submergence of the pumps the intake entrance floor at the dewatering needle sill is elevation -9.5 ft NAVD. The approach velocity at this point is well below 1.0 fps. The channel slope as per ANSI/HI 9.8 can have a maximum slope of 10H:1V to transition up to the design bottom of the approach channel.

The SFWMD has written a detailed stone protection specification with variations of stone gradations for the severity of the flows expected. For all but the largest hydraulic structures of the SFWMD, the stone gradation "B" has proven to have adequate stone size to address the flow velocities for entrance to and the discharges from the various spillways, culverts and pump intakes and discharge chambers that are typical of the SFWMD. The length and thickness of the stone blanket when velocities are under 2.0 fps is generally specified as a 20 ft. blanket length with a 2 ft. thick riprap blanket with a one ft. thick bedding stone thickness. This stone protection addresses any possible high velocity flows at the structural boundaries such as the piers noses or end sills where potential scouring could occur.

A.8.4.2.5 Design Stage

The design stages for the approach and discharge channels were established previously and are summarized in the following table:

TABLE A-19: APPROACH CHANNEL DESIGN STAGES

DESIGN STAGE	FEET (NAVD)	FEET (NGVD)
S-200 & S-199 SUCTION POOL STAGE*	0.5	2.09
INTAKE LOW WATER SHUT-OFF STAGE**	0.0	1.59

* based of C111 canal historic stage records
** assumes 0.5 ft. loss across trash rack.
Add 1.59 ft. for conversion to NGVD29 datum.

TABLE A-20: DISCHARGE CHANNEL DESIGN STAGES

DESIGN STAGE	FEET (NAVD)	FEET (NGVD)
S-200 & S-199 DISCHARGE POOL STAGE*	7.0	8.59
BASIN HIGH WATER SHUT-OFF STAGE*	7.0	8.59

*assumes 1.0 ft stage above proposed weir crest
Add 1.59 ft. for conversion to NGVD29 datum.

TABLE A-21: CHANNEL DESIGN CAPACITY

PUMP STATION	CFS	GPM
S-200	300	134,649
S-199	300	134,649

SFWMD designs their conveyance canals so the flow is maintained within canal design cross section and typically targets a (3) ft freeboard from the design stage to the top of bank. Over-bank flows are not considered desirable due to the resulting slope erosion and channelization. For canals with stages controlled by a pump operation, the freeboard can be reduced given proper monitoring and control of the stage to ensure the maintenance berm is not over-topped.

A.8.4.2.6 Channel Design

The minimum design parameters for the proposed approach and discharge channels for the station based on the maximum flow rate of 300 cfs and a maximum flow velocity of 2.5 fps is summarized in the following table. It should be noted again, the size of the excavated portion of the channel will need to be enlarged to provide borrow material for the containment berms.

TABLE A-22: APPROACH CHANNEL DESIGN

DESIGN PARAMETER	
SIDE SLOPE	3H:1V
MINIMUM STAGE (FEET NAVD)	0.5
MAXIMUM STAGE (FEET NAVD)	4.0
TOP OF BANK/MAINTENANCE BERM ELEVATION (FEET NAVD)	7.0
CANAL DEPTH AT MINIMUM STAGE (FEET)	6.0
CANAL BOTTOM ELEVATION (FEET NAVD)	-5.5
CANAL BOTTOM WIDTH (FEET)	10.0
ASSUMED EXISTING GRADE (FEET NAVD)	3.5

* assumes 3 ft. freeboard above maximum stage
Add 1.59 ft. for conversion to NGVD29 datum.

TABLE A-23: DISCHARGE CHANNEL DESIGN

DESIGN PARAMETER	
SIDE SLOPE	2H:1V
MINIMUM STAGE (FEET NAVD)	7.0
MAXIMUM STAGE (FEET NAVD)	7.0
TOP OF BANK/MAINTENANCE BERM ELEVATION (FEET NAVD)	10.0
CANAL DEPTH AT MINIMUM STAGE (FEET)	6.0
CANAL BOTTOM ELEVATION (FEET NAVD)	1.0
CANAL BOTTOM WIDTH (FEET)	25.0
ASSUMED EXISTING GRADE (FEET NAVD)	3.5

* assumes 3 ft. freeboard above maximum stage
Add 1.59 ft. for conversion to NGVD29 datum.

During a pre-review meeting held 09-13-08, the SFWMD directed the WRS to use a 4H:1V embankment side slope. The discharge channel is to be lined with a 6 inch thick concrete liner with a bottom elevation of +3.5 ft NAVD. See current civil drawings for changes to above table.

The discharge channel for S-200 will be approximately 200 ft. in length and will transition to the design section for the conveyance channel that directs water to the Header distribution Channel. The discharge channel for S-199 will be approximately 200 ft. in length and will transition to the design section for the conveyance channel that directs water to the Aerojet Canal. See the civil drawings for additional details for these project features.

A.8.4.3 Site Design

A.8.4.3.1 General

The site design will address the SFWMD standards and design criteria. The following items are not addressed by the SFWMD standards but are typical for SFWMD small pump station sites.

A.8.4.3.2 Site Drainage

The area around each pump station intake and discharge chamber will basically be level with the service bridge elevation of 9.0 ft. NAVD. For drainage the grade shall be slightly pitched away from the bridge and control building to the top of the proposed banks. This service area will be paved as per SFWMD standards. The embankment slopes around this service area shall be 3H:1V to accommodate SFWMD mowing equipment. The slopes will be sodded. The proposed stone protection will be extended around the wing walls to an elevation above the maximum design stage. Addition riprap may be added for those transition slopes steeper than 3V:1H in the areas around the intake and discharge chamber. The finished floor elevation for the control building will be set at elevation 10.0 ft. NAVD to ensure the electrical equipment is well above any localized ponding or runoff. The roof drainage from the control buildings will discharge via scuppers and downspouts on the west wall to grade with PVC piping leading to rock swales and the discharge channel.

A.8.4.3.3 Pavement

The majority of the service area around each pump station intake and discharge chamber with the security fencing will be paved. A (2) ft. offset from the fencing is typically provided which is sodded. The pavement will be in accordance with SFWMD standard details. The pavement is provided to ensure a stable and durable driving surface around the control building and intake structure for these high traffic areas. Reinforced concrete approach aprons are provided for

the service bridge to ensure a smooth and rigid driving surface transition from the asphalt pavement to the bridge. A concrete sidewalk is provided for the control building entrances.

A.8.4.3.4 Trash Collection Area

The trash collection area is provided at the end of the trash conveyor. The area is surfaced with a reinforced concrete slab. The trash that accumulates in this area is contained by a concrete curb. The trash is typically removed by a small front end loader.

A.8.4.3.5 LP Gas Underground Tank

A (500) gallon capacity underground LP Gas tank is provided for the back-up generator at each pump station site as per SFWMD standards. The tank is located adjacent to the generator room approximately 10 ft. from the exterior wall. The tank is easily accessible to the re-fueling trucks and is protected by standard SFWMD bollards. The supply piping is underground and also protected by a bollard.

A.8.4.3.6 Communication Antenna Pole

At each pump station site, a standard SFWMD 46 ft. precast concrete antenna pole will be provided to support the communication dishes. The pole is located (5) ft. from the exterior of the control building wall when possible to minimize the above-ground communication conduit and wiring.

A.8.4.3.7 In-Bank Stilling Well

At each pump station site, an in-bank stage monitoring well will be provided approximately 100 ft. from the intake entrance and one approximately 100 ft. from the discharge chamber on the control building channel bank. The stilling well and its appurtenances will be in accordance with the SFWMD detailed standards for the well, intake piping and staff gage. The well and its instrument chamber are located at the top of the channel bank with the intake piping connecting to a timber pile supported staff gage at the toe of the channel side slope. For the rock geology of the region, the pile holes will be required to be augured prior to driving the piles.

A.8.4.4 Construction Consideration

A.8.4.4.1 Turbidity Control

The Contractor is required to conform to State water quality standards as prescribed in F.A.C. Chapter 62-302, and to meet the special requirements of any environmental permits that have been issued. The Contractor will need to

install and maintain turbidity barriers where necessary to maintain turbidity releases at or below permit levels. Barriers will be installed prior to any filling, backfilling, or excavation and maintained in place until construction is complete and turbidity from construction has dissipated.

A.8.4.4.2 Maintenance of Operation of Existing Facilities

The Contractor will need to construct all work such that the existing flood control system and road traffic are not disrupted. Coordination with work that connects to the highway will need to be coordinated with State highway officials. Connection to the existing electric service will need to be coordinated by the contractor with the utility company. The contractor shall coordinate all construction activities that may impact the operation of the C-111 Canal and its control structures with SFWMD operating personnel.

A.8.5 Structural Engineering Analysis and Design

The design of each pump station consists of a concrete substructure consisting of the pump intake and discharge chamber and a control building that houses the generator and electrical rooms that adjoins the substructure. A typical SFWMD masonry and concrete frame construction is proposed for the control building, 20 ft x 28 ft. The structure will be founded on shallow footings constructed on a prepared subgrade. Precast concrete roof panels were used. A 14 ft. eave height was selected with a 4 ft. parapet for the control building. The building will be located adjacent to the intake not structurally connected to the substructure. The building will be composed of two rooms, the electrical room and the generator room.

A.8.5.1 Station Design Standards and Codes

The following codes and standards were considered applicable for the structural engineering design. In case of conflicting requirements, the more stringent codes were applied.

- ACI 318-05, Building Code Requirements for Structural Concrete
- ACI 350-01, Environmental Structures
- National Fire Protection Association - NFPA 101 – Life Safety Code
- AISC Manual of Steel Construction, 13th Edition
- Florida Building Code, 2004 Edition with current (2006) supplements (FBC)
- ASCE 7-02, Minimum Design Loads for Buildings and Other Structures
- SFWMD Design Guidelines for a Water Supply Pump Station

A.8.5.2 General Design Load Parameters

The structural design loads applied to the pump stations include:

Dead Load: Dead Load for the design included the weight of all permanent construction, including roofs, walls, slabs, actual equipment weights. The unit weight of the concrete was taken as 138 pcf.

- Roof live loads: 50 psf
- 10 inches thick hollow core slab unit weight: 86 psf
- Roof covering with insulation unit weight: 9 psf
- Rain Load: 15 psf
- Floor live loads:
  - Minimum unless noted otherwise: 100 psf
  - Truck Loading: HS-25 (AASHTO)
  - Control Building: 100 psf
- Hydrostatic Loading: Liquid and soils lateral pressure loads shall use a load factor of 1.7 for concrete design.
- Wind Loads: Wind loads for the design of the Main Wind Load Force Resisting System (MWFRS) and for cladding components of buildings were calculated in accordance to the Florida Building Code 2004 and ASCE-7-02, and comply with the SFWMD criteria. These criteria included:
  - Wind velocity of 140 miles per hour and exposure C as defined in the FBC wind maps for Miami-Dade County.
  - 100 yr mean recurrence interval.
  - 50 yr from 100 yr recurrence adjustment factor = 1.07.
  - Roof: 0 degrees.
  - Mean Roof Height: 14 feet.
  - Importance Factor = 1.15, for water supply pump station.
  - Control Building Dimensions: 20 feet x 28 feet ~ rectangular enclosed building, no windows, low-rise building.
- Backfill Parameters: The cohesiveless structural backfill was assumed to be limestone/shell/sand with the following characteristics: γ = 115.8 pcf; γsub = 68.7 pcf; ϕ = 40° and K'a = 0.22; K'p = 4.60.
- Design G.W.L.: The substructure wall designs shall assume the lateral earth pressure developed under the condition of a mean canal stage of +2.0 ft. with a saturated granular backfill to the finished grade behind the wall.
- Soil Loading Assumptions: Complete saturation or submergence of the backfill with the groundwater standing at the level of the finished grade represents the extreme case were water exerts a pressure on the wall which is independent of the lateral soil pressure. In addition to the pore water pressure, there is the lateral pressure due to the soil, which is a

function of the submerged unit weight of the soil. Both the water pressure and the soil pressure were considered to act horizontally with hydrostatic distribution. The lateral pressure for this condition was computed by the equivalent fluid method. It can be assumed use of granular backfill will reduce this lateral soil pressure to the active case once the backfill operation is completed. The available at-rest soil values using the formula p = Cwh, where C varies with the backfill from 0.4 for non-cohesive soils to 1.0 for compacted cohesive soils, for coarse sand C ~ 0.5.

- The equivalent fluid load for the soil was calculated = 96.8 pcf. The equivalent fluid load method is considered a conservative semi-empirical method and has been used because the physical characteristics of the backfill are not reliably known. Including the hydrostatic pressure to the full height of the wall adds considerably to the conservatism as well as the fact the soil's submerged at-rest unit weight values shall be used. The specifications shall require granular backfill.
- Vibration: Vibration for the submersible pumps specified is considered insignificant to the structural design.

A.8.5.3 Structural Stability

Stability Analysis of structures was made against overturning, sliding, and floatation, with recommended safety factors of 2.0, 1.5, and 1.5, respectively. Given the 3:1 length to height ratio, the substructure's center of gravity is relatively low. In addition, with the substructure founded on a tremie seal and with little driving force, the structure's stability exceeded to a large margin, the safety factors stated above.

A.8.5.4 Concrete Design Criteria

Concrete design utilized the FBC 2004, EM 1110-2-2104, ACI 350-01, and the ACI 318-05 strength design method. For strength design, the recommendations of ACI 350 were included to modify the requirements in ACI 318. From these recommendations the following adjustments to the ACI 318 load factors were utilized a) the load factors for both the lateral earth pressure H and the lateral liquid pressure F were taken as 1.7, b) the factored load combinations for total factored design load was increased by 1.3 in calculations for reinforcement in flexure.

Materials:

- Concrete for hydraulic structures — 4,500 psi compressive strength @ 28 days
- Concrete for structures in dry — 5,000 psi compressive strength @ 28 days

• Mass concrete	2,500 psi compressive strength @ 28 days
• Pre-stressed concrete design	5,000 psi compressive strength @ 28 days
• Reinforcing steel	ASTM A615, Grade 60

The minimum concrete cover shall not be less than 1.5 x the maximum aggregate or 2.5 x the bar diameter. The following concrete cover shall be assumed in the analysis:

- Cast against earth: 3 inches
- Elements with surfaces exposed to abrasion, channel side faces: 2.5 inches
- Slabs, walls, and beams typical: 1.5 inches

The minimum temperature steel for the abutments, piers, and walls shall be specified as #5 bars at 12 inches on centers. The wall thicknesses shall be sufficient to allow the proper placement and consolidation of concrete and shall be designed in multiples of 2 inches to simplify formwork. For typical design and detailing of the reinforcement, multiples of 6 inches shall be used in the spacing of the primary and secondary steel. The minimum bar spacing shall be taken as 1.5 x bar diameter or 1.5 x the maximum aggregate size. The minimum spacing between layers shall be 6 inches.

Construction joints shall be located to facilitate the construction, limit the horizontal depth of the placement and shall not impair the strength and water tightness of the structure. Horizontal joints shall be located at the base of walls and typically at the maximum spacing of 10 feet–0 inches. Reinforcement shall be continuous through the construction joint. Waterstops shall be used in construction joints where there is a head differential and the possibility of water flow through the joint.

A.8.5.5 Masonry Design Criteria

The pump station buildings will consist of a reinforced concrete frame with masonry infill panels and a 4 feet high masonry parapet. The masonry panels are considered cladding elements. The masonry design includes the following design criteria:

- Concrete Masonry Unit will be 8" x 8' x 16" two cell concrete block.
- The masonry unit shall have fm = 2000 psi.
- Grout shall have a compressive strength of 2500 psi.
- Mortar shall have a compressive strength of 2500 psi.

The infill panels will normally span vertically from concrete slab or beam to concrete beam and are considered to carry no vertical load. Horizontal bond beams will be utilized to distribute the lateral wind loads around openings to the adjacent columns. Parapets were considered to act as a cantilever.

A.8.5.6 Steel Design Criteria

Steel design utilized the AISC Manual of Steel Construction, 13th edition. Load combinations will be in accordance with ASCE 7-02, ACI 318-05, and ACI 350-1. The following materials will be generally utilized for the construction of the stations:

• Structural steel rolled shapes	A588, Grade 50
• Plates	A36, Grade 36
• Bolts and nuts	A325 and A490, minimum 0.75" diameter
• Anchor bolts	A307 (3/4" diameter and less), A36 (1" diameter and greater)
• Corrosion steel	A304 or A316
• Sheet piles	A328 and A572

A.8.5.7 General Description of Pump Station

Pump Stations S-200 and S-199 will be similar in design. The stations will include an arrangement of three (3) vertical submersible axial flow pumps. Each pump is supported by a pipe column, discharging to a common chamber. The pump's rectangular intakes have dimensions as specified according to the mechanical requirements. The intake floor slab has a top elevation of -9.5 ft NAVD88. The discharge chamber slab has a top elevation of -4.0 ft. This slab is supported by abutments and end walls as well as having the interior void space filled with structural fill. The slab was designed assuming soil settlement. The operating floor slab elevation was set at +9.0 NAVD88. Steel sheet piling was designed to withstand lateral loadings due to soil, hydrostatic pressures, and a surcharge loading of 500 psf and were detailed as per SFWMD standards.

For the design of abutments, a lateral earth pressure for a completely saturated soil to grade using the equivalent fluid load method was utilized with a 96.8 psf equivalent lateral load. An additional surcharge traffic loading 500 psf was added to this lateral load. Concrete reinforcement, shear strength, and flotation calculations were performed to arrive to a design thickness of the various substructure structural elements. The operating floor slab thickness of 18-inches was determined based on a HS-25 wheel loading and 100 psf live load as per SFWMD requirements. A buoyancy check calculation was performed taking into account the submerged weight of the structure with one bay dewatered and groundwater elevations taken as +2.0 ft. NAVD.

A.8.5.7.1 Control Building

A 20 ft x 28 ft control building with floor slab elevation +10.0 ft NAVD88 adjacent to the discharge chamber houses the electrical instrumentation control, and the communication systems. The control building structure consists of reinforced concrete spread footing and a reinforced concrete frame with masonry infill panels. The building floor is an 8-inch concrete slab-on-fill. The roof consists of 10" thick precast concrete hollowcore panels tied to a cast-in-place perimeter beam. A (4) ft high reinforced masonry parapet is provided a per SFWMD standards. The wall system consists of cast-in-place concrete columns with reinforced 8" CMU infill panels. The infill panels were considered cladding elements. An interior wall was provided to enclose the generator room. This interior wall is also masonry, and the masonry cells are filled with grout to provide a one (1) hour fire rating.

A.8.5.8 Structural Reinforcement Design

A.8.5.8.1 Pump Station Substructure

The structural components for each pump station intake include the tremie seal foundation, intake floor slab, discharge chamber floor slab, abutments, piers, backwall, needle beams and operating deck slabs. The input loads for the foundation and walls design included: wind, soil, hydrostatic pressures, dead loads, live loads, and self-weights as required by the structural design criteria.

A.8.5.8.2 Control Building

Structural elements for the control building at each pump station included: reinforced concrete roof perimeter beams and columns, reinforced concrete spread footing, masonry infill panels and parapet, reinforced concrete slab on grade, interior masonry wall, and reinforced precast hollowcore roof panels. The masonry walls, concrete columns, and concrete beams comply with the FBC for the high wind loads prescribed for the region as well as the SFWMD requirements. The input loads for the design of the control building components included: wind, soil, superimposed dead loads, superimposed live loads, and self-weights as required by the structural design criteria.

A.8.5.8.3 Sheet Piling System

The sheet piling system was design based on the water table information obtained from the SFWMD DBHYDRO historic stage records. The design utilized a PZ27 sheet pile section. The contractor shall be given the option to utilize a different sheet of equal or greater section modulus. The reinforced concrete cap and tie-back system generally followed the SFWMD standard details for the wales, tie rods, and deadman. The same backfill characteristics

assumed for the stability analysis were assumed for the wing wall design. The wingwalls were analyzed using the software program SPW91 V2, Pile Buck, Inc. This program utilizes the Rankine method. The cantilever end portions of the wingwall were checked using USS Steel Sheet Piling Design Manual methods.

The results of the analysis indicated:

The approach channel wing walls had the greatest loading due to the deeper channel at the intake. A tie-back system was necessary for the portion of the wall adjacent to the structure. The remainder of the wall was found to adequately support the load as a cantilever.

The discharge wing walls do not require a tie-back system and were found to adequately support the lateral loads as a cantilever.

The tie-back system assumed a tie-rod spacing at every second PZ27 sheet or a 3 feet center to center. The analysis also assumed the worse case loading conditions with the wale at elevation +3.0 feet NAVD. The result of the analysis indicated:

- A required tie-rod diameter of 1-3/8" diameter @ 3 feet centers.
- A 15 foot wale was considered sufficient for the approach channel wing walls.

The 6 feet high concrete wall deadman is required, equal in length to the wales and located outside the potential active failure zone of the soil 30 feet from the wing wall.

A.8.6 Mechanical Engineering Analysis and Design

A.8.6.1 Project Background

A.8.6.1.1 Pump Station Description

Pump Stations S-200 and S-199 are each rated at a total capacity of 225 cfs; provided by three (3) 75 cfs, electric, submersible axial-flow pumps. The submersible axial-flow pumps are supported by a pipe column and have a piped discharge to a chamber. The pump's rectangular intakes include trash racks, scraper style rakes, and a conveyor to collect and convey trash to a disposal site adjacent to the intake. The intake is dewatered by using SFWMD standard dewatering needles. The station's electrical, instrumentation and control (I&C), and communications equipment is housed in a reinforced concrete and masonry control building adjacent to the discharge chamber. The station has back-up power for the building service equipment only, not the pumping systems.

A.8.6.1.2 Design Standards and Codes

The following codes, standards and guidelines were utilized for the Mechanical Design of the pump stations as applicable:

- SFWMD Engineering Design Standards for Water Resource Facilities, Design Guidelines dated February 2008 (as amended)
- National Fire Protection Association, NFPA 37-Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2006
- National Fire Protection Association, NFPA 58-Liquified Petroleum Gas Code
- National Fire Protection Association, NFPA 101-Life Safety Code
- National Fire Protection Association, NFPA 10-Standard for Portable Fire Extinguishers
- ANSI/HI 9.8-1998-Pump Intake Design Standard
- USACE EM 1110-2-3102 General Principles of Pumping Station Design and Layout, Feb. 28 1995
- USACE EM 1110-2-3105 Mechanical and Electrical Design of Pumping Stations

A pump stations are small water supply pump stations and not for flood control. A submersible pump style station is suitable for this application. These types of stations are less costly to build and easier to maintain.

A.8.6.2 General Design

A.8.6.2.1 Mechanical Arrangement

The pump discharge pipe inverts were set 0.5 feet above the maximum discharge canal stage at the maximum rated flow to provide for backflow control. A 45-degree elbow was added at the end of the pump discharge pipe to provide a downward trajectory to the water into the discharge chamber.

A siphon arrangement that extended the discharge pipe below the chamber's low water stage was evaluated. For this case, the pump motor size would remain the same to prime the siphon by pumping to the proposed discharge pipe crest. However, the system head could have a variation under the siphon assisted operation given the number of pumps running and their resulting flow rate's impact of the downstream stage. This variability of head would make the selection of the pump curve and its best efficiency point (BEP) impossible to optimize. Since (1) 75 cfs pump is predicted to run continuously during certain times of the year (i.e. wet season) at normal canal stages, the operation of the pump would approach the run-out portion of the pump curve, possibly in a region of poor efficiency for both the pump and motor. This arrangement would

offer little energy benefits and therefore was not carried further into this design phase.

A.8.6.2.2 Pump Station Geometric Criteria

The natural grade (existing ground surface) at each pump station site is approximately +3.5 ft. NAVD88. The pump station elevations used in the Mechanical Engineering Design are identified in ***TABLE A-24***.

TABLE A-24: PUMP STATION ELEVATION DESIGN CRITERIA

Station Component	Elevation (ft. NAVD88)
Operating Floor TOS	+9.0
Control Building Floor FF	+10.0
Pump Discharge Pipe Centerline*	+9.0
Intake Floor TOS	-9.5
Discharge Floor TOS	-4.0
Tremie Seal TOS	-14.0
Bottom of Tremie Seal	-25.5

* assumes pipe invert 0.5 ft. above maximum discharge pool stage.
Note: Discharge pool stage for both stations assumed to1.0 ft above the proposed inflow weir crest.

A.8.6.3 Plumbing Equipment

A.8.6.3.1 Design Considerations

The reliability requirements for flood control pump stations do not apply to this project, due to each pump stations' environmental restoration function. As a result, there was an opportunity to minimize the size of the stations' superstructure by use of submersible pumps. The use of (3) 75 cfs submersible axial-flow pumps for the stations is the recommendation of the SFWMD. A small control building was utilized to house the electrical, instrumentation and control, and communication systems. The submerged pumping units results in an economy station with the elimination of the pump house. This pump type also is preferred from the maintenance perspective because of its easy pull-out design.

A.8.6.3.2 Design Life

There are a number of USACE references in regard pump station service life. Generally these references indicate 50 year design life for the facility. However, water resource structures are robustly designed for a life that is typically double this duration. It is anticipated the electrical and I&C equipment will require rehabilitation or replacement at least once during a 25 year service life. The pumping equipment with proper preventative maintenance should have a 25

year service life. Pumping system auxiliary equipment should be designed and manufactured to ensure an equally long service life for the non-wear components.

The USACE engineering regulation ER 1110-2-8159, "Engineering and Design - Life Cycle Design and Performance" defines the engineering policies for selection of all systems, components, and materials for civil works projects on the basis of their long term performance. This regulation requires the design engineer for civil works projects to use life cycle design as the basis for selection of all project elements such as materials, structural systems, mechanical equipment, and site appurtenances. Life cycle cost analysis (LCC) is an important and increasingly standard method to compare alternatives of major hydraulic facilities.

A.8.6.3.3 Pump System Analysis

The pump discharge pipe centerlines for the stations were set so that pipe inverts would be above the discharge canal high water stage with all pumps running. With a low water shut-off at 0.0 ft. NAVD88 allowing for a 0.5 ft. head differential across the trash rack, the maximum static head would be to the crest of the discharge pipe at 10.5 ft. The pumping system analysis indicated the head and capacity requirements for the pumps are in the axial flow range.

A.8.6.3.4 Pump Performance Characteristics

Performance requirements are enforced by the factory performance test in accordance with ANSI/HI 2.6-2000 Vertical Pump Test standard. In accordance with the ANSI/HI standard acceptance criteria, the rate of flow tolerance at rated pump total head and speed can vary from 0 percent to +10 percent of the specified Q. Efficiency will be equal to or greater than the specified minimum efficiency at the rated flow, total pump head, and speed. The pump input horsepower requirements will not over-load the selected driver throughout the pump curve from shut off head to the maximum operation flow range.

The rated capacity (Q) should be within the region of 80 percent to 110 percent of the BEP for the furnished propeller. Various manufacturers' catalog curves have been reviewed for pump availability and to select pump sizes for the required performance for the pumps.

A.8.6.3.5 Pump Type

Vertical, submersible, axial-flow pumps were selected by the SFWMD. For water supply applications with automated or remote operations, electric motor-driven pumps have low maintenance and are a cost effective alternative. The SFWMD maximum motor voltage requirement is 480 VAC. The required motor horsepower is within the range available for this pump type.

This pump type is a completely submerged self-contained unit with a bell entrance, propeller, planetary reduction gear, motor, and diffuser. The unit is supported and housed by a steel discharge column and is capable of removal without unbolting the discharge piping. Use of this submerged unit provides for a quiet operation and permits the station's superstructure size to be greatly reduced. Submersible pumps are designed as a single machine even though specifications may not always recognize that unity. It is important that the design specifications state that a single manufacturer is to design and supply all parts of the pump unit including pump, motor, discharge tube, reduction gear, and cables.

While the general venturi configuration of the pumps built by different suppliers is similar, the details (e.g., number of bearings, wearing ring design, cast versus fabrication, impeller design, and materials) can vary. Based on currently available design details, there is little justification or preference of one manufacturer's design over another. The pump portion of the specification is a low-tech design compared with the motor and housing internal design. Approximately 70 percent to 80 percent of the cost of the unit is the motor. The pump portion should be comprised of rugged, reliable, long-lasting components that are trouble-free.

The submersible pump motors conform to the requirements of NEMA MG 1. The motor will be sized to avoid overload when operating at any point along the characteristic curve of the pump and will be 3-phase, 60-Hz, 480 V, squirrel cage induction type, NEMA Design Type B. The stator windings and stator leads will be insulated with a moisture-resistant Class F insulation with temperature resistance of 155 degrees C (311 degrees F). The service factor will be 1.0. The temperature rise above ambient for continuous full load rated conditions and for the class of insulation used will not exceed the values in NEMA MG. The motor will be rated for continuous duty when submerged and will also be capable of operation in the dry for short periods of time for testing and maintenance purposes. The starting torque will be sufficient to start the pump, but in no case less than 60 percent of full-load torque. Breakdown torque will not be less than 200 percent of full-load torque.

The thrust bearing support will have sufficient strength and rigidity to support the weight of the entire rotating element of the motor, pump impeller and shaft, and the hydraulic thrust.

The power and instrumentation cable will be specifically designed for use with a submersible pump application and will conform to the requirements of NEMA WC 7. The submersible cable will be suitable for continuous immersion in water at the maximum depth encountered. The cable will have an ampacity of not less than 125 percent of the motor full load current. The cable length will be

determined by the pump manufacturer. Power and instrumentation cables will enter the motor through a sealing system that prevents water entry into the unit and provides strain relief. The cable entry may be comprised of rubber bushings, flanked by stainless steel washers, having a close tolerance fit against the cable outside diameter and the entry inside diameter for sealing by compression of the bushing, or the entry may be sealed by other gland compression methods. The following sensors will be provided:

- A thermal sensor in the gear reduction unit (if used) to monitor oil temperature
- Temperature sensors in the stator windings to protect the motor against overheating
- Temperature sensors to monitor the main and support bearings
- Float-switch sensor positioned between the bearings and the stator-end coils to detect if liquid penetrates the stator housing
- A junction box leakage detector and a water-in-oil detector

The pump is typically designed with a planetary gear connecting the pump shaft to the motor shaft. Lubrication is of the permanent type, and cooling is accomplished by the water flowing over the pump/motor unit. A dual independent mechanical rotating shaft seal system is provided between the motor, planetary gear system, and the impeller.

A.8.6.4 Pump Intake Design

The primary function of the pump intake is to provide the required flow to the pump. This flow should be uniform with a minimum of rotational wakes, free of harmful debris, have enough depth to prevent the formation of free surface vortices, and have an approach speed that avoids flow separation at boundaries. The intake structure is designed to allow the pumps to achieve their optimum hydraulic performance for all operating conditions. From a cost perspective, the design objective was to keep the depth and footprint size of this substructure to the minimum necessary to satisfy the hydraulic criteria. The standard generally used in North America to design the geometry of pump intakes is the ANSI/HI 9.8-1998 - Pump Intake Design Standard. The SFWMD operating level requirements (i.e. minimum service platform clearance) required the intake length to exceed the minimum length required by HI standards.

For the submersible pump arrangement, where the pump is supported by a discharge tube and the bell is exposed at the entrance of the tube, the pump is considered to have the same flow characteristics as a typical vertical pump with bell intake. Therefore, the geometry requirements as prescribed for a rectangular intake by the ANSI/HI 9.8 are considered applicable. In accordance with section 9.8 of the HI standard, each pump will be installed in its own bay. The pump bay will have adequate width and depth to limit the approach velocity

to 1.5 ft/sec. The pump dimensions will be determined as multiples of the pump bell diameter. The inlet bell diameter will be based on limiting the bell inlet velocity to 5.5 fps.

A.8.6.4.1 Intake Physical Model Test

ANSI/HI 9.8-1998-Pump Intake Design Standard recommends that any pump station with a pump capacity greater than 40,000 gpm or a station capacity greater than 100,000 gpm to be physically modeled to identify unacceptable flow patterns. The proposed pump stations have an intake design that exceeds the ANSI/HI 9.8-1998 minimums for length, a significant benefit for a uniform approach flow to the pump. Therefore, no physical model study is required or recommended.

A.8.6.5 Station Auxiliaries

A.8.6.5.1 Trash Collection System

The trash rack, rake and conveyance system is custom engineered equipment that is complete with all structural support, motors, and monitoring and control components for the removal of trash accumulated on the rack and its conveyance to a disposal area. The design of the equipment will be the responsibility of a manufacturer experienced with the fabrication and installation of this type equipment. There are a wide variety of systems available, unique in their design and operation. For this size pump facility, a front cleaning scraper bar-type trash rake has been the SFWMD preference. The raking equipment may be supplied independent or in combination with the rack.

A.8.6.5.2 Trash Rack

The trash rack is designed to collect debris harmful to the pump and maintain an acceptable head loss across the rack. The maximum bar spacing and the allowable material size into the intake shall be confirmed by the pump manufacturer. In accordance with USACE Engineering Manual EM1110-2-3102 General Principles of Pumping Station Design and Layout, the bar "clear spacing" will be not less than 1.75 inches and not more than 3 inches. The maximum velocity of water through the rack will not exceed 2.5 fps. For this station, the clear spacing will be 2 inches. The rack will span the entire width and the full height from the base slab to the service bridge of the intake and have an inclination of 60 degrees from horizontal. In accordance with ANSI/HI 9.8-1998 the water velocity at the entrance of the intake is less than 1.5 fps.

The rack will be capable of being removed for access to the pump. Anchorage of the rack will be at the service bridge with the toe of the rack resting on the sill plate as per SFWMD standards. The rack will be designed for four lift points.

The rack anchorage will be readily accessible with adequate tolerance to facilitate easy re-installation. All fasteners shall be of the locking type such as with lock nuts and lock washers.

In accordance with USACE Engineering Manual EM1110-2-3105, Mechanical and Electrical Design of Pumping Stations, the head loss through a properly designed trash rack that is raked regularly should not exceed 6 inches.

The rack can be subject to both steady and dynamic loads during operation. Fatigue resistance of welded joints and vibration resistance of the structural members and fasteners is an important design consideration. All structural design will be in accordance with the AISC Manual of Steel Construction and needs to consider all live and dead loads with a minimum 25 percent increase in live loads to address impact loads caused by the operation of the rake. The rack is designed for a maximum loading corresponding to five foot of differential head above the elevation of the pump's low water shut off for the full width of the rack. The maximum allowable deflection of the rack for design purposes is L/360 with a maximum of one (1) intermediate support provided if required. All materials of the rack will be corrosion-resistant, with the bars, plates or other structural shapes being ASTM A276 Type 316L stainless steel, and the nuts, bolts, anchors, fasteners being the applicable ASTM A193 or ASTM A194 Type 316L, stainless steel. The rack will follow SFWMD standards.

A.8.6.5.3 Trash Rakes

The type of raking device used to remove trash from the rack depends on the estimated trash type and loading rate, the environmental conditions of the region, the size of the station and in some cases the space available. In the past, raking for small stations was done by hand. However, new installations are equipped with automated rakes that collect the trash and transport it to a dump site.

Currently, small to medium-sized stations utilize a chain-driven, scraper-style rake. This is a front-cleaning, scraper bar type trash rake, utilizing horizontal scraping bars supported by chains that rotate on sprockets, driven by an electric motor. The bars clean from the bottom to the top, riding on the front of the rack, and return over the raking bars. The scraping bars are typically made of polyethylene material and are grooved to penetrate between the rack bars. Debris is removed to the disposal site via a belt conveyor. The rake operation is continuous with the operation of the pump. The rack/rake inclination preferred by the SFWMD for optimum operation is 60 degrees, although the rake is capable of effectively operating at a much steeper angle. All submerged materials of the rake are made of corrosion-resistant materials.

This rake type has a number of advantages, including, being easily adapted to different site conditions, intake geometry, and type of debris by varying the chain and scraping bar length. In addition, the speed of the rake can be varied to adjust to the estimated trash loading. The unit can be supplied as a rake only, or in combination with a bar rack. An important criterion for design is that the rake must be able to operate effectively in high wind and not be vulnerable to flying debris. The rake equipment will be designed to withstand hurricane strength winds. The rake equipment will also be designed to operate without loss of effectiveness, up to sustained wind speeds of 70 mph. The rake widths are limited to 12 feet requiring multiple units to service intake widths of greater dimensions. The rake should require the minimal dismantling necessary to facilitate this maintenance requirement and needs to be designed for easy re-installation.

A.8.6.5.4 Trash Rake Operation Control

The operation of the rake equipment will be determined by the position of an "Auto–Off–Manual" selector switch located on the Control Panel. "Auto" mode will interlock the rake and conveyance equipment with the operation of the pump and will require no operator interface for proper operation of the system. "Manual" mode will allow operation of the system or any of the system components by an operator.

The electrical control for the rake equipment will be located in the Station Control Center (SCC) in the control building. Local controls, disconnects, etc. as required, will be located adjacent to rake equipment on the service bridge. The control panel enclosure will be rated NEMA Type 12. Local disconnects, enclosures for local controls, etc. will be rated NEMA Type 4X. When the trash rake system is running in "AUTO" mode, the Programmable Logic Controller (PLC) of the SCC will start the trash conveyor system. When all the trash rakes are stopped, the SCC PLC logic will maintain the conveyor running for an additional three minutes (adjustable) before stopping the conveyor.

The rake will be provided with a load limiting device that will shut down the rake and signal an alarm condition back to the control panel, if the pull force on the rake exceeds the setting of the load limiting device.

A.8.6.6 Intake Dewatering

The intake's structural design will permit the dewatering of one intake bay at a time for inspection and/or maintenance of a pump unit. The intake will be provided with needle beams and a base slab sill for use of the SFWMD's standard dewatering needles. This dewatering system consists of approximately 22 feet long aluminum fabricated panels (needles) of incremental widths. The needle widths vary from 2 feet to 4 feet and are selected in accordance with the

bay width for closure of the opening. The horizontal steel beam (needle beam) is placed in the abutment and pier slots and the needles placed with the bottom against the sill and the top leaning against the beam at a 10v:1h slope. The needles are compressed horizontal by the use of a spreader beam to ensure closure of the panels against the abutment and piers of the intake. The needle beams and base slab sill require a specialized geometric design to accommodate this standard SFWMD dewatering system.

With proper installation of the dewatering needles, which sometimes includes installation of a plastic tarp on the water side of the needles to aid in sealing the dewatering system, the bay is pumped down using a portable electric submersible pump.

A.8.6.7 LP Gas Fuel System for the Emergency Generator

Emergency power will be provided to run the building services only at each station, but not to power the pumps. As per NFPA 37, the LP-Gas fuel system for the emergency generator will satisfy minimum requirements. The fuel tank will be located outside, a minimum of 10 feet from the exterior building face, and will be an underground tank. The tank will be constructed in accordance with applicable requirements of NFPA 30 - Flammable and Combustible Liquids Code. The tank will be installed in accordance with NFPA 58-Liquefied Petroleum Gas Code. The tank capacity will be 500 gallons as per SFWMD requirements.

Gas piping will be installed in accordance with the provisions of NFPA 58-Liquefied Petroleum Gas Code. Gas trains for engines will contain the following safety components:

- Equipment isolation valve
- Regulator
- Two automatic safety shutoff valves
- Manual leak test valve for each automatic safety shutoff valve

Regulators will vent to the atmosphere a minimum of 5 feet from any structure opening.

Valves will be in accordance with Chapter 5 of NFPA 30. A manual shutoff valve at a remote location will be provided to isolate the fuel supply. An automatic safety shutoff valve will stop the flow of fuel in the event the engine stops.

Vents will be installed in accordance with Chapter 5 of NFPA 30 - Flammable and Combustible Liquids Code. The vent will terminate outside the building at a point 24 inches from any building opening at the same or lower level. Piping

will be in accordance with Chapter 5 of NFPA 30 - Flammable and Combustible Liquids Code except all piping will be steel. The system design will follow SFWMD standards.

A.8.6.7.1 LP-Gas Generator Exhaust System

The emergency generator exhaust system will be designed and installed in accordance with Chapter 8 of NFPA 37. The system will follow SFWMD standards. The engine exhaust system will be installed to discharge combustion gases quickly and silently with minimum restriction including the generator exhaust silencer. In no case will the total exhaust system backpressure restriction imposed on the engine at full operating load exceed the engine manufacturer's maximum allowable exhaust backpressure limits.

A.8.6.7.2 Piping

All exhaust piping will be Schedule 40 stainless steel piping. The exhaust piping will be covered with appropriate high temperature insulation and shielding inside of the generator room. The generator exhaust silencer is to be installed outside of the room and the exhaust outlet extended to the edge of the roof and terminated with a counter weighted exhaust outlet rain cap. The exhaust silencer and associated piping will be supported and braced to prevent the weight or thermal growth from being transferred to the engine. Flexible expansion fittings will be provided to accommodate thermal growth. Support dampers and springs will be included where necessary to isolate damaging vibrations. A stainless steel construction, manual shut-off valve shall be installed on a NPT drain fitting at the low point of the exhaust piping outside in order to drain collected water.

A.8.6.7.3 Silencer

The exhaust silencer (muffler) will be a minimum of "critical" grade to provide extreme noise attenuation for environments with low background noise where slight noise emissions would be objectionable. The silencer shall have a minimal capability of up to 35-40 dB(A) attenuation at between 125 and 2000 Hz octave band center frequencies. The exhaust silencer will be selected and furnished so that the exhaust sound/noise from the generator engine at any range of generator's normal operation is to be attenuated by the installed silencer in order to meet the noise level requirements. The silencer will be stainless steel body construction and furnished with inlet and outlet weld-on-type ANSI companion flanges, gaskets, bolts/nuts, and an appropriately sized stainless steel, bellows type, engine expansion flex connector for connection to the engine.

Suitably rated high temperature resistant gaskets will be utilized for all exhaust system flanged connections. The silencer support will be per SFWMD standards.

A.8.6.8 Flow Measurement

The SFWMD requires a means to monitor the pump discharge flow rate. For pump stations, the pump's rate of flow is typically based on the pump's performance curve, which is programmed into the SCC PLC. Based on the head differential between the intake canal WSE (headwater), and the discharge canal WSE (tailwater), the PLC calculates the flow rate utilizing a SFWMD software program that incorporates the pump curve information.

The stations of this project will include an intake bay, submersible pumps and a discharge chamber. The discharge pipe invert of each pump unit will be located above the high water level in the discharge chamber so each pump will always have a "free discharge" above the water surface. In this configuration, measuring the tailwater elevation in the discharge chamber would not provide for accurate flow measurements (i.e., inaccurate calculation of static head effecting pump performance). The accurate measurement of the tailwater condition would be the crest of the discharge pipe. A monitor is not required for this data point since the elevation is static and does not change with operations of the system. With respect to flow measurement, the PLC would always read this static elevation as the tailwater elevation when computing flow at any given time. The SFWMD has approved this coordinated method of flow measurement as their preferred method.

A.8.7 Plumbing Analysis and Design

The SFWMD guidelines for an unmanned water supply pump station do not require the following systems:

- Potable Water
- Sanitary Systems

The submersible pump type does not require an engine cooling system, or any other service water requirements.

A.8.8 Ventilation Design

A.8.8.1 Design Standards and Criteria

The following design standards were utilized in the design of the control building ventilation for each pump station:

- American Society of Heating, Refrigerating, and Air Conditioning Engineers, (ASHRAE) Handbook
- National Fire Protection Association, NFPA 37-Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2006
- SFWMD Standards for Construction of Water Resource Facilities-Design Guidelines dated February 2008
- USACE EM1110-2-3105 Mechanical and Electrical Design of Pumping Stations

A.8.8.2 Outdoor Design Conditions

The outdoor design conditions were based on those of the Miami Weather Station (Lat: 25°45', Long: 80°17'). The outdoor design conditions included:

- The design summer dry bulb will be set at the 2-1/2 percent value with an outdoor summer dry bulb temperature of 90/77°F.
- The design summer wet bulb will be set at the 2-1/2 percent value with an outdoor summer wet bulb temperature of 78°F.
- The design winter dry bulb will be set at the 99 percent dry bulb value with the outdoor temperature of 47°F.
- Mean daily temperature range = 15 degrees.
- Winter prevailing wind direction and speed: NNW at 8 knots.
- Summer prevailing wind direction and speed: SE at 8 knots.
- The median of annual temperature extremes: 92.5°F maximum and 39°F minimum. The building has no windows; therefore, the 97.7 percent value of these extremes was used as per ASHRAE 90A-80. The maximum and minimum temperatures were, therefore, 90°F and 40°F, respectively.

The indoor design temperature for freeze protection is 40°F. Since the winter design dry bulb is above this value, heating is not required for the control building and was not provided.

A.8.8.3 Building Characteristics

The pump stations are unmanned, automatically or remotely controlled water supply stations. The control building for each station consists of an approximate 20 foot x 28 foot reinforced, concrete masonry unit, single-story building with a slab on grade and a precast concrete panel roof. The control building is divided into two rooms, the 18 foot x 20 foot electrical room that houses the electrical, I&C, and communication equipment and a 10 foot x 20 foot standby generator room. The ceiling height is approximately 12 feet. The building is totally enclosed with only metal pedestrian doors. There are no windows in the building.

A.8.8.4 Ventilation Design

The pump stations are unmanned facilities. Only mechanical ventilation will be provided for removal of heat and gases from the electrical and generator rooms to maintain an indoor temperature required by the operating systems to extend life expectancy of equipment and controls. The system design is based on the amount of air removed to maintain a maximum indoor temperature under 104°F in accordance with EM1110-2-3105. A minimum of six (6) air changes are provided during non-operational periods.

The mechanical ventilating systems consist of air intake louvers, intake and exhaust hoods and insect screens, and exhaust fans with gravity backdraft dampers to remove excess heat by ventilating with cooler outdoor air. For the generator room, an exhaust fan is provided in addition to the generator engine fan which exhausts hot air from/through the radiator cooling system. Intake areas with louvers are provided to supply the make-up air. The generator room ventilation will satisfy the combustion air requirements as per FBC Section M703.2.1. The fan operation of the generator room and the electrical room is controlled by a thermostat. The system design follows SFWMD standards.

The control center instrumentation and control circuits do not require cooling fans or louvers in the enclosure for continuous operation in the 105° F ambient temperature of the electrical room but they will be provided for the reason stated above.

For estimating the building's cooling requirements, U-values were used for the solar heat gain calculations. These calculations assumed a constant temperature differential between the outdoor and indoor air and did not consider the diurnal cycles of solar radiation and air temperature. Building materials with heavy mass can react to temperature fluctuations, producing a dynamic thermal response, which differs substantially from the heat flow calculations based solely on instantaneous radiant heat. Research has indicated the actual measured rate of heat transfer for CMU walls is 20 to 70 percent less than steady-state calculation methods predict.

Heat transfer through solid materials is not instantaneous with higher density and greater mass causing slower absorption and longer retention of heat. The thermal inertia (the rate at which the wall heats up or cools down) is dependent on the wall thickness, density, specific heat, and conductivity. The thermal storage of the building element is directly proportional to its weight. Masonry's and concrete's thermal storage capacities are effective in retarding heat migration and increasing the lag time required for the inside and outside surface temperatures to reach equilibrium. The mid-day solar radiation load on the south face of a building will not completely penetrate an 8-inch thick CMU wall for approximate 8 hours. Therefore, building envelopes with significant thermal

storage capacity will delay the peak load until after the hottest part of the day when the solar radiation has passed.

Heat gain is also affected by the surface color and emissivity of the wall, orientation, intensity of direct and diffused solar radiation, and the surface reflectivity. The heat gain equation prescribed by ASHRAE includes a cooling load temperature difference (CLTD) factor to simulate air temperatures, which would give a rate of heat exchange equivalent. The rate of heat exchange is determined by considering the following variables:

- Q = UA (CLTD)
- Q = heat gain (Btu/hr)
- U = coefficient of thermal transmission of the opaque wall or roof assembly [Btu/(hr.°F.ft2)]
- A = opaque wall or roof surface (sq ft)
- CLTD = cooling load difference (°F)

Ventilation requirements of the generator and electrical rooms are summarized in ***TABLE A-25*** below:

TABLE A-25: FINAL VENTILATION REQUIREMENTS

Room	Exhaust Fan Rating	Motor Hp	Fan Size	Louver Size
Generator	4000 cfm @ 0.25 in.	3/4	24" x 24"	(2) 48"x 48" intake (1) 48"x48" exhaust
Electrical	2200 cfm @ 0.33 in.	1/2	24" x 24"	(1) 48"x48" intake

A.8.8.5 Equipment

A.8.8.5.1 Fans

Direct-drive propeller type fans were selected which bear the AMCA certified ratings seal listed in AMCA 261. Axial-flow fans are capable of moving large quantities of air at low pressure and have been the fan type traditionally used in SFWMD pump stations. This fan type, however, does produce higher noise levels than centrifugal fans. The fan will be a complete, heavy duty assembly, including a corrosion-resistant housing and/or frame, shutter, suitable gaskets, motor guards, closure pieces, and mounting holes. Aluminum insect screens with an 18 by 16 mesh, conforming to Federal Specification RR-W-365, will be provided. Fans will be protected by a rain hood. The hood design will address the estimated components and cladding wind loads for the building. The fan motor and propeller are balanced for smooth operation. Belt-driven fans were considered, but due to their higher maintenance and lower efficiency, and since

the fans required are relatively small in capacity, direct-drive propeller fans were recommended.

A.8.8.5.2 Fixed Wall Louvers

Wall louvers are required to bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511. The louvers are certified for having passed the Dade County Florida large missile impact test, uniform static air pressure test, cyclic wind loading, and the wind-driven rain test. The louver sizing was based on a free air area determined by using a free air minimum velocity of 739 fpm. With the selected louver and associated free air area this velocity is not exceeded.

Louver blades will be fabricated of extruded 6063-T5 aluminum alloy in accordance with the recommendations of SMACNA. Jamb frames, mullions and stiffeners will also be fabricated of extruded 6063-T5 aluminum alloy. Frame corners and blades are welded, assembled or fastened with self-tapping, stainless steel screws. Mullions have integral internal drains and will be the same finish as the louvers and spaced to address wind load requirements. Mullion covers on both faces of joints between louvers were provided. Closures and clips are fabricated from extruded aluminum alloy angles and flat bars for louver perimeters. Extruded aluminum alloy clips were provided as required for securing mullion ends. Metal thickness is a minimum 0.125 inches. The required finish is Architectural Class 1, satin anodic-coating AA-C22-A41, natural anodized. All fasteners will be determined by the manufacturer and exposed fasteners will be shop enamel finished to match louvers. Aluminum insect screens with an 18 by 16 mesh, conforming to Federal Specification RR-W-365, will be provided.

All louvers will be protected by a rain hood. The hood design will address the estimated components and cladding wind loads for the building.

A.8.8.5.3 LP-Gas Generator

The emergency generator engine air supply was designed to meet at least the minimum requirements for combustion, cooling, and ventilation and prevent flue gas products from being drawn from stacks or vents in accordance with NFPA 37.

A.8.8.6 Generator Engine Cooling System

The engine jacket water-cooling system is a pressurized closed circuit design with provision for manual filling, thermal expansion, and coolant de-aeration. The radiator blower fan and engine cooling water centrifugal-type transfer pump are driven by the engine. The coolant pump circulates the engine jacket water

through the entire engine cooling water system, including the radiator. Any auxiliary coolant transfer pumps required for separate circuit after cooling of the engine through the radiator will also be engine driven.

The radiator is of sufficient capacity to allow the generator set full rated operation at 110 degrees F outside ambient temperature. The radiator is furnished with a duct flange for use with a radiator air discharge duct or shroud, to be furnished and installed between the radiator and the radiator air discharge louvered opening. The radiator is furnished with a painted perforated metal grill to protect the radiator core. The heat rejected to the engine jacket water and after cooler is radiated to the atmosphere by the radiator and removed by the engine-driven fan through the close-coupled radiator. The radiator will properly cool the engine jacket water and after cooler water while the engine is operating at full load capacity within the generator room at maximum specified site temperature.

The radiator fan, fan drive, and fan belts are totally enclosed and covered with 14 gauge punched steel mesh guarding for personnel protection, and will be OSHA approved. The radiator-cooling fan is a blower type, mechanically direct-driven from the engine. Air is drawn from the engine sides and top and exhausted through the radiator core to the air discharge plenum. Coolant lines are high temperature, strength reinforced, and have flexible connections. A removable radiator pressure cap and radiator overflow line is installed on the radiator as well as a flexibly connected coolant water drain line with stainless steel construction, manual shutoff valve, terminated with a stainless steel NPT fitting, and a threaded, stainless steel cap. An electronic coolant level sensor/alarm switch is furnished and installed in the radiator by the engine manufacturer for coolant level monitoring and generator set shutdown for an excessively low coolant level condition.

UL recognized engine coolant electric, jacket water heater(s) is provided and installed on the engine by the manufacturer. The heater(s) is complete with an automatic thermostatic control suitably sized to maintain uniform engine coolant temperature from 90 to 175°F while the engine is idle. The heater(s) is 120 VAC single-phase, controlled for automatic on/off operation by the heater thermostats, connected to a heater contactor, and installed and wired by the generator set manufacturer. The heater(s) is automatically de-energized by the generator set controls anytime the engine runs. The engine manufacturer will install the heater with manual isolation shutoff valves at each heater hose connection at the engine in order to facilitate heater/heater hose maintenance without having to drain the engine coolant water. The unit will have an engine/radiator closed loop type cooling system with a water/ethylene glycol based coolant mixture as per the engine manufacturer's recommendations.

A.8.9 Fire Protection and Detection Analysis and Design

A.8.9.1 Fire Protection Design Criteria

The applicable fire protection design criteria and codes included:

- SFWMD Standards for Construction of Water Resource Facilities - Design Guidelines dated February 2008
- Florida Building Code
- National Fire Protection Association, NFPA 101-Life Safety Code
- National Fire Protection Association, NFPA 37-Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2006
- National Fire Protection Association, NFPA 10-Standard for Portable Fire Extinguishers, 2002

A.8.9.2 Fire Detection and Suppression Requirements

The pump station buildings do not require a fire detection or automatic sprinkler system nor is it required by the SFWMD pump station guidelines. These guidelines do, however, require multi-purpose dry chemical extinguishers. Extinguishers with an UL rating 4A:60B:C are appropriate for the hazards associated with this facility and included in the final design.

A.8.9.3 Fire Protection Building Design Requirements

The purpose of the control buildings is to provide a secure and weather tight facility for the electrical control and communication equipment. Each station will normally be unmanned and remotely operated. The submersible pumps will be electric motor-driven. No storage of hazardous materials is provided within the building. There is an emergency generator located within the control building. This emergency generator will be driven by a LP gas engine. Fuel will be stored in an underground storage tank 10 feet from the exterior wall of the building. The engine will be enclosed in its own room and provided with forced ventilation when in operation or when the temperature of the room exceeds 85°F.

Control building construction will be Type 1, non-combustible, and will include a cast-in-place concrete frame and concrete masonry infill panels. The roof will be composed of 10 inches thick, hollow-core, pre-cast concrete slabs. As per NFPA 37 paragraph 4.1.2, engines located within structures will have the interior wall separating the engine room from the remainder of the pump house with a 1-hour fire rating. Interior doors will have 1-hour rating and will be self-closing. The engine room ventilation will adequately prevent a hazardous accumulation of

flammable vapors or gases, when the engine is operating as well as when it is shut down.

A.8.10 Electrical Analysis and Design

A.8.10.1 Design Criteria

The electrical design of the pump stations are in compliance with the latest edition of the National Electrical Code (NEC), 2008. The electrical design complies with the SFWMD standards or general engineering practice for small pump stations.

A.8.10.2 Power Supply

Three phase electrical service is provided to the pump station by FPL from the existing overhead service along Ingraham Highway (SR 9336) and SW 232 Ave. The voltage is stepped down to 480 volts for service to the control building. An underground line will be installed to the station from the FPL transformer. The station will be used for water supply with no flood protection functions, and therefore, the reliability of the power supply is not critical to the operation of the pump station.

A.8.10.3 Low Voltage Station

An electrical system with a specified voltage of 600V or less is considered a low voltage grounded system. A low voltage grounded system is a system where the local power supply is a transformer with the transformer secondary grounded. The first disconnecting means on the load side of this transformer provides the point where the neutral conductor is grounded. The neutral is connected to the equipment grounding circuit conductor only at one point, which is within the enclosure of the disconnecting means. The grounding electrode conductor or the equipment grounding circuit conductor will not be used as the neutral.

A.8.10.4 Power Distribution Equipment

A.8.10.4.1 Design Criteria

The following design criteria apply to the power distribution equipment:

- NEC (NFPA 70) National Electrical Code 2008, Latest Edition
- UL 83 - Thermoplastic Insulated Wires and Cables
- NETA International Electrical Testing Association - 2003 Acceptance Testing Specifications

A.8.10.4.2 Wiring

Power and lighting wire rated for 600 volts in duct or conduit for all power and lighting circuits is XHHW-2 rated at 90°C in wet and dry locations, meeting the requirements of UL 83.

Conductors for feeders, as defined in Article 100 of the NEC, were sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent. Conductors for branch circuits, as defined in Article 100 of the NEC, were sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

Control wire in conduits is No.14 AWG, the same type as power and lighting wire described above. Control wires at panels and cabinets will be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.

Instrumentation cable is rated at 600 volts with individual conductors No. 16 AWG stranded, tinned copper. Insulation will be color coded polyethylene: black-red for two-conductor cable and black-red-white for three-conductor cable. Instrumentation cables will be composed of the individual conductors, an aluminum polyester foil shield, a No. 16 AWG stranded tinned copper drain wire, and a PVC outer jacket with a thickness of 0.048-inches.

A.8.10.5 Surge Protection

Surge protection is provided to protect against voltage surges on the incoming power lines. A three-phase transient voltage surge suppression (TVSS) is provided at the service entrance to the station. In addition, all analog and digital inputs to the PLC that are generated from devices that are exterior to the pump station will be furnished with a TVSS.

A.8.10.5.1 Design Criteria

The service entrance TVSS will comply with the following standards and design criteria:

- UL 1449 Second Edition and be UL 1283 listed
- UL 1449 listed 200kA SCCR in compliance with NEC 285.6

TVSS will provide surge current diversion paths for all modes of protection; L-N, N-G in WYE systems, and L-L, L-G in DELTA systems. Each mode including

N-G will be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device. TVSS for service entrance applications will be modular in design. TVSS will provide audible diagnostic monitoring by way of audible alarm. This alarm will activate upon a fault condition. An alarm on/off switch will be provided to silence the alarm. An alarm push to test switch will be provided.

If a dedicated breaker for the TVSS is not provided in the switchboard, the service entrance TVSS will include an integral UL recognized disconnect switch. A dedicated breaker will serve as a means of disconnect for distribution TVSS.

Minimum surge current capability (single pulse rated) per phase will be: 320kA per phase (High Lightning Exposure Areas) and 240kA per phase (Medium Lightning Exposure Areas).

UL 1449 2nd Edition Listed Suppression Voltage Ratings for service entrance will not exceed that shown in the following table:

TABLE A-26: SUPPRESSION VOLTAGE RATINGS

Voltage	L-N	L-G	N-G	MCOV
208Y/120V	400	400	400	150V
480Y/277V	700	700	700	320v

TVSS will have a minimum EMI/RFI filtering of –50dB at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology. Distribution and Branch Panel Surge Suppressor will satisfy the following standards or design criteria:

- TVSS will comply with the provisions of UL 1449 Second Edition and UL 1283 listed
- TVSS will have a UL 1449 listed 200kA SCCR in compliance with NEC 285.6
- TVSS will provide surge current diversion paths for all modes of protection; L-N, L-G, and N-G in WYE systems, and L-L, L-G in DELTA systems

Each mode including N-G will be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device. The TVSS will provide diagnostic lights. A dedicated breaker will serve as a means of disconnect for distribution TVSS. Minimum surge current capability (single pulse rated) per phase will be:

- 160kA per phase (High Exposure)
- 80kA per phase (Medium Exposure)

The 120 VAC control power that feeds the control center power supply will be protected with transient voltage surge suppression specifically designed for the protection of power supplies.

A.8.10.6 Station Electrical System

A.8.10.6.1 Design Criteria

The electrical system for each station will comply with the following reference standards:

- American National Standards Institute (ANSI):
  - C37 Series-Power Switchgear
  - C50.10-General Requirements for Synchronous Machines
  - C50.13-Cylindrical Rotor Synchronous Generators
  - C50.14-Combustion Gas Turbine Driven Cylindrical Rotor Synchronous Generators
- Institute of Electrical and Electronic Engineers (IEEE):
  - C62.1-Surge Arresters for Alternating-Current Power Circuits
  - 43-Testing Insulation Resistance of Rotating Machinery
  - 56-Insulation Maintenance of Large Alternating-Current Rotating Machinery (10 kVA and larger)
  - 115-Synchronous Machines
- National Electrical Code (NEC)
- National Electrical Manufacturing Association (NEMA)
- National Electrical Safety Code (NESC)
- Society of Automotive Engineers (SAE)

A.8.10.6.2 Lighting

A 120/208V three-phase, 4-wire system with identified grounded neutral and separate ground wire for lighting, receptacle, and small power was provided. Photocell controlled exterior lighting was provided at the control building entrances and on the rear of the building. The interior lighting design for the electrical and the generator rooms will comply with the National Electrical Code (NEC). Fluorescent ceiling mounted fixtures were utilized to satisfy the interior lighting requirements. For interior lighting; the coefficients of utilization, luminary dirt depreciation, and lamp lumen depreciation will be taken as 0.90, 0.90, and 0.90 respectively, which equals to 0.72 Light Loss Factor (LLF).

The electrical room was designed to have an average of 40 foot-candles, and the generator room was designed to have an average of 35 foot-candles. High

Pressure Sodium fixtures were utilized to satisfy the exterior lighting requirements. The exterior fixtures will either be pole mounted or mounted on the side of the building. For exterior lighting, the coefficients of utilization, luminary dirt depreciation, and lamp lumen depreciation will be taken as 0.94, 0.93, and 0.93 respectively, which equal 0.81 LLF. The exterior lighting was designed to have an average of 5 foot-candles with the use of full cutoff High Pressure Sodium fixtures.

All equipment and materials bear UL label. The fluorescent lamp ballasts have a UL Listed Class "P" with a power factor correction capacitor to provide not less than 0.9 pf and conform to ANSI and UL Standards regarding light output, reliable starting, radio interference and dielectric rating. Interior luminaries will operate in the ambient temperature of 117 degrees Fahrenheit for interior of the control building.

A.8.10.6.3 Back-up Power System

Each pump station is provided with an LP-Gas generator for backup emergency power for the general building service only. The generator is driven by a LP-Gas powered engine sized to supply power to all station demands except the pump units. The generator automatically starts with failure of the primary power supply by use of an auto-transfer switch. The generator is housed in its own room and was situated to provide accessibility for maintenance, repair, and fire fighting as per the requirements of Chapter 4 NFPA 30. Backup power is not required for the pumps as the pump stations will not be used for flood control purposes.

A.8.10.6.4 Engine-Generator

A 20 kW engine generator was provided for back-up service for the station during the time utility power is unavailable. Controls were provided in the 125 ampere ATS to either manually or automatically start the engine-generator. A RTU output command will remotely STOP the engine generator should the unit unnecessarily start.

The engine is a stationary, LP-Gas, 4 cycle, compression ignition, liquid cooled with dry exhaust manifolds. The horsepower rating of the engine at its minimum tolerance level will be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. An electronic governor system provides automatic isochronous frequency regulation. The governing system dynamic capabilities are controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system will actively control the fuel rate as appropriate to the state of the generator set.

A.8.10.7 Grounding System

A.8.10.7.1 Design Criteria

The grounding system will conform to the following codes and standards:

- NEC Article 250–Grounding,
- UL 467-Standard for Safety Grounding and Bonding Equipment,
- IEEE 837-1989 Standard for Qualifying Permanent Connections Used in Substation Grounding, and
- IEEE 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

A.8.10.7.2 General Requirements

A grounding system grid consists of connection to the reinforcement mat of the primary base slabs and the grounding electrode system connected by a main #2/0 AWG ground cable. Various building elements and equipment is connected to this main ground per NEC and specifications using #2/0 bare copper wire. The components of the grounding electrode system will be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment, and will conform to the applicable requirements of NEC Article 250 and local codes.

The grounding electrode system complies with the following requirements:

- Conductors: Grounding loop conductors will be bare annealed copper conductors suitable for direct burial and have a minimum size of #2/0.
- Ground Rods: The ground rod will be a minimum of 3/4-inch in diameter, 20 feet long with pointed end to facilitate driving, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond will be corrosion resistant. The rod length will be clearly stamped near the top of the rod.
- Conform to ANSI/UL 467.
- Buried cable-to-cable and cable-to-ground rod connections are made using exothermic welds or compression connectors suitable for direct burial.
- Exposed grounding connectors are of the compression type (connector to cable), made of high copper alloy, and manufactured specifically for the particular grounding application.
- Grounding clamps are used to bond each separately derived system to the grounding electrode conductors.
- Equipment Grounding Circuit Conductors: These conductors are the same type and insulation as the load circuit conductors. The minimum size is outlined in Table 250.122 of the NEC.

- Cable to equipment ground lugs are compression type, bolted to the equipment with silicon bronze bolts and lock washers.

A.8.10.8 Lightning Protection

Each pump station includes a lightning protection system, complete and functional per plans and specifications. The system includes air terminals, roof and down conductors and building grounding grid, the grounding rod system and ground riser extension to electrical equipment.

A.8.10.8.1 Design Criteria

Lightning protection will conform to the following codes and standards:

- Lightning Protection Institute (LPI): 175, Installation Standard,
- National Fire Protection Association (NFPA): 780, Lightning Protection Code, and
- Underwriters Laboratories, Inc. (UL), 96, Standard for Safety Lightning Protection Components and 96A, Standard for Safety Installation Requirements for Lightning Protection Systems.

A.8.10.8.2 General Requirements

Components of the grounding electrode system will be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment, and will conform to the applicable requirements of NEC Article 250 and local codes. No combination of materials will be utilized that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such materials. Where unusual conditions exist which could cause corrosion of conductors, conductors with protective coatings or oversized conductors will be used. Where mechanical hazards are involved, the conductor will be sized to compensate for the hazard or the conductor will be protected by covering with molding or tubing made of wood or non-magnetic material. When metallic conduit or tubing is used, the conductor will be connected at the upper and lower ends.

A.8.10.8.3 Air Terminals

Air terminals will be in accordance with UL 96 and NFPA 780. The tip of the air terminal will be a minimum of 2 feet above the parapet. The terminals will be located within 2 feet of the corners of the building. Spacing of the terminals will not exceed 25 feet. The design and support will be in accordance with NFPA 780 and will be rigidly supported. Terminals with a length greater than 24 inches

will be supported by a brace. The terminals and their anchorage will be designed for the design wind load requirements.

A.8.10.8.4 Conductors

All conductors will be copper. Main and secondary conductors will be in accordance NFPA 780 and UL 96 for Class I, Class II, modified materials as approved. Clamp type connectors will only be used for the connection to the roof conductor to the air terminal. All other connections, bonds, and splices will be exothermic welds or by high compression fittings. Grounding loop conductors will be bare annealed copper conductors suitable for direct burial and will be of a minimum size of #2/0.

The grounding rods will conform to ANSI/UL 467 and will be a minimum of 3/4-inch in diameter, 20-feet long with pointed end to facilitate driving, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond will be corrosion resistant. The rod length will be clearly stamped near the top of the rod.

A.8.10.9 Submersible Motors

The SFWMD requires maximum 480V, 3 phase, 60 Hz electrical power systems for flood control and water supply stations. The motor is a squirrel cage induction motor designed for a SSRVS type starter that has an integrated full voltage bypass option to allow for full voltage starting in the event the SSRVS cannot be used and complies with the following standards and codes:

- NEC (NFPA 70) National Electrical Code 2008 Edition
- NETA International Electrical Testing Association-2003 Acceptance Testing Specifications
- NEMA MG-1 1998-Revision 1, 2000-Motors and Generators
- IEEE 43-1974-revision of IEEE Std 43-1961-Recommended Practice for Testing Resistance of Rotating Machinery
- NEMA MG-2-2001-Safety Standard and Guide for Construction Installation and Use of Electric Motors and Generators
- IEEE 112–1996-revision of IEEE Std 112-1991-Standard Test Procedure for Polyphase Induction Motors and Generators

Power and instrumentation cables enter the top of the motor. The cables prevent moisture wicking in case of outer casing damage. The cable will be encased in conduit when possible. The primary cable seal will be comprised of a single elastomer grommet flanked by washers. The secondary cable seal will be an elastomer material poured and set around the individual cables. The cable junction chamber and motor will be separated by a stator lead isolation plate and bearing holder which will isolate the motor interior.

A.8.10.10 Motor Starters

Motor starters are mounted in a standalone unit. Each motor starter unit consists of a combination magnetic contactor and short circuit protective device. A short circuit protective device is an instantaneous, magnetic only circuit breaker or thermal magnetic circuit breaker. All circuit breakers provided as part of a motor starter unit are capable of being padlocked in the open position and reset of thermal overload elements will be possible with the unit door closed. Three phase overload trip units are furnished to suit the full load current of the equipment installed. Overload relays will be solid-state type capable of detecting phase loss and ground faults and will meet NEMA class 20 tripping characteristics.

Each starter unit will have its own control power transformer. Units will have a 115-volt grounded secondary. One secondary fuse and 2 primary fuses are provided. Control power transformers were sized to accommodate the control devices indicated with a minimum transformer size of 50 VA. Local control devices are mounted independently of the cover door. All starters have a local "running" lamp and an "off" light to indicate the presence of control power when the motor is not running. Indicating lights are push-to-test type. Starters are provided with elapsed time meters, and hand/off/auto selector switches.

Motor starters will be designed to NEMA ratings. Starters designed to IEC ratings or with dual IEC/NEMA ratings will not be acceptable, either as part of the SCC, as remote starters, or as part of any equipment package. Full voltage motor starter units will be NEMA Size 1 or larger. Each combination starter will be rated for a minimum 65,000 RMS symmetrical amperes.

A.8.10.10.1 Soft Starters

The pump motors are provided with solid state reduced voltage starters, and will meet the requirements of UL 508 and will consist of an incoming power circuit breaker, a power section, logic board, isolation contactor, and paralleling full load bypass contactor. The starters conform to the following: the SCR-based power section will consist of 6 back-to-back SCRs, two SCRs per phase, and will be rated for a minimum peak inverse voltage rating of 2.5 times line voltage, 1200 PIV for 480 volts. Units using triacs or SCR/diode combinations will not be acceptable. Resistor/capacitor snubber networks will be used to prevent false firing of SCRs due to dv/dt characteristics of the electrical system.

Starters will include the following logic and control functions:

- Adjustable maximum starting current from 200 percent to 500 percent
- Ramp time adjustment from 1 to 40 seconds
- Adjustable linear voltage deceleration

- Kick start
- Phase loss protection
- Adjustable under-voltage/ over-voltage protection
- Current unbalance protection
- Instantaneous over-current detection
- Phase rotation protection (prevents starting)
- Shorted SCR detection.
- Selectable Class 10, 20, 30 electronic overload protection
- Heat sink over-temperature protection
- Dry contacts for remote indication of RUN and TRIP status
- Battery "back up" of set starter parameters
- Event recorder
- Elapsed time meter
- LCD status display

The paralleling bypass contactor will energize when the motor reaches full speed. The contactor will be fully rated for across-the-line starting duty. The effect of the bypass contactor during normal operation is the elimination of heat buildup resulting from the voltage drop across the SCRs.

It is the intent of the SFWMD to use the bypass contactor also as a means of starting the motor should problems be encountered with the soft starter. A door mounted selector switch will be furnished such that the starting means can be selected as being either via the soft starter or via the bypass contactor as across-the-line. An isolation contactor will be supplied. The isolation contactor will remove three phase power from the input side of the solid state controller when the bypass contactor is selected for across-the-line starting. The starter will be housed in an appropriate NEMA rated enclosure.

Heaters and cooling fans will be provided if required to maintain the equipment within the manufacturer's environmental guidelines. The enclosure will be of two-door compartment type construction. The left hand compartment will contain the starter power section and any equipment rated at line voltage. The right hand compartment will include only that equipment rated at 120 VAC or less including the starter's CPU PC card and LCD display. The enclosure will include a partition dividing the two compartments. Each compartment will be designed to provide a barrier between the equipment at line voltage and the equipment at 120 VAC or less.

The starter will be provided with a control power transformer sized to accommodate all controls. An input power circuit breaker will be provided. Lug termination of the incoming power conductors will not be permitted. The starter and circuit breaker will be rated for 42 KAIC RMS at 480V. The starter will

have a door mounted indication of run, phase rotation, phase loss, under-voltage, current unbalance, and current trip.

The door mounted LCD/keyboard display assembly will be designed to:

- Set or examine operating parameters
- Provide starter status information
- Provide real-time information about line current, voltage, and frequency
- Provide a means to start and stop the starter

A.8.10.11 Station Security

The security standards for a SFWMD pump station are based on preventing unauthorized access and providing a safe environment for SFWMD employees. The basic security elements implemented in the design of the pump station are fencing, handrails, and secure entrance doors.

A.8.11 Instrumentation and Control Analysis and Design

A.8.11.1 System Description

The I&C system for each pump station consists of the SCC with an Ethernet/IP based communications network per plans and specifications. The SCC provides the pump station operator with a central location to monitor and control all pump station systems. The SCC provides monitoring and control for each individual pumping system and will be located in the electrical room. Each pumping system consists of a motor driven pump and auxiliaries. Hard-wired I/O to the SCC will include I/O from the pumping system monitors and auxiliaries required for the proper and safe operation system.

The pump drivers have three modes of operation, automatic, manual and remote. Automatic operation consists of the pump drivers with the auxiliary systems automatically controlled by the suction pool stage. Manual operation consists of operating each component of the pumping system by using manual controls. Remote operation consists of operating the pump drivers via the SFWMD's telemetry system with the auxiliaries automatically controlled. Typically for stage control involving small capacity water supply stations (similar to seepage return pumps), the automatic mode is the primary mode of operation where the pump drivers come on and are shut off based on the suction pool stage. There is an on/off sequencing of the pump drivers to ensure uniform hours of operation.

The various auxiliary functions such as low water level shut-down, trash rake operation and alarm, and high motor temperature are monitored and controlled by the station's SCC. The SCC's PLC has the capability to automatically shut

the motor down given an alarm condition. The PLC is connected via an Ethernet network to the RTU (ACE 3600) for communication to the SFWMD operational center.

An upstream in-bank stilling well with stage monitoring equipment is provided for continuous water level input to the SCC and the PLC. The SCC operates the pumps as per the selected mode of operation. There is an intake stage monitor for shut-off of the pump driver given low-water on the pump side of the trash rack. This stilling well low level water transmitter is for protection of the pump to prevent water levels less than that prescribed by the design standard. In addition, a stilling well and monitor in the discharge chamber are provided that will shut-down the pump operation given a high water stage in the chamber. This monitor is to protect the pumps from an overload condition given a problem with the downstream conveyance facilities. There is, also, a water level monitor at the discharge structure and at the spreader structure to shut down the pumps, given a water stage that exceeds preset maximum to avoid the possibility of flooding existing roads or pedestrian walkways.

A.8.11.2 Control Equipment

A.8.11.2.1 Station Control Center (SCC)

The station control center controls and monitors the operation of each pumping system and is connected to the SCADA Ethernet/IP network. The SCC includes a microprocessor based controller and display, mounted in a single door enclosure located in the electrical room. The panel is powered by 24 VDC for use in non-hazardous areas. The controller is programmed to communicate to the RTU to control and monitor each pump and its auxiliaries. A 24 VDC power supply, with float charger, gel-type batteries, UPS, and 24 VDC distribution panel is provided. In addition, the SCC controls and monitors station auxiliaries or monitors are not directly associated with the pumping systems. The SCC is connected to the SCADA Ethernet/IP network. The control center includes a fully programmed and configured PLC, HMI, Ethernet hub, uninterruptible power supply, power supplies of the various voltages required by the equipment, terminal blocks, operator interface devices, plastic slotted sidewall wiring duct, over current protective devices, interconnecting wiring, communications equipment and appurtenances housed within a free standing enclosure(s).

The SCC is equipped with a MANUAL-OFF-AUTO selector switch to select between manual and automatic operation of the auxiliary pump systems. A LOCAL-REMOTE selector switch is provided to select between local and remote operation of the pumping system via the SFWMD's telemetry system. MANUAL operation consists of an operator manually controlling each component of the pumping system through the use of manual controls independent of the PLC.

AUTO operation consists of the PLC controlling the pumping system. This includes start-up and shutdown and steady state operation via programmed software. When the AUTO-MANUAL selector switch is in AUTO, the pumps will start and stop based on inflow canal stages. Other stage monitors including the low water intake stage, high water discharge chamber level and high water discharge structure stage will automatically stop the pump. In addition, the SCC has an EMERGENCY STOP (mushroom red head - pull to reset) pushbutton for emergency shutdown activation. The emergency stop pushbutton will be able to activate in both MANUAL and AUTO modes. The EMERGENCY STOP push-button will shutdown the pump and the trash collection system.

The SCC has, at a minimum, the following safety alarms and shutdowns for each pumping system:

- Pump motor fault alarm
- Intake low water level alarm
- Discharge chamber high water level alarm
- Discharge structure high water level alarm/shutdown

A screen that displays real time information will include:

- Cumulative pump run time,
- Control status–AUTO or MANUAL,
- Pump-on or off, and
- Trash rake status–on or off.

A.8.11.2.2 Programmable Logic Controller (PLC)

The microprocessor based controller (PLC) is mounted in the SCC and will provide control and monitoring of the motor pump driver and the auxiliary systems. The PLC and its appurtenances will be equal to or exceed the quality and capabilities of the following models:

- Logic Controller (PLC): The microprocessor based controller will be fully programmed and configured Allen-Bradley "ControlLogix" for the SCC. The PLC and appurtenances will be DIN rail mounted on the back panel of the enclosure.
- Digital DC Input Module: Digital input module, Allen Bradley 1769-Series with 20 percent minimum spare input points.
- Digital DC Output Module: Digital output module, Allen Bradley 1769-Series with 20 percent minimum spare output points.
- Analog I/O Module: Analog I/O module(s), Allen Bradley 1769-Series with 20 percent minimum spare input points.
- Resistance Input Module: Analog resistance input module(s), Allen Bradley 1769-Series with 20 percent minimum spare input points.

- Power Supplies: Furnish Allen Bradley 1769-Series power supplies to supply the load requirements of the system.
- Human Machine Interface (HMI): Furnish Allen-Bradley Panel-View Plus series HMIs. The HMI for the SCC will be fully programmed and configured Allen Bradley Panel-View Plus 1250 Color Keypad/Touch with standard communications (Ethernet and RS-232), DC input, 128 MB Flash, and 128 MB RAM, Allen Bradley 2711P-Series.
- A surge suppressor will protect the I/O modules of the PLC from lightning induced surges, electrical fast transients and EMI/RFI noise. The surge suppressor will meet or exceed highest class severity level of IEC 1000-4-4 and 1000-4-5. The suppressor will be UL-497B listed.

A.8.11.2.3 Generator Control and Monitoring

The generator set is provided with a microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system is designed to allow local monitoring and control of the generator set, and remote monitoring and control. The control is mounted on the generator set. The control is vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control panel includes the following features and functions:

- Mode Selector Switch: The mode select switch will initiate the following control modes. When in the Run or Manual position the generator set will start, and accelerate to rated speed and voltage as directed by the operator. In the Off position the generator set will immediately stop, bypassing all time delays. In the Auto position the generator set will be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
- Emergency Stop Switch: The emergency stop switch will be red "mushroom-head" push-button. Depressing the emergency stop switch will cause the generator set to immediately shut down, and be locked out from automatic restarting.
- Reset Switch: The reset switch will be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
- Panel Lamp Switch: Depressing the panel lamp switch will cause the entire panel to be lighted with DC control power. The panel lamps will automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

The generator set is provided with a metering set which includes the following features and functions:

- Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter will display all three phases. Ammeter and KW meter scales will be color coded in the following fashion: readings from 0-90 percent of generator set standby rating: green; readings from 90-100 percent of standby rating: amber; readings in excess of 100 percent: red.
- Digital metering set, 0.5 percent accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor.
- Generator output voltage will be available in line-to-line and line-to-neutral voltages, and will display all three phase voltages (line to neutral or line to line) simultaneously.
- Both analog and digital metering is required. The analog and digital metering equipment will be driven by a single microprocessor, to provide consistent readings and performance.

The generator set is provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps are high-intensity LED type. The lamp condition will be clearly apparent under bright room lighting conditions. The generator set control will indicate the following alarm and shutdown conditions on an alphanumeric digital display panel:

• Low oil pressure	alarm
• Low oil pressure	shutdown
• Oil pressure sender failure	alarm
• Low coolant temperature	alarm
• High coolant temperature	alarm
• High coolant temperature	shutdown
• Engine temperature sender failure	alarm
• Low coolant level	alarm or shutdown—selectable
• Fail to crank	shutdown
• Fail to start/over-crank	shutdown
• Over-speed	shutdown
• Low DC voltage	alarm
• High DC voltage	alarm
• Weak battery	alarm
• Low fuel	alarm
• High AC voltage	shutdown
• Low AC voltage	shutdown
• Under frequency	shutdown
• Over current	warning

- Over current shutdown
- Short circuit shutdown
- Over load alarm
- Emergency stop shutdown

The following information will be available from a digital status panel on the generator set control:

Engine oil pressure (psi or kPA):

- Engine coolant temperature (degrees F or C),
- Engine oil temperature (degrees F or C),
- Engine speed (rpm),
- Number of hours of operation (hours),
- Number of start attempts, and
- Battery voltage (DC volts).

A.8.11.2.4 Engine Control Functions

The engine control system includes a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings will be for three cranking periods of 15 seconds each, with 15-second rest period between cranking periods. The control system includes an engine governor control, which functions to provide steady state frequency regulation. The governor control includes adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The control system includes time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions. The control system will include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

A.8.11.2.5 Alternator Control Functions

The generator set includes an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It is immune from mis-operation due to load-induced voltage waveform distortion. The voltage regulation system is equipped with three-phase RMS sensing and will control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system includes a torque-matching characteristic, which will reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator includes adjustments for gain, damping, and frequency roll-off.

Provisions are provided to shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided will be in compliance to the requirements of NFPA 70 article 445. Controls are provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.

An AC over/under voltage monitoring system that responds only to true RMS voltage conditions is provided. The system initiates shutdown of the generator set when alternator output voltage exceeds 110 percent of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130 percent. Under voltage shutdown occurs when the output voltage of the alternator is less than 85 percent for more than 10 seconds.

A battery monitoring system will be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit is disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm is initiated.

A.8.11.2.6 Control Interfaces for Remote Monitoring and Control

All control and interconnection points from the generator set to remote components will be brought to a separate connection box. No field connections will be made in the control enclosure or in the AC power output enclosure.

The control system will have a form "C" dry common alarm contact set rated 2A @ 30 VDC to indicate existence of any alarm or shutdown condition on the generator set. It will also contain one set of contacts rated 2A @ 30 VDC to indicate generator set is ready to load. The contacts will operate when voltage and frequency are greater than 90 percent of rated condition. A fused 10 amp switched 24 VDC power supply circuit will be provided in the control system for customer use. DC power will be available from this circuit whenever the generator set is running. A fused 20 amp 24 VDC power supply circuit will be provided for customer use. DC power will be available from this circuit at all times from the engine starting/control batteries.

A.8.11.3 Monitoring Equipment

A.8.11.3.1 Water Level Monitors

A stilling well with a level transmitter provides analog water level data of the Spur Canal extension. The water level transmitters provide a proportional 4–20 ma signal. The stilling well level transmitters are normally continuously

powered from a 120 VAC to 24 VDC power supply. Upon the loss of 120 VAC service, the RTU's "Pulse Analog Circuit" program will intermittently power and scan the analog water level transmitters. The canal stage monitor is housed in an in-bank stilling well in accordance with the SFWMD standard construction of Box Type Stilling Well. The typical water level monitor is a linear potentiometer as manufactured by Water Log, Inc.

A stilling well with a float level switch is provided in each pump intake to monitor low water levels as well as in the discharge chamber to monitor high water levels. The intake low water and the discharge chamber high water pump shut-off stilling wells consist of a 12-inch diameter schedule 80 PVC pipe secured to the intake wall with stainless steel straps and anchor bolts. The level control is provided by a polypropylene float switch. A high level float switch is also provided in the spreader structure.

A.8.11.3.2 Submersible Pump Monitors

A leakage monitor is provided to detect the presence of water in the stator chamber. Three motor winding thermostats will be in the stator windings, one switch in each stator phase. The pump is equipped with moisture detection in three locations: the oil chamber, the motor housing, and the motor junction box. The moisture detection system will operate an alarm and shut down the pump.

A.8.12 Telemetry Analysis and Design

A.8.12.1 Telemetry Network

The SFWMD's existing microwave telemetry system is used for the communication to the station's monitoring control systems. As per discussions with SFWMD staff the existing system has sufficient capacity for the addition of this new data site. The closest VHF communication hub is the SFWMD's Homestead field station. The station coordinates are: Lat 25° 37' 24.45" and Long 80° 18' 41.64".

A.8.12.2 Communications Equipment

A.8.12.2.1 Remote Terminal Unit

A RTU will be provided and installed that consists of devices and instrumentation to control the operation and to provide monitoring of a pumping system per plans and specifications. The RTU panel is modular in design and includes power supply, battery, radio, antenna, processor, I/O cards, relays, and surge protection. The RTU will include a Motorola ACE 3600 CPU supplied with 24 VDC power supply fed by the lighting panel with generator back up and include the following components:

- CPU Module,
- Digital Input Module,
- Digital Output Module,
- Analog Input Module,
- Radio,
- Amplifier,
- Power Supply,
- Communication Interface Module, and
- Antenna.

The Motorola STS program will be installed to the new RTU to functionally test each input and output. Following the successful completion of the field tests, SFWMD personnel will furnish and install the control program and communication parameters necessary to integrate the site RTU.

The Remote Terminal Unit provides the following discrete outputs:

- Motor Start/Stop
- Gen Set Disable

The Remote Terminal Unit monitors the following discrete data points:

- Motors Alarms
- Motor Run Indication
- Auxiliary System Alarms
- Auxiliary Run Indication
- Low Intake Water
- Discharge Chamber High Water Level
- Discharge Structure High Stage

The following instruments/discrete data points are directly connected to the ACE 3600 unit and will be transmitted to the SFWMD's SCADA system:

- Headwater Stilling Well Level
- 24 VDC Power Supply Fail
- Commercial Power Fail
- Gen Set Run
- RTU Enclosure Tamper Switch

The digital radio/antenna final selection is based upon RF analysis performed by the SFWMD's Communications Network Analyst of the Infrastructure Systems Division. The antenna will be mounted on the SFWMD standard antenna pole. Appurtenances required for installation of the ACE 3600 CPU, radio, antenna,

coaxial cable, coaxial connectors, terminal blocks, mounting hardware, etc. will be determined in the next phase of the design.

A.8.12.3 Operational Testing

All systems will be exercised through an operational test with simulation at the factory in order to demonstrate achievement of the specified performance. All primary element inputs will be simulated (inputs will be adjustable by switch, if discrete; by potentiometer or similar device, if analog). Primary outputs will be monitored via output devices (pilot lights, for discrete; a meter, a digital display [12-bit min. resolution]) or other such analog devices for analog outputs.

A.8.12.3.1 Operational Readiness Test

Prior to start-up of the pumping systems, the entire instrumentation and control system will be inspected and tested to ensure it is ready for operation. The instrumentation and control system will be inspected for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis. All instruments and systems will be calibrated after installation, in conformance with the component manufacturer's recommendation. The tests will utilize the recommended test equipment to prove accuracy and/or performance. A loop sheet or calibration sheet for each loop and device with tested results will be provided.

A.9 S-198 STRUCTURE

A.9.1 Introduction

The following Basis of Design Report (BODR) addresses the proposed water supply control structure of the C111 Spreader Canal Western project (Project). The intent of this Project is to improve the quantity, timing, and distribution of the water delivered to the Florida Bay. The project includes a gated control structure within the lower C-111 Canal, located between S-18C and the theoretical confluence of the C-111 Canal with a theoretical extension of the C-110 Canal. The proposed structure, S-198, is intended reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction.

This BODR utilized the input from the SFWMD hydraulic analysis to replace S197 to establish the design stage for the proposed structure. The objective of the structure is to minimize hydraulic loss given the S197 design flow rate.

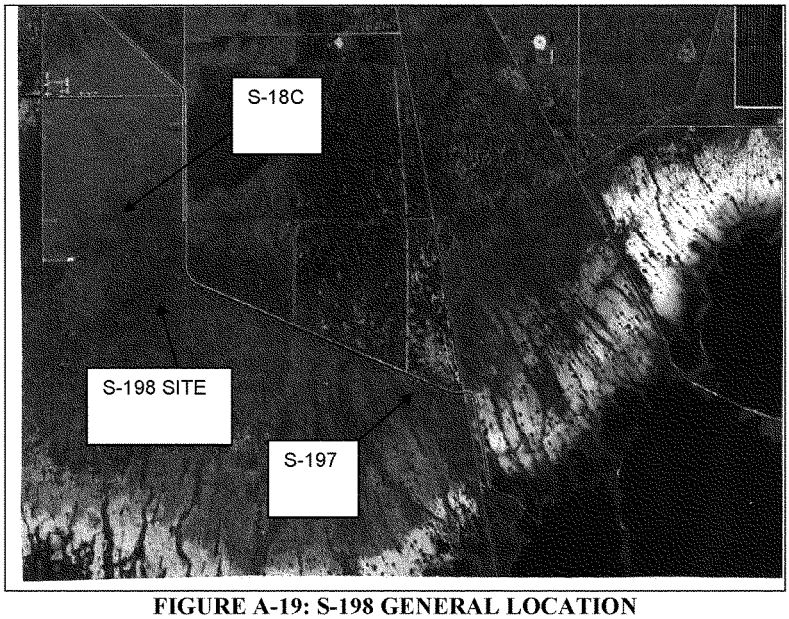


FIGURE A-19: S-198 GENERAL LOCATION

The ultimate Project objective is to evaluate system wide responses to the operation of the C-111 SC Western project components to aid in the conceptual development of a plan to reduce and eventually eliminate the point source discharge of the C-111 Canal to the Florida Bay in conjunction with the re-hydration of the coastal areas drained by this flood control system. The plan will not reduce the flood protection benefits now afforded by the current infrastructure.

A.9.1.1 Control Structure Design Objectives

The design priority is to deliver a facility that addresses the Project objectives and satisfies the SFWMD minimum design criteria and O&M requirements at a reasonable cost. In general, the primary design and construction objectives for the facility shall:

- Satisfy the design and operational criteria as defined by the SFWMD
- Provide a reliable facility
- Have negligible effect on the flood protection system
- Require robust structural and mechanical systems to provide a long service life
- Provide remote operation and monitoring on canal stages

- Ensure minimum maintenance costs by use of appropriate corrosion-resistant materials and coating systems and the proper site and building design
- Provide a design that addresses operator and public safety
- Ensure facilities to be designed to address vandalism

A.9.1.2 General Control Structure Description

The gated control structure shall be located in south Miami/Dade County immediately west of C110 Canal on the C111 Canal. The control structure will consist of (8) 8 ft high x 10 ft wide reinforced concrete box culverts and a SFWMD standard control building located adjacent to the control structure to house the electrical, control, and communication equipment. Steel sheet pile wingwalls will be provided to direct flows to and from the structure. The approach channel/forebay shall be transitioned to limit turbulent flow and shall have erosion protection to address the high velocity flows near the entrance of the structure. Facilities for energy dissipation and erosion protection shall be provided at the point of discharge to ensure stability to the channel side slopes. Local and remote control shall be provided in accordance with current SFWMD standards.

A.9.1.3 Reliability and Cost Considerations

The control structure will be part of the existing flood protection system. Auxiliary or redundant systems will be provided. Dependability will be a consideration during the design and equipment selection process since it relates to the quality of the constructed facility. Equipment is primarily specified on the basis of reliability under emergency conditions, again to ensure a quality installation. Given a failure of the generator the gates can either be operated manually, by use of a portable generator, or by the more typical means by use of a potable tripod-mounted portable electric operator. The equipment selected will be rugged, reliable, and well suited for the service. The structure shall be of a robust design that is sized to house and support the equipment to ensure a long service life.

A.9.1.4 Life Cycle Cost (LCC) Analysis

The engineering regulation ER 1110-2-8159, "Engineering and Design-Life Cycle Design and Performance" defines the engineering policies for selection of all systems, components, and materials for civil works projects on the basis of their long term performance. This regulation requires the design engineer for civil works projects to use life cycle design as the basis for selection of all project elements such as materials, structural systems, mechanical equipment, and site appurtenances.

A.9.1.5 Design Life

There are a number of USACE references in regard hydraulic structure's service life. Generally these references indicate 50 year design life for the facility. However, water resource structures are robustly designed for a life that is typically double this duration. It is anticipated the electrical and I&C equipment will require rehabilitation or replacement at least once during a 25 year service life. The gates and operators with proper preventative maintenance should have a 50 year service life. Auxiliary equipment should be designed and manufactured to ensure an equally long service life for the non-wear components.

A.9.2 Geotechnical Engineering Analysis and Design

RADISE International, Riviera Beach, Florida completed geotechnical field investigations to support pump station design activities. The objectives of the geotechnical investigations and analyses were to:

- Collect representative geotechnical data from engineering borings
- Perform laboratory testing of collected samples
- Perform engineering analyses of encountered site conditions and proposed facility designs
- Perform an evaluation of the structure designs to provide adequate factors of safety and provide for long term stability

The Geotechnical Report submitted on July 18, 2008 provides details of all geotechnical investigations carried out to date.

A.9.2.1 Field Exploration and Laboratory Testing

A.9.2.1.1 SPT Borings and Coring

The field investigation program performed (2) borings for the structure. The results were presented in the Geotechnical Report. One rock core boring and one STP boring within (15) ft. of each other were taken.

Borings were completed using a truck-mounted rotary drill using rotary wash methods. Steel casing was used to stabilize the boreholes as needed. The rock borings were performed generally in accordance with ASTM D 2113-99. Sampling and penetration testing of the subsoils was accomplished using the Standard Penetration Test (SPT) method (ASTM D1586). SPT sampling was performed continuously from the ground surface extending to a depth of 75 feet below grade, and at 5-foot intervals thereafter. Completed boreholes were grouted to the ground surface using a neat cement grout.

Each collected sample was visually classified in the field in general accordance with ASTM D2487.

TABLE A-27: BORING SUMMARY

Boring Designation	Boring Type	Site	Depth (feet)
CB0042	SPT	S-198	75
CB0042A	Rock Core	S-198	53

A.9.2.2 Laboratory Testing

Laboratory testing was performed on the soil and rock samples recovered in the borings, to determine material classification and engineering properties. Data from laboratory results are presented in the Geotechnical Report.

A.9.2.3 Existing Site Conditions

A.9.2.3.1 Site Surface Conditions

The S-198 site is to be located on the C111 Canal approximately 4 miles west of US1. The average elevation of this region varies from approximately -1.0 to -0.5 feet (NAVD88).

A.9.2.3.2 Regional Geology and Subsurface Conditions

The subsurface conditions at the site can be generalized to include two layers based on information provided by the completed geologic borings. These layers include:

- Layer I: Organic Silt with Peat (PT)–This layer consists of a thin surface layer of organic silt with dark brown fibrous peat.
- Layer II: Silty Sand (Marl) (SP-SM, SM, ML)-This layer varies in thickness from 0.3 to 1.5 feet.
- Layer III: Limestone-Underlying the marl, is generally vuggy limestone with numerous voids, weakly to well cemented limestone with silt lenses, and low plasticity silt, and calcareous silt and clay with limestone fragments, and shell with some well cemented limestone.

Unconfined compressive strength test for the sample was performed for the Geotechnical Report. The tested range varied between 460 and 1041 pounds per square inch (psi). The core boring had an average recovery of 53 percent.

The rock quality designations (RQDs) ranged from 0 percent to 83 percent.

The typical subsurface profile at the site can be summarized as follows:

- Organic peats and marls is zero to 2 ft. thick below prevailing ground surface.
- Moderately to well cemented limestone/sandy limestone 40 to 50 feet thick.
- Groundwater 3.7 feet below existing grade.

The engineering data are summarized as below:

A.9.2.3.3 S198 Site Limestone Parameters

- SPT N-Value-14 to greater than 100+ bpf
- Percent recovery from coring-6 to 100 percent (average 53 percent)
- RQD-0 to 83 percent (average 25.2 percent)
- Dry Unit Weight-98 to 135 pounds per cubic foot (pcf)
- Unconfined compressive strength–460 to 1041 psi

A.9.2.3.4 Groundwater Conditions

Groundwater was reported in the boring at depth of approximately 3.7 feet below ground surface. Groundwater elevations are summarized in ***TABLE A-28***. This range of groundwater levels is consistent with historically reported groundwater levels in this vicinity.

Groundwater levels at the sites will fluctuate due to operation of control structures and adjacent canals, as well as a result of the change in seasons. The range of groundwater elevations reported during field investigation likely represents a higher bound as the borings were performed during the wet season. During the wet season, it is expected that ground water could be temporarily ponded at or above the surface or be very close to the ground surface.

Groundwater levels were measured and recorded for all borings. The measured water levels are presented on the boring logs, which are summarized in the table below.

TABLE A-28: OBSERVED GROUNDWATER ELEVATIONS

Boring Designation	Depth to Groundwater (ft)
CB0042	3.7

A.9.2.3.5 Corrosion Potential

Factors used as indicators of the corrosion potential of soil include soil pH balance and concentration of sulfate and chloride ions. Generally, a pH less than seven (7) indicates an acidic soil environment, potentially corrosive to buried metal and concrete. Sulfate and chloride ion concentrations greater than 1,000 to 300 parts per million (ppm) respectively indicate soil that is potentially corrosive to buried metal and concrete. Soil resistivity less than about 10,000 ohm-cm indicate soils that are potentially corrosive to buried metals.

TABLE A-29: CORROSIVITY TESTS

Boring Designation	Sample Depth (ft)	pH	Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)	Corrosivity Aggressive Potential
CB0042	2.0 - 3.7	9.3	7300	5.3	7.3	Slightly Aggressive

The results of chemical testing indicated that the materials tested have a slight to moderate potential for corrosion to buried metal and concrete based on pH, sulfate and chloride ion concentrations, and soil resistively.

A.9.2.4 Design Evaluations

A.9.2.4.1 General Geotechnical Site Suitability

Based on the results of the geotechnical field investigations and physical laboratory testing program, the site is considered suitable for all components of the project. The predominantly strong subsurface conditions encountered in the borings are well-suited for the foundation support of properly designed structure. The permeability of the limestone is highly variable and controlled by solutioning and jointing systems in the rock. While the strong, well cemented subsurface materials are desirable for the support of the proposed structures and stability of the canal side slopes, these materials present a challenge for excavation and dewatering.

A.9.2.4.2 Summary of Generalized Design Parameters

Based on results obtained from the physical laboratory tests performed on the collected soil samples and data from existing reports, the unconfined compressive strength and split tensile strength of subsurface material were determined. These parameters are summarized in ***TABLE A-30*** below.

TABLE A-30: SUMMARY OF LABORATORY TESTING RESULTS

Unconfined Compression Test		
Boring	**Sample Depth (ft)**	**Unconfined Compressive Strength (psi)**
CB-0042A	23-28	1041
CB-0042A	23-28	843
CB-0042A	38-43	460

A.9.2.5 Geotechnical Analysis

A.9.2.5.1 Slope Stability

The stratigraphy of the design cross-section of the approach and discharge channels consisted of well-cemented limestone underlain by a moderately cemented limestone. The soil parameters are based on the field testing program as described in the Geotechnical report. From review past canals constructed in the area, the canals constructed in the moderate to well-cemented limestone are not at risk for slope failure even with steeply sloped sides of 0.5H:1V. The performance to date of the existing canals with 0.5H:1V side slopes confirms the proposed side slopes should be adequate.

A.9.2.5.2 Structure Stability Criteria

The structure will be evaluated and sized to provide a suitable margin of safety between the overall forces and combinations of loads that can cause unsatisfactory resistance to flotation, sliding, overturning, or bearing failure. The required factors of safety for stability were designated for "critical" structures that are new and thus have "ordinary site information" (EC 1110-2-2100).

A.9.2.5.3 Approach Channel Erosion Potential

Cemented limestone is generally considered erosion resistant for the flow conditions anticipated for this project. Although the porosity and vugginess of the limestone may result in lower than expected RQDs, the material is moderately to well cemented. SFWMD canals have typically been constructed without erosion protection in soils that are weaker than those observed at the proposed sites. Based on field observations, the existing C-111 Canal in the adjacent areas have performed well with respect to erosion. It was concluded that the approach channels for the stations can be constructed without erosion protection measures except in the near vicinity of the proposed structure.

While it is assumed that normal flow velocities in unprotected channels will not exceed 2.5 fps, flow velocities can be expected to be higher around the control structures. Consequently, erosion control measures in the form of riprap

generated from on-site excavations is provided in these localized areas. Stone protection for the channels and embankment slopes upstream and downstream of hydraulic structures are typically sized using the procedures given in USACE EM 1110-2-1601 Hydraulic Design of Flood Control Channels. The charts and tables of this design document apply to high energy discharges and require significant interpretation for application to the relatively low velocities of the hydraulic structures of this Project. Typically for low velocity flows, construction of a 24 inch thick blanket of riprap is provided with a minimum 12 inch thickness of bedding stone. A filter fabric placed on the subgrade is normally required. In areas where higher velocities or turbulence is expected, the riprap and bedding stone thicknesses are increased and/or the standard gradation is changed. The extent of the stone protection is typically to that point upstream and down where flow velocities or turbulent conditions are diminished to non-erosive velocities. For sandy soils this allowable velocity is typically taken as 1.5 to 2.0 fps.

An important aspect of the erosion protection and site design is the need to provide stable transitions to the structure entrances. This site design therefore will consider the smooth transition of the water flow into and from the structure.

A.9.2.6 Construction Recommendations

This section provides general recommendations for the construction of the project including recommendations for general site preparation, excavation, and dewatering.

A.9.2.6.1 Site Access and Preparation

Access to the site will be from US1 along the north berm road of the C-111 Canal.

A.9.2.6.2 Excavations and Dewatering

The C-111 Canal depth at the site will require minor excavation, if any for construction of the structure. Excavation of a by-pass channel will be required during construction. This channel would be most cost effectively located to the south of the site.

Dewatering for construction of the structure in the dry will require a steel sheet pile cofferdam with tremie concrete seal due to the porous nature of the limerock of this region. The cofferdam and seal should be designed for a water stage of 3.0 ft NAVD, the maximum tailwater stage of S197.

A.9.2.6.3 Structural Backfill

Preliminary design indicates the possible need for fill at the site to transition to the design elevations of the structure. Therefore material will required to be borrowed from off-site or from the spoil of the C-11 Canal. The structural backfill should consist of cohesiveless soils. The structural backfill should be placed in horizontal layers not exceeding 12 inches in loose thickness and compacted to not less than 95 percent relative density determined in accordance with ASTM D4253-00 and D4254-00.

Backfilling against structures should be allowed only after the concrete has attained majority of its design strength (typically 75 percent is specified) and sufficient portion of the structure is in place to resist the lateral load. It is further recommended that the filling take place simultaneously on opposite sides of the structure such that fill conditions on opposite sides do not vary by more than 5 feet in height.

The use of heavy equipment adjacent to the structures will be carried out with substantial care within a prescribed allowable offset distance, typically 3 feet from the wall. To avoid excessive wall loadings due to backfilling, (i.e., generating much larger effective horizontal wall forces), specifications should require either limiting the compacting equipment size or type and/or also providing a minimum 3-foot offset distance from the wall. The wall backfill specifications should define the actual density required within a narrow + 2 pcf of maximum dry density per ASTM D698 within the stated distance from the structure.

Compaction equipment should consist of self-propelled vibratory rollers in open areas and wheeled compactors/hand-operated vibrating plates for closer and confined work areas adjacent to the walls.

In-place testing of each compacted lift should be required. For larger areas, typically one test per 2,500 square feet is required for either self-propelled or hand operated machines. Areas where it is not practical to perform density tests, may be considered for acceptance by the Geotechnical Engineer's representative based on a firm and unyielding surface during the proof rolling, or compaction process.

A.9.3 Hydraulic Analysis and Design

A.9.3.1 Hydrologic Background

The intent of this Project is to improve the quantity, timing, and distribution of the water delivered to the Florida Bay. The proposed structure, S-198, is

intended to reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction.

This BODR utilized the input from the SFWMD hydraulic analysis for replacement of the S197 structure to establish the design stage for the proposed structure. The objective of the structure is to minimize hydraulic loss given the S197 design flow rate.

The project will not lessen the flood protection currently provided by the C-111 Canal. Therefore this first project phase shall include the continued use of the C-111 Canal for peak flood discharges. The ultimate project goal is the degradation of the C-111 Canal eliminating this point source discharge.

A.9.3.2 Location

The proposed structure is located between S-18C and the confluence of the C-111 Canal with a theoretical extension of the C-110 Canal, approximately 4 miles from U.S. Highway 1.

A.9.3.3 Hydrological and Hydraulic Data

Pool stages were established from the SFWMD design data for the S-18C and S-197 structures. A review was also made of historic record stage data from the SFWMD database DBHYDRO. The information provided by the SFWMD did not define the design stages for the structure which had to be established by review of the record data in conjunction with the Project's proposed civil works.

TABLE A-31: S197 STAGE DATA - HW

Stage	Feet (NAVD)	Feet (NGVD)
Minimum	-1.43	0.16
Maximum	1.74	3.33
Design	-0.19	1.4

Add 1.59 ft. to NAVD88 for conversion to NGVD29 datum.

TABLE A-32: S-197 STAGE DATA - TW

Stage	Feet (NAVD)	Feet (NGVD)
Minimum	-1.54	0.046
Maximum	1.68	3.27
Design	-0.99	0.6

Add 1.59 ft. to NAVD88 for conversion to NGVD29 datum.

TABLE A-33: S-197 DATA – FLOW

Flow	Flow (CFS)
Minimum	0
Maximum	2,613
Design	2,400

TABLE A-34: S-18C STAGE DATA - HW

Stage	Feet (NAVD)	Feet (NGVD)
Minimum	-2.46	-0.87
Maximum	1.64	3.23
Design	1.71	3.3

Add 1.59 ft. to NAVD88 for conversion to NGVD29 datum.

TABLE A-35: S-18C STAGE DATA - TW

Stage	Feet (NAVD)	Feet (NGVD)
Minimum	-2.63	-1.042
Maximum	0.99	2.58
Design	1.21	2.8

Add 1.59 ft. to NAVD88 for conversion to NGVD29 datum.

TABLE A-36: S-18C DATA - FLOW

Flow	Flow (CFS)
Minimum	-11.0
Maximum	2,940
Design	2,100

A.9.3.4 Structure Design Considerations

The primary hydraulic design criteria include:

- Minimize the impact on the existing flood protection afforded by the C-111 Canal
- Provide a S-197 "LIKE" structure
- The structure in to be locally or remotely operated by the SFWMD telemetry system
- The headwater stage for the S-197 structure shall be used as the design stage for the proposed S-198 structure

Use of reinforced concrete box culverts is considered to satisfy the S-197 "LIKE" structure requirement. For box culverts, slide gates with single stem motor operators are typically used when the head differential is less than 10 feet. A

single stem motor operator should not be used for a gate width greater than 10 feet. A greater width increases the probability of racking. The use of a slide gate is also restricted to this width for similar reasons. Dual stem gates have long since been eliminated at the SFWMD due to the probability of racking.

Given a 10 foot width and the design flow rate for S-197 of 2,400 cfs, a hydraulic analysis was performed. This analysis indicated (8) 8'h x 10'w culverts would be required to limit the head loss to 0.35 ft. This is considered a reasonable head loss that would have a minimum effect on the existing conveyance system. The (8) boxes require the full width of the C-111 Canal, given the need for a by-pass channel. The structure location slightly favored the north for this reason. The 8 ft. height was selected to minimize the operating level elevation and depth of excavation into relatively hard limerock strata. With this height, an operating platform is avoided and the gate operators can be operated and maintained with an operating level of 7.0 ft, the proposed protection elevation.

A.9.3.5 System Operation

The structure will be operated either locally or remotely via the SFWMD telemetry system. The SFWMD standard control and communication design shall be used for this structure.

A.9.3.6 Protection Elevation

The estimated hurricane surge for S18C is 7.0 ft NGVD. Given this structure is further east and south, 7.0 ft NAVD88 will be assumed for the protection elevation of S-198. The 8 ft. gate height works well with this elevation minimizing the endwall height to elevation 9.0 ft NAVD. With this height an operating platform is avoided and the gate operators can be operated and maintained with an operating level of 7.0 ft, the proposed protection elevation.

A.9.4 Civil Engineering Analysis and Design

A.9.4.1 General

A.9.4.1.1 Project Design Considerations and Criteria

The SFWMD has over its history adopted a number of standard construction requirements for their civil works. These criteria generally were taken from the Central & South Florida Flood Control Project (C&SFFC Project) designed and constructed by the USACE. This project started in the early 1950's through 1980's constructed the primary water supply and flood protection infrastructure of the SFWMD. The structure site must satisfy a number of SFWMD criteria.

A.9.4.1.2 Equipment Maintenance

For removal of the gates or other auxiliary equipment for major maintenance the site design must:

- Provide adequate area for the set-up of a crane to remove and load gates to a flat-bed truck.
- Provide a means to dewater the structure (single bay) with the use of the SFWMD's standard dewatering needles for gate maintenance.
- The service bridge must be designed for HS-25 truck loading.
- The substructure design must address a 500 psf surcharge soil loading for the possible crane set-up and operation close to the structure.

A.9.4.1.3 Channel Maintenance

The approach and discharge channels also have a number of site design considerations:

- 40 ft. wide maintenance berms are provided each side of the approach and discharge channels where right-of-way is available, to address wide top widths where the entire canal cannot be reached from one side. For this structure adequate R/W is not available and the C-111 Canal is maintained from the north bank.
- The maintenance berms should have a minimum 3 foot freeboard above the maximum design stage of the channel.
- Provide access ramps to the channel's maintenance berms.
- All ramps have minimum 10 ft. width and a slope not greater than 10H:1V.
- A weed barrier is provided at the entrance to the approach channel. The barrier is angled relative to the channel centerline so the floating weeds and debris gather on the maintenance berm bank for collection and disposal. The barrier also serves as a safety barrier preventing boats from approaching the station.
- All stone protection provided should extend up the bank to an elevation above the maximum design high water.

A.9.4.1.4 Site Security

The structure site shall have the following security features:

- Standard SFWMD 6 ft. high non-climbable chain link security fence around the perimeter of the site with 16 ft. wide double leaf swing gates at the entrances to the site or ramp locations.
- Control building SFWMD standard door lock box.

- Non-climbable and locking roof ladders as per SFWMD standards for roof heights less than 20 ft. Greater roof heights require a protection cage for the ladder with a lockable door.

A.9.4.1.5 Site Safety

The structure site shall have the following safety features to protect the public as well as the SFWMD operations personnel:

- Safety float barriers (weed barrier) across the approach channels.
- Handrail around the inflow and discharge endwalls, along wing walls or any other area where there is a significant difference in elevation that has personnel access.
- SFWMD standard bollards placed around the LP gas fuel tank and corners of buildings.

A.9.4.2 Approach Channel Design

A.9.4.2.1 Channel Slopes

To provide efficient conveyance to and from the structure, the site design will use a trapezoidal cross section, with a straight alignment and flat canal bottom for the approach and discharge canals. In this limerock geology a stable cut section can be as steep as 0.5H:1V as evidenced by a number of existing C&SFFC Project canals in the south Miami-Dade County area. However, the traditional side slope of 2H:1V will be used.

Embankment slopes are typically 2H:1V as is the case for the L-1E Levee. Typically vegetation growth on this rock fill is sparse, and there is occasionally slope erosion. However, in general, the embankments are stable and become well cemented with age and resistant to surface erosion.

The side slopes for the approach channel are proposed to be 2H:1V. The side slopes for the discharge channels to the control structure are also proposed to be 2H:1V since it is composed of both a cut and embankment slope with transitions at the station wing walls as required.

A.9.4.2.2 Flow Velocity

For the rock geology of the Project site, unlined canals are specified for approach and discharge channels. Typically 2.0 fps maximum flow velocity is assumed for the sizing of the canal cross sections. This is a conservative value that applies to medium sandy soils. Low flow velocity to minimize erosion increases canal cross sections and Project costs. For this application the flow velocity was calculated to be 3.75 fps through the box culvert. At the structure, the bottom width will

transition from the inflow or discharge outlet of the structure and elevation to the existing bottom width and elevation of the C-111 Canal. For this site the canal bottom is deeper than the culvert inverts, therefore reducing the flow velocity within a short distance from the structure.

A.9.4.2.3 Scour Protection

The transition of the flow into the culvert inlet and flow from the structure are in large part addressed by the structure wing walls. Primarily at the discharge area at the region of the outlet of the discharge boxes, there is considerable turbulence that requires some distance for the flow jets to spread and develop into a uniform and more steady state flow pattern. Since the canal bottom is deeper than the culvert inverts the discharge velocity should rapidly decrease as the channel section transitions to the larger cross section.

The SFWMD has written a detailed stone protection specification with variations of stone gradations for the severity of the flows expected. For all but the largest hydraulic structures of the SFWMD, the stone gradation "B" has proven to have adequate stone size to address the flow velocities for entrance to and the discharges from the various spillways, culverts and pump intakes and discharge chambers that are typical of the SFWMD. The length and thickness of the stone blanket when velocities are under 2.0 fps is generally specified as a 20 ft. blanket length with a 2 ft. thick riprap blanket with a one ft. thick bedding stone thickness. This stone protection addresses any possible high velocity flows at the structural boundaries such as the piers noses or end sills where potential scouring could occur.

A.9.4.2.4 Design Stage

The design stages for the approach and discharge channels were established previously and are summarized in the following table:

TABLE A-37: S-198 DESIGN STAGES

Design Stage	Feet (NAVD)	Feet (NGVD)
S-198 Headwater	**0.11**	**1.75**
S-198 Tailwater	**-0.19**	**1.4**

Add 1.59 ft. to the NAVD88 for conversion to NGVD29 datum.

SFWMD designs their conveyance canals so the flow is maintained within canal design cross section and typically targets a (3) ft freeboard from the design stage to the top of bank. Over-bank flows are not considered desirable due to the resulting slope erosion and channelization.

A.9.4.3 Site Design

A.9.4.3.1 General

The site design will address the SFWMD standards and design criteria discussed in ***SECTION 18.4.1***. The following items are not addressed by the SFWMD standards but are typical for SFWMD water control facility sites.

A.9.4.3.2 Site Drainage

The area around the control structure will basically be level with the service bridge elevation of 7.0 ft. NAVD. For drainage the grade shall be slightly pitched away from the structure and control building to the top of the proposed banks. The embankment slopes around this service area shall be 4H:1V as per recent SFWMD requirements. The proposed stone protection will be extended around the wing walls to an elevation above the maximum design stage. Addition riprap may be added for those transition slopes steeper than 3V:1H in the areas around the inflow and discharge wing walls of the culverts. The finished floor elevation for the control building will be set at the estimated surge elevation of 7.0 ft. NAVD to ensure the electrical equipment is well above any localized ponding or runoff.

A.9.4.3.3 LP Gas Underground Tank

A (500) gallon capacity underground LP Gas tank is provided for the generator as per SFWMD standards. The tank is located adjacent to the generator room approximately 10 ft. from the exterior wall. The tank is easily accessible to the re-fueling trucks and is protected by standard SFWMD bollards. The supply piping is underground and also protected by a bollard.

A.9.4.3.4 Communication Antenna Pole

A standard SFWMD 46 ft. precast concrete antenna pole will be provided to support the communication dishes. The pole is located (5) ft. from the exterior of the control building wall when possible to minimize the above-ground communication conduit and wiring.

A.9.4.3.5 In-Bank Stilling Well

An in-bank stage monitoring well will be provided approximately 100 ft. from the culvert entrance and one approximately 100 ft. from the discharge outlet on the control building channel bank. The stilling well and its appurtenances will be in accordance with the SFWMD detailed standards for the well, intake piping and staff gage. The well and its instrument chamber are located at the top of the channel bank with the intake piping connecting to a timber pile supported

staff gage at the toe of the channel side slope. For the rock geology of the region, the pile holes will be required to be augured prior to driving the piles.

A.9.4.4 Construction Consideration

A.9.4.4.1 Turbidity Control

The Contractor is required to conform to State water quality standards as prescribed in F.A.C. Chapter 62-302, and to meet the special requirements of any environmental permits that have been issued. The Contractor will need to install and maintain turbidity barriers where necessary to maintain turbidity releases at or below permit levels. Barriers will be installed prior to any filling, backfilling, or excavation and maintained in place until construction is complete and turbidity from construction has dissipated.

A.9.4.4.2 Maintenance of Operation of Existing Facilities

The Contractor will need to construct all work such that the existing flood control system and road traffic are not disrupted. A by-pass channel will be required around the structure cofferdam. The contractor shall coordinate all construction activities that may impact the operation of the C-111 Canal and its control structures with SFWMD operating personnel.

A.9.5 Structural Engineering Analysis and Design

The control structure design consists of a concrete substructure consisting of (8) 10 ft wide x 8 ft wide reinforced concrete gated box culverts and pre-cast reinforced concrete control building that houses the generator and electrical rooms adjacent the substructure. A typical SFWMD pre-cast reinforced concrete control building, 15 ft x 30 ft is proposed. The building will be located on the north C-111 Canal berm to the west of the control structure so that the gates are visible from the building. The building will be composed of two rooms, the electrical room and the generator room.

A.9.5.1 Design Standards and Codes

The following codes and standards were considered applicable for the structural engineering design. In case of conflicting requirements, the more stringent codes were applied.

- ACI 318-05, Building Code Requirements for Structural Concrete
- ACI 350-01, Environmental Structures
- National Fire Protection Association-NFPA 101–Life Safety Code
- AISC Manual of Steel Construction, 13th Edition

- Florida Building Code, 2004 Edition with current (2006) supplements (FBC)
- ASCE 7-02, Minimum Design Loads for Buildings and Other Structures

A.9.5.2 General Design Load Parameters

The structural design loads applied to the control structure include:

Dead Load: Dead Load for the design included the weight of all permanent construction, including roofs, walls, slabs, actual equipment weights. The unit weight of the concrete was taken as 138 pcf.

- Floor live loads:
  - Minimum unless noted otherwise 100 psf
  - Truck Loading HS-25 (AASHTO)
  - Control Building 100 psf
- Hydrostatic Loading: Liquid and soils lateral pressure loads shall use a load factor of 1.7 for concrete design.
- Wind Loads: Wind loads for the design of the Main Wind Load Force Resisting System (MWFRS) and for cladding components of buildings were calculated in accordance to the Florida Building Code 2004 and ASCE-7-02, and comply with the SFWMD criteria. These criteria included:
  - Wind velocity of 140 miles per hour and exposure C as defined in the FBC wind maps for Miami-Dade County.
  - 100 yr mean recurrence interval.
  - 50 yr from 100 yr recurrence adjustment factor = 1.07.
  - Roof: 0 degrees.
  - Mean Roof Height: 14 feet.
  - Importance Factor = 1.15, for water supply pump station.
  - Control Building Dimensions: 15 feet x 30 feet ~ rectangular enclosed building, no windows, low-rise building, with an eave height of 10 ft.

Note: This criteria is for a non-flood protection, unmanned facility. It is assumed during storm events the structure gates will be in the open position and there will be no operation of the structure.

- Backfill Parameters: The cohesiveless structural backfill was assumed to be limestone/shell/sand with the following characteristics: γ = 115.8 pcf; γsub = 68.7 pcf; $\phi = 40°$ and $K'_a = 0.22$; $K'_p = 4.60$.
- Design G.W.L.: The substructure wall designs shall assume the lateral earth pressure developed under the condition of a mean canal stage of +2.0 ft. with a saturated granular backfill to the finished grade behind the wall.

- Soil Loading Assumptions: Complete saturation or submergence of the backfill with the groundwater standing at the level of the finished grade represents the extreme case were water exerts a pressure on the wall which is independent of the lateral soil pressure. In addition to the pore water pressure, there is the lateral pressure due to the soil, which is a function of the submerged unit weight of the soil. Both the water pressure and the soil pressure were considered to act horizontally with hydrostatic distribution. The lateral pressure for this condition was computed by the equivalent fluid method. It can be assumed use of granular backfill will reduce this lateral soil pressure to the active case once the backfill operation is completed. The available at-rest soil values using the formula p = C, where C varies with the backfill from 0.4 for non-cohesive soils to 1.0 for compacted cohesive soils, for coarse sand C ~ 0.5.
- The equivalent fluid load for the soil was calculated = 96.8 pcf. The equivalent fluid load method is considered a conservative semi-empirical method and has been used because the physical characteristics of the backfill are not reliably known. Including the hydrostatic pressure to the full height of the wall adds considerably to the conservatism as well as the fact the soil's submerged at-rest unit weight values shall be used. The specifications shall require granular backfill.

A.9.5.3 Structural Stability

The stability analysis of structure assumed against overturning, sliding, and floatation, the recommended safety factors of 2.0, 1.5, and 1.5, respectively. Given the 3:1 length to height ratio, the substructure's center of gravity is very low. In addition, with the substructure founded on a tremie seal and with little driving force, the structure's stability in regard to overturning is assumed to exceed to a large margin, the safety factor stated above. Flotation is also considered to exceed the recommended safety factor by a large margin due to the structure's dead load and the soil load on the culvert boxes. Sliding is also considered to exceed its safety factor due to the large dead load and footprint of the control structure with the minor hydraulic head. No further analysis is considered warranted.

A.9.5.4 Concrete Design Criteria

Concrete design utilized the FBC 2004, EM 1110-2-2104, ACI 350-01, and the ACI 318-05 strength design method. For strength design, the recommendations of ACI 350 were included to modify the requirements in ACI 318. From these recommendations the following adjustments to the ACI 318 load factors were utilized a) the load factors for both the lateral earth pressure H and the lateral liquid pressure F were taken as 1.7, b) the factored load combinations for total

factored design load was increased by 1.3 in calculations for reinforcement in flexure.

Materials:

• Concrete for hydraulic structures	4,500 psi compressive strength @ 28 days
• Concrete for structures in dry	5,000 psi compressive strength @ 28 days
• Mass concrete	2,500 psi compressive strength @ 28 days
• Pre-stressed concrete design	5,000 psi compressive strength @ 28 days
• Reinforcing steel	ASTM A615, Grade 60

The minimum concrete cover shall not be less than 1.5 x the maximum aggregate or 2.5 x the bar diameter. The following concrete cover shall be assumed in the analysis:

- Cast against earth: 3 inches
- Elements with surfaces exposed to abrasion, channel side faces: 2.5 inches
- Slabs, walls, and beams typical: 1.5 inches

The minimum temperature steel for the abutments, piers, and walls shall be specified as #5 bars at 12 inches on centers. The wall thicknesses shall be sufficient to allow the proper placement and consolidation of concrete and shall be designed in multiples of 2 inches to simplify formwork. For typical design and detailing of the reinforcement, multiples of 6 inches shall be used in the spacing of the primary and secondary steel. The minimum bar spacing shall be taken as 1.5 x bar diameter or 1.5 x the maximum aggregate size. The minimum spacing between layers shall be 6 inches.

Construction joints shall be located to facilitate the construction, limit the horizontal depth of the placement and shall not impair the strength and water tightness of the structure. Horizontal joints shall be located at the base of walls and typically at the maximum spacing of 10 feet – 0 inches. Reinforcement shall be continuous through the construction joint. Waterstops shall be used in construction joints where there is a head differential and the possibility of water flow through the joint.

A.9.5.5 Masonry Design Criteria

The control building will consist of a reinforced concrete panels. Only the interior room wall is currently considered to be masonry. The masonry design includes the following design criteria:

- Concrete Masonry Unit will be a 8" x 8' x 16" two cell concrete block.
- The masonry unit shall have fm = 2000 psi.
- Grout shall have a compressive strength of 2500 psi.
- Mortar shall have a compressive strength of 2500 psi.

A.9.5.6 Steel Design Criteria

Steel design utilized the AISC Manual of Steel Construction, 13th edition. Load combinations will be in accordance with ASCE 7-02, ACI 318-05, and ACI 350-1. The following materials will be generally utilized for the construction of the facility:

• Structural steel rolled shapes	A588, Grade 50
• Plates	A36, Grade 36
• Bolts and nuts	A325 and A490, minimum 0.75" diameter
• Anchor bolts	A307 (3/4" diameter and less), A36 (1" diameter and greater)
• Corrosion steel	A304 or A316
• Sheet piles	A328 and A572

A.9.5.7 General Description of Control Structure

The structure's (8) ft high x 10 ft wide box culverts with end walls and piers shall be constructed of reinforced concrete. The base slab has a top elevation of -9.0 ft NAVD88. The culvert top slab elevation was set at +0.5 NAVD88 and will support a soil load to elevation 7.0 ft NAVD. Steel sheet piling was designed to withstand lateral loadings due to soil, hydrostatic pressures, and a surcharge loading of 500 psf and will be detailed as per SFWMD standards.

For the design of abutments, a lateral earth pressure for a completely saturated soil to grade using the equivalent fluid load method was utilized with a 96.8 psf equivalent lateral load. An additional surcharge traffic loading 500 psf was added to this lateral load. Concrete reinforcement and shear strength calculations were performed to arrive to a design thickness of the various substructure structural elements. The culvert top slab thickness of 18-inches was determined based on a HS-25 wheel loading and 100 psf live load as per SFWMD requirements as well as the soil load to elevation 7.0 ft NAVD.

A.9.5.7.1 Control Building

A 15 ft x 30 ft control building with floor slab elevation +7.0 ft NAVD88 adjacent to the control structure houses the electrical instrumentation control, and the communication systems. The control building structure consists of precast or cast-in-place reinforced panels. The building floor is an 8-inch concrete

slab-on-grade. The roof consists of precast concrete panels. An interior wall is provided to enclose the generator room. This interior wall is masonry, and the masonry cells are filled with grout to provide a one (1) hour fire rating.

A.9.5.8 Structural Reinforcement Design

A.9.5.8.1 Substructure

The structural components for the control structure include the tremie seal foundation, base slab, abutments, piers, end walls, needle beams and top culvert top slab. The input loads for the foundation and walls design included: wind, soil, hydrostatic pressures, dead loads, live loads, and self-weights as required by the structural design criteria.

A.9.5.8.2 Control Building

Structural elements for the control building included: reinforced concrete roof and wall panels, reinforced concrete slab on grade, and the interior masonry wall. The building design shall comply with the FBC for the high wind loads prescribed for the region as well as the SFWMD requirements. The input loads for the design of the control building components included: wind, soil, superimposed dead loads, superimposed live loads, and self-weights as required by the structural design criteria.

A.9.5.8.3 Sheet Piling System

The sheet piling system was design based on the water table information obtained from the SFWMD DBHYDRO historic stage records. The design utilized a PZ27 sheet pile section. The contractor shall be given the option to utilize a different sheet of equal or greater section modulus. The reinforced concrete cap and tie-back system shall generally follow the SFWMD standard details for the wales, tie rods, and deadman. The same backfill characteristics assumed for the stability analysis will be assumed for the wing wall design. The wing walls were analyzed using the software program SPW91 V2, Pile Buck, Inc. This program utilizes the Rankine method. The cantilever end portions of the wing wall were checked using USS Steel Sheet Piling Design Manual methods.

The initial results of the analysis indicated the wing walls do not require a tie-back system and were found to adequately support the lateral loads as a cantilever. Further analysis should be made at a later design phase.

A.9.6 Mechanical Engineering Analysis and Design

A.9.6.1 Project Background

A.9.6.1.1 Control Structure Description

The control structure design consists of a concrete substructure consisting of (8), 10 ft wide x 8 ft wide reinforced concrete gated box culverts and pre-cast, reinforced, concrete control building that houses the generator and electrical rooms adjacent to the substructure. The building will be located on the north C-111 Canal berm to the west of the control structure so that the gates are visible from the building. The building will be composed of two rooms: the electrical room and the generator room.

The gates will be single-stem, motor-operated slide gates, with channel (flush) mounted frame. The control and operation of the gates will be in accordance with SFWMD standards for such facilities. The structure bay will be capable of being dewatered by used of the SFWMD's standard dewatering needles for gate maintenance or removal.

A.9.6.1.2 Design Standards and Codes

The following codes, standards and guidelines were utilized for the Mechanical Design of the control structure as applicable:

- SFWMD Engineering Design Standards for Water Resource Facilities, Design Guidelines dated February 2008 (as amended)
- National Fire Protection Association, NFPA 37-Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2006
- National Fire Protection Association, NFPA 101- Life Safety Code
- National Fire Protection Association, NFPA 10 - Standard for Portable Fire Extinguishers

A.9.6.2 General Design

A.9.6.2.1 General Arrangement

The control structure will be composed of (8), 8'H x 10'W box culverts with an invert at elevation -9.0 NAVD. Given the design flow rate of 2,400 cfs, the top lip of the box will be at elevation -1.0 ft NAVD, therefore, providing the required submergence to achieve design flow. The box will be 40 ft in length providing adequate area at the operating ground elevation of +7.0 ft for maintenance equipment. The control building will be located on the north bank immediately north of the existing berm road used for canal maintenance. The building will house the electrical, control, and communication equipment necessary for the

operation of the (8) gates. The building location will be on the upstream side of the control structure to provide visibility of the gates when operated from the building.

The gates shall be the SFWMD's standard single disc stainless steel, single stem slide gates with motor operator. The gates shall be specified to be designed for a 10 ft head differential which will provide a significant safety factor over the anticipated heads the gate will actually see.

A.9.6.2.2 Control Structure Geometric Criteria

The natural grade (existing ground surface) at the pump station site is approximately +3.0 ft. NAVD88. The control structure elevations used in the Mechanical Engineering Design are identified in ***TABLE A-38***.

TABLE A-38: ELEVATION DESIGN CRITERIA

Station Component	Elevation (ft. NAVD88)
Culvert Invert	- 9.0
Control Building Floor FF	+7.0
Control Structure Operating Level	+7.0
Gate Pedestal Base Elevation	+9.0
Tremie Seal TOS	-11.5
Bottom of Tremie Seal	-21.5

A.9.6.3 Gates and Auxiliary Equipment

A.9.6.3.1 Design Considerations

The reliability requirements for flood control facility apply to this control structure although the structure will be unmanned and will not be operated at times of flood conveyance. The structure's purpose is environmental and therefore will have its gates in the open position at times when potential flood conditions exist. The control structure, however, must be capable of extreme flood conditions to ensure it passes the flood design flows without failure. The control building, on the other hand, does not have to be designed to SFWMD flood protection criteria since its damage or loss will not affect the flood protection system.

A.9.6.3.2 Design Life

There are a number of USACE references in regard to hydraulic structures' service life. Generally, these references indicate a 50 year design life for a facility. However, water resource structures are robustly designed for a life that

is typically double this duration. It is anticipated that the electrical and I&C equipment will require rehabilitation or replacement at least once during a 25 year service life. The gates and operators, with proper preventative maintenance, should have a 50 year service life. Auxiliary equipment should be designed and manufactured to ensure an equally long service life for the non-wear components.

The USACE engineering regulation ER 1110-2-8159, "Engineering and Design-Life Cycle Design and Performance" defines the engineering policies for selection of all systems, components, and materials for civil works projects on the basis of their long term performance. This regulation requires the design engineer for civil works projects to use life cycle design as the basis for selection of all project elements such as materials, structural systems, mechanical equipment, and site appurtenances. Life cycle cost analysis (LCC) is an important and increasingly standard method to compare alternatives of major hydraulic facilities.

A.9.6.3.3 Gate Design

Detailed gate requirements will be defined in the specifications. The gate frame shall be a channel mounted design that is flush with the face of the pier or abutment. In lieu of a yoke for support of the operator, a support bracket anchored to the face of the end wall is proposed. However, a yoke is an acceptable alternative.

The gate disc shall be fabricated from flat structural steel plate, reinforced with structural steel members as required for the application. The disc should be designed not to trap debris or soil. A drain for the thrust nut assembly is required.

The gate seals shall be securely fastened to slides and frames. The sill seal shall be a flush bottom type, with a neoprene bottom seal and structural steel embedment member in the sill. J-seals shall be provided for the sides of the frame. A top gate seal is provided to prevent leakage over the top of the gate when closed

The gate guides are required to run the full length of the disc and shall be capable of taking the total thrust produced by water pressure, as well as capable of supporting the slide when the gate is open.

The stem thrust nut shall be designed for all loads during opening and closing and shall be locked to prevent turning in the slide. Lift stems shall consist of 18-8 stainless steel meeting the requirements of ASTM A582. The stem design force shall not be less than 1.25 times the output thrust of the electric motor lift unit in the stalled motor condition. Stem threads shall be machine cut or rolled and of the square or Acme type. The number of threads per inch shall be such to

work most efficiently with the lift mechanism used. A stop collar is required at the full-open position. A rising stem with stem guides is required.

A.9.6.4 Culvert Dewatering

The structural design will permit the dewatering of one culvert bay at a time for inspection and/or maintenance of the gate unit. Each bay will be provided with a needle beam and a base slab sill for use of the SFWMD's standard dewatering needles both upstream and downstream. This dewatering system consists of approximately 22 ft. long aluminum fabricated panels (needles) of incremental widths. The needle widths vary from 2 feet to 4 feet and are selected in accordance with the bay width for closure of the opening. The needles placed with the bottom against the sill and the top leaning against the beam at a 10v:1h slope. The needles are compressed horizontally by the use of a spreader beam to ensure closure of the panels against the abutment and piers of the intake. The needle beams and base slab sill require a specialized geometric design to accommodate the SFWMD dewatering system.

With proper installation of the dewatering needles, which sometimes includes installation of a plastic tarp on the water side of the needles to aid in sealing the dewatering system, the bay is pumped down using a portable electric, submersible pump.

A.9.6.5 LP Gas Fuel System for the Emergency Generator

An emergency generator will be provided to operate the gates given the failure of the utility service. As per NFPA 37, the LP-Gas fuel system for the emergency generator will satisfy minimum requirements. The fuel tank will be located outside, a minimum of 10 feet from the exterior building face, and will be an underground tank. The tank will be constructed in accordance with applicable requirements of NFPA 30 - Flammable and Combustible Liquids Code. The tank will be installed in accordance with NFPA 58- Liquefied Petroleum Gas Code. The tank capacity will be 500 gallons as per SFWMD requirements.

Gas piping will be installed in accordance with the provisions of NFPA 58 - Liquefied Petroleum Gas Code. Gas trains for engines will contain the following safety components:

- Equipment isolation valve
- Regulator
- Two automatic safety shutoff valves
- Manual leak test valve for each automatic safety shutoff valve

Regulators will vent to the atmosphere a minimum of 5 feet from any structure opening.

Valves will be in accordance with Chapter 5 of NFPA 30. A manual shutoff valve at a remote location will be provided to isolate the fuel supply. An automatic safety shutoff valve will stop the flow of fuel in the event the engine stops.

Vents will be installed in accordance with Chapter 5 of NFPA 30 - Flammable and Combustible Liquids Code. The vent will terminate outside the building at a point 24 inches from any building opening at the same or lower level. Piping will be in accordance with Chapter 5 of NFPA 30 - Flammable and Combustible Liquids Code except all piping will be steel. The system design will follow SFWMD standards.

A.9.6.5.1 LP-Gas Generator Exhaust System

The emergency generator exhaust system will be designed and installed in accordance with Chapter 8 of NFPA 37. The system will follow SFWMD standards. The engine exhaust system will be installed to discharge combustion gases quickly and silently with minimum restriction including the generator exhaust silencer. In no case will the total exhaust system backpressure restriction imposed on the engine at full operating load exceed the engine manufacturer's maximum allowable exhaust backpressure limits.

A.9.6.5.2 Piping

All exhaust piping will be Schedule 40 stainless steel piping. The exhaust piping will be covered with appropriate high temperature insulation and shielding inside of the generator room. The generator exhaust silencer is to be installed outside of the room and the exhaust outlet extended to the edge of the roof and terminated with a counter weighted exhaust outlet rain cap. The exhaust silencer and associated piping will be supported and braced to prevent the weight or thermal growth from being transferred to the engine. Flexible expansion fittings will be provided to accommodate thermal growth. Support dampers and springs will be included where necessary to isolate damaging vibrations. A stainless steel construction, manual shut-off valve shall be installed on a NPT drain fitting at the low point of the exhaust piping outside in order to drain collected water.

A.9.6.5.3 Silencer

The exhaust silencer (muffler) will be a minimum of "critical" grade to provide extreme noise attenuation for environments with low background noise where slight noise emissions would be objectionable. The silencer shall have a minimal capability of up to 35 - 40 dB(A) attenuation at between 125 and 2000 Hz octave band center frequencies. The exhaust silencer will be selected and furnished so that the exhaust sound/noise from the generator engine at any range of

generator's normal operation is to be attenuated by the installed silencer in order to meet the noise level requirements. The silencer will be stainless steel body construction and furnished with inlet and outlet weld-on-type ANSI companion flanges, gaskets, bolts/nuts, and an appropriately sized stainless steel, bellows type, engine expansion flex connector for connection to the engine.

Suitably rated high temperature resistant gaskets will be utilized for all exhaust system flanged connections. The silencer support will be per SFWMD standards.

A.9.7 Plumbing Analysis and Design

The SFWMD guidelines for an unmanned water control structure do not require the following systems:

- Potable Water
- Sanitary Systems

A.9.8 Ventilation Design

A.9.8.1 Design Standards and Criteria

The following design standards were utilized in the design of the control building ventilation:

- American Society of Heating, Refrigerating, and Air Conditioning Engineers, (ASHRAE) Handbook
- National Fire Protection Association, NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2006
- SFWMD Standards for Construction of Water Resource Facilities - Design Guidelines dated February 2008

A.9.8.2 Outdoor Design Conditions

The outdoor design conditions were based on those of the Miami Weather Station (Lat: 25°45', Long: 80°17'). The outdoor design conditions included:

- The design summer dry bulb will be set at the 2-1/2 percent value with an outdoor summer dry bulb temperature of 90/77°F.
- The design summer wet bulb will be set at the 2-1/2 percent value with an outdoor summer wet bulb temperature of 78°F.
- The design winter dry bulb will be set at the 99 percent dry bulb value with the outdoor temperature of 47°F.
- Mean daily temperature range = 15 degrees.

- Winter prevailing wind direction and speed: NNW at 8 knots.
- Summer prevailing wind direction and speed: SE at 8 knots.
- The median of annual temperature extremes: 92.5°F maximum and 39°F minimum. The building has no windows; therefore, the 97.7 percent value of these extremes was used as per ASHRAE 90A-80. The maximum and minimum temperatures were, therefore, 90°F and 40°F, respectively.

The indoor design temperature for freeze protection is 40°F. Since the winter design dry bulb is above this value, heating is not required for the control building and was not provided.

A.9.8.3 Building Characteristics

The control building is unmanned and consists of an approximate 15 feet x 30 feet reinforced concrete single-story building with a slab on grade and a precast concrete panel roof. The control building is divided into two rooms, the 18 feet x 20 feet electrical room that houses the electrical, I&C, and communication equipment and a 10 feet x 20 feet standby generator room. The ceiling height is approximately 9 feet. The building is totally enclosed with only metal pedestrian doors. There are no windows in the building.

A.9.8.4 Ventilation Design

The building is an unmanned facility. Only mechanical ventilation will be provided for removal of heat and gases from the electrical and generator rooms to maintain an indoor temperature required by the operating systems to extend life expectancy of equipment and controls. The system design is based on the amount of air removed to maintain a maximum indoor temperature under 104°F in accordance with EM 1110-2-3105. A minimum of six (6) air changes are provided during non-operational periods.

The mechanical ventilating systems consist of air intake louvers, intake and exhaust hoods and insect screen, and exhaust fans with gravity back draft dampers to remove excess heat by ventilating with cooler outdoor air. For the generator room, an exhaust fan is provided in addition to the generator engine fan which exhausts hot air from/through the radiator cooling system. Intake areas with louvers are provided to supply the make-up air. The generator room ventilation will satisfy the combustion air requirements as per FBC Section M703.2.1. The fan operation of the generator room and the electrical room is controlled by a thermostat. The system designed follows SFWMD standards.

The control center instrumentation and control circuits do not require cooling fans or louvers in the enclosure for continuous operation in the 105° F ambient temperature of the electrical room but they will be provided for the reason stated above.

For estimating the building's cooling requirements, U-values were used for the solar heat gain calculations. These calculations assumed a constant temperature differential between the outdoor and indoor air and did not consider the diurnal cycles of solar radiation and air temperature. Building materials with heavy mass can react to temperature fluctuations, producing a dynamic thermal response, which differs substantially from the heat flow calculations based solely on instantaneous radiant heat. Research has indicated the actual measured rate of heat transfer for CMU walls is 20 to 70 percent less than steady-state calculation methods predict.

Heat transfer through solid materials is not instantaneous with higher density and greater mass causing slower absorption and longer retention of heat. The thermal inertia (the rate at which the wall heats up or cools down) is dependent on the wall thickness, density, specific heat and conductivity. The thermal storage of the building element is directly proportional to its weight. Masonry's and concrete's thermal storage capacities are effective in retarding heat migration and increasing the lag time required for the inside and outside surface temperatures to reach equilibrium. The mid-day solar radiation load on the south face of a building will not completely penetrate an 8-inch thick CMU wall for approximate 8 hours. Therefore, building envelopes with significant thermal storage capacity will delay the peak load until after the hottest part of the day when the solar radiation has passed.

Heat gain is also affected by the surface color and emissivity of the wall, orientation, intensity of direct and diffused solar radiation, and the surface reflectivity. The heat gain equation prescribed by ASHRAE includes a cooling load temperature difference (CLTD) factor to simulate air temperatures, which would give a rate of heat exchange equivalent. The rate of heat exchange is determined by considering the following variables:

- Q = UA (CLTD)
- Q = heat gain (Btu/hr)
- U = coefficient of thermal transmission of the opaque wall or roof assembly [Btu/(hr.°F.ft2)]
- A = opaque wall or roof surface (sq ft)
- CLTD = cooling load difference (°F)

Ventilation requirements of the generator and electrical rooms that are summarized in ***TABLE A-39*** below:

TABLE A-39: PRELIMINARY VENTILATION REQUIREMENTS

Room	Exhaust Fan Rating	Motor Hp	Fan Size	Louver Size
Generator	4000 cfm @ 0.25 in.	3/4	24" x 24"	(2) 48"x 48" intake (1) 48"x48" exhaust
Electrical	2200 cfm @ 0.33 in.	1/2	24" x 24"	(1) 48"x48" intake

A.9.8.5 Equipment

A.9.8.5.1 Fans

Direct-drive propeller type fans were selected which bear the AMCA certified ratings seal listed in AMCA 261. Axial-flow fans are capable of moving large quantities of air at low pressure and have been the fan type traditionally used in SFWMD facilities. This fan type however, does produce higher noise levels than centrifugal fans. The fan will be a complete, heavy duty assembly, including a corrosion-resistant housing and/or frame, shutter, suitable gaskets, motor guards, closure pieces, and mounting holes. Aluminum insect screens with an 18 by 16 mesh, conforming to Federal Specification RR-Wl-365, will be provided. Fans will be protected by a rain hood. The hood design will address the estimated components and cladding wind loads for the building. The fan motor and propeller are balanced for smooth operation. Belt-driven fans were considered, but due to their higher maintenance and lower efficiency, and since the fans required are relatively small in capacity, direct-drive propeller fans were recommended.

A.9.8.5.2 Fixed Wall Louvers

Wall louvers are required to bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511. The louvers are certified for having passed the Dade County Florida large missile impact test, uniform static air pressure test, cyclic wind loading, and the wind-driven rain test. The louver sizing was based on a free air area determined by using a free air minimum velocity of 739 fpm. With the selected louver and associated free air area this velocity is not exceed.

Louver blades will be fabricated of extruded 6063-T5 aluminum alloy in accordance with the recommendations of SMACNA. Jamb frames, mullions and stiffeners will also be fabricated of extruded 6063-T5 aluminum alloy. Frame corners and blades are welded, assembled or fastened with self-tapping, stainless steel screws. Mullions have integral internal drains and will be the same finish as the louvers and spaced to address wind load requirements. Mullion covers on both faces of joints between louvers were provided. Closures and clips are fabricated from extruded aluminum alloy angles and flat bars for louver perimeters. Extruded aluminum alloy clips were provided as required for

securing mullion ends. Metal thickness is a minimum 0.125 inches. The required finish is Architectural Class 1, satin anodic-coating AA-C22-A41, natural anodized. All fasteners will be determined by the manufacturer and those exposed fasteners will be shop enamel finished to match louvers. Aluminum insect screens with an 18 by 16 mesh, aluminum conforming to Federal Specification RR-W-365, will be provided.

All louvers will be protected by a rain hood. The hood design will address the estimated components and cladding wind loads for the building.

A.9.8.5.3 LP-Gas Generator

The emergency generator engine air supply was designed to meet at least the minimum requirements for combustion, cooling, and ventilation and prevent flue gas products from being drawn from stacks or vents in accordance with NFPA 37.

A.9.8.6 Generator Engine Cooling System

The engine jacket water-cooling system is a pressurized closed circuit design with provision for manual filling, thermal expansion, and coolant de-aeration. The radiator blower fan and engine cooling water centrifugal-type transfer pump are driven by the engine. The coolant pump circulates the engine jacket water through the entire engine cooling water system, including the radiator. Any auxiliary coolant transfer pumps required for separate circuit after cooling of the engine through the radiator will also be engine driven.

The radiator is of sufficient capacity to allow the generator set full rated operation at 110 degrees F outside ambient temperature. The radiator is furnished with a duct flange for use with a radiator air discharge duct or shroud, to be furnished and installed between the radiator and the radiator air discharge louvered opening. The radiator is furnished with a painted perforated metal grill to protect the radiator core. The heat rejected to the engine jacket water and after-cooler is radiated to the atmosphere by the radiator and removed by the engine-driven fan through the close-coupled radiator. The radiator will properly cool the engine jacket water and after-cooler water while the engine is operating at full load capacity within the generator room at maximum specified site temperature.

The radiator fan, fan drive, and fan belts are totally enclosed and covered with 14 gauge punched steel mesh guarding for personnel protection and will be OSHA approved. The radiator-cooling fan is a blower type, mechanically direct-driven from the engine. Air is drawn from the engine sides and top and exhausted through the radiator core to the air discharge plenum. Coolant lines are high temperature, strength reinforced, and have flexible connections. A

removable radiator pressure cap and radiator overflow line is installed on the radiator as well as a flexibly connected coolant water drain line with stainless steel construction, manual shutoff valve terminated with a stainless steel NPT fitting, and a threaded, stainless steel cap. An electronic coolant level sensor/alarm switch is furnished and installed in the radiator by the engine manufacturer for coolant level monitoring and generator set shutdown for an excessively low coolant level condition.

UL recognized engine coolant electric jacket water heater(s) is provided and installed on the engine by the manufacturer. The heater(s) is complete with an automatic thermostatic control suitably sized to maintain uniform engine coolant temperature from 90 to 175°F while the engine is idle. The heater(s) is 120 VAC single-phase, controlled for automatic on/off operation by the heater thermostats, connected to a heater contactor, and installed and wired by the generator set manufacturer. The heater(s) is automatically de-energized by the generator set controls anytime the engine runs. The engine manufacturer will install the heater with manual isolation shutoff valves at each heater hose connection at the engine in order to facilitate heater/heater hose maintenance without having to drain the engine coolant water. The unit will have an engine/radiator closed loop type cooling system with a water/ethylene glycol based coolant mixture as per the engine manufacturer's recommendations.

A.9.9 Fire Protection and Detection Analysis and Design

A.9.9.1 Fire Protection Design Criteria

The applicable fire protection design criteria and codes included:

- SFWMD Standards for Construction of Water Resource Facilities-Design Guidelines dated February 2008
- Florida Building Code
- National Fire Protection Association, NFPA 101 - Life Safety Code
- National Fire Protection Association, NFPA 37-Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2006
- National Fire Protection Association, NFPA 1-Standard for Portable Fire Extinguishers, 2002

A.9.9.2 Fire Detection and Suppression Requirements

The control building does not require a fire detection or automatic sprinkler system nor is it required by the SFWMD guidelines. These guidelines do, however, require multi-purpose dry chemical extinguishers. Extinguishers with an UL rating 4A:60B:C are appropriate for the hazards associated with this facility and included in the final design.

A.9.9.3 Fire Protection Building Design Requirements

The purpose of the control building is to provide a secure and weather tight facility for the electrical control and communication equipment. The building will normally be unmanned and remotely operated. The control gates will be electric-motor driven. No storage of hazardous materials is provided within the building. There is an emergency generator located within the control building. This emergency generator will be driven by a LP gas engine. Fuel will be stored in an underground storage tank 10 feet from the exterior wall of the building. The engine will be enclosed in its own room and provided with forced ventilation when in operation or when the temperature of the room exceeds 85°F.

Control building construction will be Type 1, non-combustible, and will include precast concrete panels. The roof will be composed of pre-cast concrete slabs. As per NFPA 37 paragraph 4.1.2, engines located within structures will have the interior wall separating the engine room from the remainder of the pump house with a one-hour fire rating. Interior doors will have one-hour rating and will be self-closing. The engine room ventilation will adequately prevent a hazardous accumulation of flammable vapors or gases, both when the engine is operating as well as when it is shut down.

A.9.10 Electrical Analysis and Design

A.9.10.1 Design Criteria

The electrical design of the facility shall be in compliance with the latest edition of the National Electrical Code (NEC), 2008. The electrical design complies with the SFWMD standards or general engineering practice for hydraulic structures.

A.9.10.2 Power Supply

Three phase electrical service is proposed to be provided by FP&L from the existing overhead service along US1, approximately 4 miles to the east of the site. The voltage is stepped down to 480 volts for service to the control building. An underground line will be installed to the facility from the FP&L transformer. The facility will be used for environmental purposes with no flood protection functions, and therefore, the reliability of the power supply is not critical to the operation.

A.9.10.3 Low Voltage Facility

An electrical system with a specified voltage of 600V or less is considered a low voltage grounded system. A low voltage grounded system is a system where the local power supply is a transformer with the transformer secondary grounded. The first disconnecting means on the load side of this transformer provides the

point where the neutral conductor is grounded. The neutral is connected to the equipment grounding circuit conductor only at one point, which is within the enclosure of the disconnecting means. The grounding electrode conductor or the equipment grounding circuit conductor will not be used as the neutral.

A.9.10.4 Power Distribution Equipment

A.9.10.4.1 Design Criteria

The following design criteria apply to the power distribution equipment:

- NEC (NFPA 70) National Electrical Code 2008, Latest Edition
- UL 83-Thermoplastic Insulated Wires and Cables
- NETA International Electrical Testing Association-2003 Acceptance Testing Specifications

A.9.10.4.2 Wiring

Power and lighting wire rated for 600 volts in duct or conduit for all power and lighting circuits is XHHW-2 rated at 90°C in dry locations, meeting the requirements of UL 83.

Conductors for feeders, as defined in Article 100 of the NEC, were sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent. Conductors for branch circuits, as defined in Article 100 of the NEC, were sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

Control wire in conduits is No.14 AWG, the same type as power and lighting wire described above. Control wires at panels and cabinets will be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.

Instrumentation cable is rated at 600 volts with individual conductors No. 16 AWG stranded, tinned copper. Insulation will be color coded polyethylene: black-red for two-conductor cable and black-red-white for three-conductor cable. Instrumentation cables will be composed of the individual conductors, an aluminum polyester foil shield, a No. 16 AWG stranded tinned copper drain wire, and a PVC outer jacket with a thickness of 0.048-inches.

A.9.10.5 Surge Protection

Surge protection is provided to protect against voltage surges on the incoming power lines. A three-phase transient voltage surge suppression (TVSS) is provided at the service entrance to the building. In addition, all analog and digital inputs to the PLC that are generated from devices that are exterior to the facility will be furnished with a TVSS.

A.9.10.5.1 Design Criteria

The service entrance TVSS will comply with the following standards and design criteria:

- UL 1449 Second Edition and be UL 1283 listed,
- UL 1449 listed 200kA SCCR in compliance with NEC 285.6.

TVSS will provide surge current diversion paths for all modes of protection; L-N, N-G in WYE systems, and L-L, L-G in DELTA systems. Each mode including N-G will be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device. TVSS for service entrance applications will be modular in design. TVSS will provide audible diagnostic monitoring by way of audible alarm. This alarm will activate upon a fault condition. An alarm on/off switch will be provided to silence the alarm. An alarm push to test switch will be provided.

If a dedicated breaker for the TVSS is not provided in the switchboard, the service entrance TVSS will include an integral UL recognized disconnect switch. A dedicated breaker will serve as a means of disconnect for distribution TVSS.

Minimum surge current capability (single pulse rated) per phase will be: 320kA per phase (High Lightning Exposure Areas) and 240kA per phase (Medium Lightning Exposure Areas).

UL 1449 2nd Edition Listed Suppression Voltage Ratings for service entrance will not exceed that shown in the following table:

TABLE A-40: SUPPRESSION VOLTAGE RATINGS

Voltage	L-N	L-G	N-G	MCOV
208Y/120V	400	400	400	150V
480Y/277V	700	700	700	320v

TVSS will have a minimum EMI/RFI filtering of –50dB at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology. Distribution and

Branch Panel Surge Suppressor will satisfy the following standards or design criteria:

- TVSS will comply with the provisions of UL 1449 Second Edition and UL 1283 listed
- TVSS will have a UL 1449 listed 200kA SCCR in compliance with NEC 285.6
- TVSS will provide surge current diversion paths for all modes of protection; L-N, L-G, and N-G in WYE systems, and L-L, L-G in DELTA systems

Each mode including N-G will be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device. The TVSS will provide diagnostic lights. A dedicated breaker will serve as a means of disconnect for distribution TVSS.

Minimum surge current capability (single pulse rated) per phase will be:

- 160kA per phase (High Exposure)
- 80kA per phase (Medium Exposure)

The 120 VAC control power that feeds the control center power supply will be protected with transient voltage surge suppression specifically designed for the protection of power supplies.

A.9.10.6 Electrical System Design

A.9.10.6.1 Design Criteria

The facility's electrical system will comply with the following reference standards:

- American National Standards Institute (ANSI):
  - C37 Series-Power Switchgear
  - C50.10-General Requirements for Synchronous Machines
  - C50.13-Cylindrical Rotor Synchronous Generators
  - C50.14-Combustion Gas Turbine Driven Cylindrical Rotor Synchronous Generators
- Institute of Electrical and Electronic Engineers (IEEE):
  - C62.1-Surge Arresters for Alternating-Current Power Circuits
  - 43-Testing Insulation Resistance of Rotating Machinery
  - 56-Insulation Maintenance of Large Alternating-Current Rotating Machinery (10 kVA and larger)
  - 115-Synchronous Machines
- National Electrical Code (NEC)

- National Electrical Manufacturing Association (NEMA)
- National Electrical Safety Code (NESC)
- Society of Automotive Engineers (SAE)

A.9.10.6.2 Lighting

A 120/208V three-phase, 4-wire system with identified grounded neutral and separate ground wire for lighting, receptacle, and small power was provided. Photocell controlled exterior lighting is required at the control building entrances and on the rear of the building. The interior lighting design for the electrical and the generator rooms will comply with the National Electrical Code (NEC). Fluorescent ceiling mounted fixtures were utilized to satisfy the interior lighting requirements. For interior lighting; the coefficients of utilization, luminary dirt depreciation, and lamp lumen depreciation will be taken as 0.90, 0.90, and 0.90 respectively, which equals to 0.72 Light Loss Factor (LLF).

The electrical room is designed to have an average of 40 foot-candles, and the generator room was designed to have an average of 35 foot-candles. High Pressure Sodium fixtures shall be utilized to satisfy the exterior lighting requirements. The exterior fixtures will either be pole mounted or mounted on the side of the building. For exterior lighting, the coefficients of utilization, luminary dirt depreciation, and lamp lumen depreciation will be taken as 0.94, 0.93, and 0.93 respectively, which equal 0.81 LLF. The exterior lighting was designed to have an average of 5 foot-candles with the use of full cutoff High Pressure Sodium fixtures.

All equipment and materials bear UL label. The fluorescent lamp ballasts have a UL Listed Class "P" with a power factor correction capacitor to provide not less than 0.9 pf and conform to ANSI and UL Standards regarding light output, reliable starting, radio interference and dielectric rating. Interior luminaries will operate in the ambient temperature of 117 degrees Fahrenheit for interior of the control building.

A.9.10.6.3 Back-up Power System

The facility is provided with an LP-Gas generator for backup emergency power. The generator is driven by a LP-Gas powered engine sized to supply power to all facility demands, however, there may be consideration given in regard to the number of gates that may be operated at a given time. The generator automatically starts with failure of the primary power supply by use of an auto-transfer switch. The generator is housed in its own room and was situated to provide accessibility for maintenance, repair, and fire fighting as per the requirements of Chapter 4 NFPA 30.

A.9.10.6.4 Engine-Generator

Initial calculations indicate a 20 kW engine generator is required for back-up service for the facility during the time utility power is unavailable. Controls were provided in the 125 ampere ATS to either manually or automatically start the engine-generator. A RTU output command will remotely STOP the engine generator should the unit unnecessarily start.

The engine is a stationary, LP-Gas, 4 cycle, compression ignition, liquid cooled with dry exhaust manifolds. The horsepower rating of the engine at its minimum tolerance level will be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. An electronic governor system provides automatic isochronous frequency regulation. The governing system dynamic capabilities are controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system will actively control the fuel rate as appropriate to the state of the generator set.

A.9.10.7 Grounding System

A.9.10.7.1 Design Criteria

The grounding system will conform to the following codes and standards:

- NEC Article 250–Grounding,
- UL 467-Standard for Safety Grounding and Bonding Equipment,
- IEEE 837-1989 Standard for Qualifying Permanent Connections Used in Substation Grounding, and
- IEEE 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

A.9.10.7.2 General Requirements

A grounding system grid consists of connection to the reinforcement mat of the primary base slabs and the grounding electrode system connected by a main #2/0 AWG ground cable. Various building elements and equipment is connected to this main ground per NEC and specifications using #2/0 bare copper wire. The components of the grounding electrode system will be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding Equipment, and will conform to the applicable requirements of NEC Article 250 and local codes.

The grounding electrode system complies with the following requirements:

- Conductors: Grounding loop conductors will be bare annealed copper conductors suitable for direct burial and have a minimum size of #2/0.
- Ground Rods: The ground rod will be a minimum of 3/4-inch in diameter, 20 feet long with pointed end to facilitate driving, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond will be corrosion resistant. The rod length will clearly stamped near the top of the rod.
- Conform to ANSI/UL 467.
- Buried cable-to-cable and cable-to-ground rod connections are made using exothermic welds or compression connectors suitable for direct burial.
- Exposed grounding connectors are of the compression type (connector to cable), made of high copper alloy, and manufactured specifically for the particular grounding application.
- Grounding clamps are used to bond each separately derived system to the grounding electrode conductors.
- Equipment Grounding Circuit Conductors: These conductors are the same type and insulation as the load circuit conductors. The minimum size is outlined in Table 250.122 of the NEC.
- Cable to equipment ground lugs are compression type, bolted to the equipment with silicon bronze bolts and lock washers.

A.9.10.8 Lightning Protection

The facility includes a lightning protection system, complete and functional per plans and specifications. The system includes air terminals, roof and down conductors and building grounding grid, the grounding rod system and ground riser extension to electrical equipment.

A.9.10.8.1 Design Criteria

Lightning protection will conform to the following codes and standards:

- Lightning Protection Institute (LPI): 175, Installation Standard,
- National Fire Protection Association (NFPA): 780, Lightning Protection Code, and
- Underwriters Laboratories, Inc. (UL), 96, Standard for Safety Lightning Protection Components and 96A, Standard for Safety Installation Requirements for Lightning Protection Systems.

A.9.10.8.2 General Requirements

Components of the grounding electrode system will be manufactured in accordance with ANSI/UL 467 - Standard for Safety Grounding and Bonding

Equipment, and will conform to the applicable requirements of NEC Article 250 and local codes. No combination of materials will be utilized that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such materials. Where unusual conditions exist which could cause corrosion of conductors, conductors with protective coatings or oversized conductors will be used. Where mechanical hazards are involved, the conductor will be sized to compensate for the hazard or the conductor will be protected by covering with molding or tubing made of wood or non-magnetic material. When metallic conduit or tubing is used, the conductor will be connected at the upper and lower ends.

A.9.10.8.3 Air Terminals

Air terminals will be in accordance with UL 96 and NFPA 780. The tip of the air terminal will be a minimum of 2 feet above the roof. The terminals will be located within 2 feet of the corners of the building. Spacing of the terminals will not exceed 25 feet. The design and support will be in accordance with NFPA 780 and will be rigidly supported. Terminals with a length greater than 24 inches will be supported by a brace. The terminals and their anchorage will be designed for the design wind load requirements.

A.9.10.8.4 Conductors

All conductors will be copper. Main and secondary conductors will be in accordance NFPA 780 and UL 96 for Class I, Class II, modified materials as approved. Clamp type connectors will only be used for the connection to the roof conductor to the air terminal. All other connections, bonds, and splices will be exothermic welds or by high compression fittings. Grounding loop conductors will be bare annealed copper conductors suitable for direct burial and will be of a minimum size of #2/0.

The grounding rods will conform to ANSI/UL 467 and will be a minimum of 3/4-inch in diameter, 20-feet long with pointed end to facilitate driving, and have a uniform covering of electrolytic copper metallically bonded to a rigid steel core. The copper to steel bond will be corrosion resistant. The rod length will be clearly stamped near the top of the rod.

A.9.10.9 Motors

The SFWMD requires maximum 480V, 3 phase, 60 Hz electrical power systems for hydraulic facilities. The motor is required to be a squirrel cage induction motor designed for a SSRVS type starter that has an integrated full voltage bypass option to allow for full voltage starting in the event the SSRVS cannot be used and complies with the following standards and codes:

- NEC (NFPA 70) National Electrical Code 2008 Edition
- NETA International Electrical Testing Association-2003 Acceptance Testing Specifications
- NEMA MG-1 1998-Revision 1, 2000-Motors and Generators
- IEEE 43-1974-revision of IEEE Std 43-1961-Recommended Practice for Testing Resistance of Rotating Machinery
- NEMA MG-2-2001-Safety Standard and Guide for Construction Installation and Use of Electric Motors and Generators
- IEEE 112–1996-revision of IEEE Std 112-1991-Standard Test Procedure for Polyphase Induction Motors and Generators

A.9.10.10 Motor Starters

Motor starters are mounted in a standalone unit. Each motor starter unit consists of a combination magnetic contactor and short circuit protective device. A short circuit protective device is an instantaneous, magnetic only circuit breaker or thermal magnetic circuit breaker. All circuit breakers provided as part of a motor starter unit are capable of being padlocked in the open position and reset of thermal overload elements will be possible with the unit door closed. Three phase overload trip units are furnished to suit the full load current of the equipment installed. Overload relays will be solid-state type capable of detecting phase loss and ground faults and will meet NEMA class 20 tripping characteristics.

Each starter unit will have its own control power transformer. Units will have a 115-volt grounded secondary. One secondary fuse and 2 primary fuses are provided. Control power transformers were sized to accommodate the control devices indicated with a minimum transformer size of 50 VA. Local control devices are mounted independently of the cover door. All starters have a local "running" lamp and an "off" light to indicate the presence of control power when the motor is not running. Indicating lights are push-to-test type. Starters are provided with elapsed time meters, and hand/off/auto selector switches.

Motor starters will be designed to NEMA ratings. Starters designed to IEC ratings or with dual IEC/NEMA ratings will not be acceptable, either as part of the SCC, as remote starters, or as part of any equipment package. Full voltage motor starter units will be NEMA Size 1 or larger. Each combination starter will be rated for a minimum 65,000 RMS symmetrical amperes.

A.9.10.11 Facility Security

The security standards for a SFWMD water control facilities are based on preventing unauthorized access and providing a safe environment for SFWMD employees. The basic security elements implemented in the design of the facility are fencing, handrails, and secure entrance doors.

A.9.11 Instrumentation and Control Analysis and Design

A.9.11.1 System Description

The gates shall have two modes of operation, local manual operation of remote operation via the SFWMD telemetry system. The I&C system for the facility consists of the RTU communications system design as per the SFWMD detailed standards. Remote stage monitoring shall be provided of the headwater and tailwater stages. Each gate will be equipped with a gate position indicator to monitor the gate opening. Limit switches shall be provided to protect the gate.

A.9.11.2 Control Equipment

A.9.11.2.1 Control Center

The facility's control center controls and monitors the operation of a each gate and is connected to the RTU. The control center includes an uninterruptible power supply, power supplies of the various voltages required by the equipment, terminal blocks, operator interface devices, plastic slotted sidewall wiring duct, over current protective devices, interconnecting wiring, communications equipment and appurtenances housed within a free standing enclosure(s).

The control center includes a LOCAL-REMOTE selector switch is provided to select between local and remote operation of the system via the SFWMD's telemetry system. MANUAL operation consists of an operator manually controlling each component of the system through the use of manual controls. In addition, the control center or local control station has an EMERGENCY STOP (mushroom red head – pull to reset) pushbutton for emergency shut-down activation. The emergency stop pushbutton will be able to activate in both MANUAL and AUTO modes. The EMERGENCY STOP push-button will shut down the gate motor.

A.9.11.2.2 Generator Control and Monitoring

The generator set is provided with a microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system is designed to allow local monitoring and control of the generator set, and remote monitoring and control. The control is mounted on the generator set. The control is vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control panel includes the following features and functions:

- Mode Selector Switch: The mode select switch will initiate the following control modes. When in the Run or Manual position the generator set will start, and accelerate to rated speed and voltage as directed by the operator. In the Off position the generator set will immediately stop, bypassing all time delays. In the Auto position the generator set will be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
- Emergency Stop Switch: The emergency stop switch will be red "mushroom-head" push-button. Depressing the emergency stop switch will cause the generator set to immediately shut down, and be locked out from automatic restarting.
- Reset Switch: The reset switch will be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
- Panel Lamp Switch: Depressing the panel lamp switch will cause the entire panel to be lighted with DC control power. The panel lamps will automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

The generator set is provided with a metering set which includes the following features and functions:

- Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter will display all three phases. Ammeter and KW meter scales will be color coded in the following fashion: readings from 0-90 percent of generator set standby rating: green; readings from 90-100 percent of standby rating: amber; readings in excess of 100 percent: red.
- Digital metering set, 0.5 percent accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor.
- Generator output voltage will be available in line-to-line and line-to-neutral voltages, and will display all three phase voltages (line to neutral or line to line) simultaneously.
- Both analog and digital metering is required. The analog and digital metering equipment will be driven by a single microprocessor, to provide consistent readings and performance.

The generator set is provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps are high-intensity LED type. The lamp condition will be clearly apparent under bright room lighting conditions. The generator set control will indicate the following alarm and shutdown conditions on an alphanumeric digital display panel:

• Low oil pressure	alarm
• Low oil pressure	shutdown
• Oil pressure sender failure	alarm
• Low coolant temperature	alarm
• High coolant temperature	alarm
• High coolant temperature	shutdown
• Engine temperature sender failure	alarm
• Low coolant level	alarm or shutdown-selectable
• Fail to crank	shutdown
• Fail to start/over-crank	shutdown
• Over-speed	shutdown
• Low DC voltage	alarm
• High DC voltage	alarm
• Weak battery	alarm
• Low fuel	alarm
• High AC voltage	shutdown
• Low AC voltage	shutdown
• Under frequency	shutdown
• Over current	warning
• Over current	shutdown
• Short circuit	shutdown
• Over load	alarm
• Emergency stop	shutdown

The following information will be available from a digital status panel on the generator set control:

Engine oil pressure (psi or kPA):

- Engine coolant temperature (degrees F or C),
- Engine oil temperature (degrees F or C),
- Engine speed (rpm),
- Number of hours of operation (hours),
- Number of start attempts, and
- Battery voltage (DC volts).

A.9.11.2.3 Engine Control Functions

The engine control system includes a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings will be for three cranking periods of 15 seconds each, with 15-second rest period between cranking periods. The control system includes an engine governor control, which functions to provide steady state frequency regulation. The governor control includes adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is

starting. The control system includes time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions. The control system will include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

A.9.11.2.4 Alternator Control Functions

The generator set includes an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It is immune from miss-operation due to load-induced voltage waveform distortion. The voltage regulation system is equipped with three-phase RMS sensing and will control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system includes a torque-matching characteristic, which will reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator includes adjustments for gain, damping, and frequency roll-off.

Provisions are provided to shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided will be in compliance to the requirements of NFPA 70 article 445. Controls are provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.

An AC over/under voltage monitoring system that responds only to true RMS voltage conditions is provided. The system initiates shutdown of the generator set when alternator output voltage exceeds 110 percent of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130 percent. Under voltage shutdown occurs when the output voltage of the alternator is less than 85 percent for more than 10 seconds.

A battery monitoring system will be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit is disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm is initiated.

A.9.11.2.5 Control Interfaces for Remote Monitoring and Control

All control and interconnection points from the generator set to remote components will be brought to a separate connection box. No field connections will be made in the control enclosure or in the AC power output enclosure.

The control system will have a form "C" dry common alarm contact set rated 2A @ 30 VDC to indicate existence of any alarm or shutdown condition on the generator set. It will also contain one set of contacts rated 2A @ 30 VDC to indicate generator set is ready to load. The contacts will operate when voltage and frequency are greater than 90 percent of rated condition. A fused 10 amp switched 24 VDC power supply circuit will be provided in the control system. DC power will be available from this circuit whenever the generator set is running. A fused 20 amp 24 VDC power supply circuit will be provided. DC power will be available from this circuit at all times from the engine starting/control batteries.

A.9.11.3 Monitoring Equipment

A.9.11.3.1 Water Level Monitors

A stilling well with a level transmitter provides analog water level data of the C-111 Canal. The water level transmitters provide a proportional 4–20 ma signal. The stilling well level transmitters are normally continuously powered from a 120 VAC to 24 VDC power supply. Upon the loss of 120 VAC service, the RTU's "Pulse Analog Circuit" program will intermittently power and scan the analog water level transmitters. The canal stage monitor is housed in an in-bank stilling in accordance with SFWMD standards. The typical water level monitor is a linear potentiometer as manufactured by Water Log, Inc.

A.9.12 Telemetry Analysis and Design

A.9.12.1 Telemetry Network

The SFWMD's existing microwave telemetry system is used for the communication to the facility's monitoring control systems. The closest VHF communication hub is the SFWMD's Homestead field station. The station coordinates are: Lat 25° 37' 24.45" and Long 80° 18' 41.64".

A.9.12.2 Communications Equipment

A.9.12.2.1 Remote Terminal Unit

A RTU will be provided and installed that consists of devices and instrumentation to control the operation and to provide monitoring of the gates per plans and specifications. The RTU panel is modular in design and includes power supply, battery, radio, antenna, processor, I/O cards, relays, and surge protection. The RTU will include a Motorola ACE 3600 CPU supplied with 24 VDC power supply fed by the lighting panel with generator back up and include the following components:

- CPU Module,
- Digital Input Modules,
- Digital Output Module,
- Analog Input Module,
- Radio,
- Amplifier,
- Power Supply,
- Communication Interface Module, and
- Antenna.

The Motorola STS program will be installed to the new RTU to functionally test each input and output. Following the successful completion of the field tests, SFWMD personnel will furnish and install the control program and communication parameters necessary to integrate the site RTU.

The Remote Terminal Unit provides the following discrete outputs:

- Motor Start/Stop
- Gen Set Disable

The Remote Terminal Unit monitors the following discrete data points:

- Motors Alarms
- Motor Run Indication

The following instruments/discrete data points are directly connected to the ACE 3600 unit and will be transmitted to the SFWMD's SCADA system:

- Headwater Stilling Well Level
- Tailwater Stilling Well Level
- 24 VDC Power Supply Fail
- Commercial Power Fail
- Gen Set Run
- RTU Enclosure Tamper Switch

The digital radio/antenna final selection is based upon RF analysis performed by the SFWMD's Communications Network Analyst of the Infrastructure Systems Division. The antenna will be mounted on the SFWMD standard antenna pole. Appurtenances required for installation of the ACE 3600 CPU, radio, antenna, coaxial cable, coaxial connectors, terminal blocks, mounting hardware, etc. will be determined in the next phase of the design.

A.9.12.3 Operational Testing

All systems will be exercised through an operational test with simulation at the factory in order to demonstrate achievement of the specified performance. All primary element inputs will be simulated (inputs will be adjustable by switch, if discrete; by potentiometer or similar device, if analog). Primary outputs will be monitored via output devices (pilot lights, for discrete; a meter, a digital display (12-bit min. resolution) or other such analog devices for analog outputs.

A.9.12.3.1 Operational Readiness Test

Prior to start-up of the gate operating system, the entire instrumentation and control system will be inspected and tested to ensure it is ready for operation. The instrumentation and control system will be inspected for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis. All instruments and systems will be calibrated after installation, in conformance with the component manufacturer's recommendation. The tests will utilize the recommended test equipment to prove accuracy and/or performance. A loop sheet or calibration sheet for each loop and device with tested results will be provided.

A.10 HYDROLOGIC AND HYDRAULIC MODELING FOR ALTERNATIVE ANALYSIS (MODBRANCH)

A.10.1 Overview and Introduction

The MODBRANCH model was used as part of the C-111 Spreader Canal (C-111 SC) PIR1 study to estimate the environmental and flooding impacts of various planning conditions and alternatives.

For PIR1, five base conditions were used:

- Pre-Drainage (NSMMB),
- Existing Condition Base (ECB),
- Initial Operating Regime (IOR),
- Future without CERP (FwoCERP), and
- Pre-CERP Baseline (PCB1).

In addition to the base conditions, there were many preliminary configurations simulated. Analysis of these preliminary simulations resulted in a selection of six final alternatives. These were designated as Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D. The planning conditions and the final alternatives are described in more detail below.

A.10.2 Model Selection and Utilization

Because of the complex interaction between the Biscayne Aquifer and various drainage canals in the study area, simulations were done using the MODBRANCH model. MODBRANCH is a hybrid code that couples MODFLOW, a three-dimensional groundwater flow model with Branch, a one-dimensional canal routing model. The model code was originally developed by the United States Geological Survey (USGS). E. D. Swain and E. J. Wexler of the USGS coupled the models. More information on the creation of MODBRANCH may be found in "A Coupled Surface-Water and Ground-Water Flow Model for Simulation of Stream-Aquifer Interaction," (Swain and Wexler, USGS Open File Report 92-138). The U.S. Army Corps of Engineers further modified the model to more accurately represent the characteristics of the South Florida area.

FIGURE A-20 shows the model domain (blue line) superimposed on an aerial photograph of the area. Major canals are shown in red. This figure illustrates the complexity of the area. Land elevations vary from the high Atlantic Ridge to the low Everglades. Land use varies from urban to suburban to agricultural to wilderness.

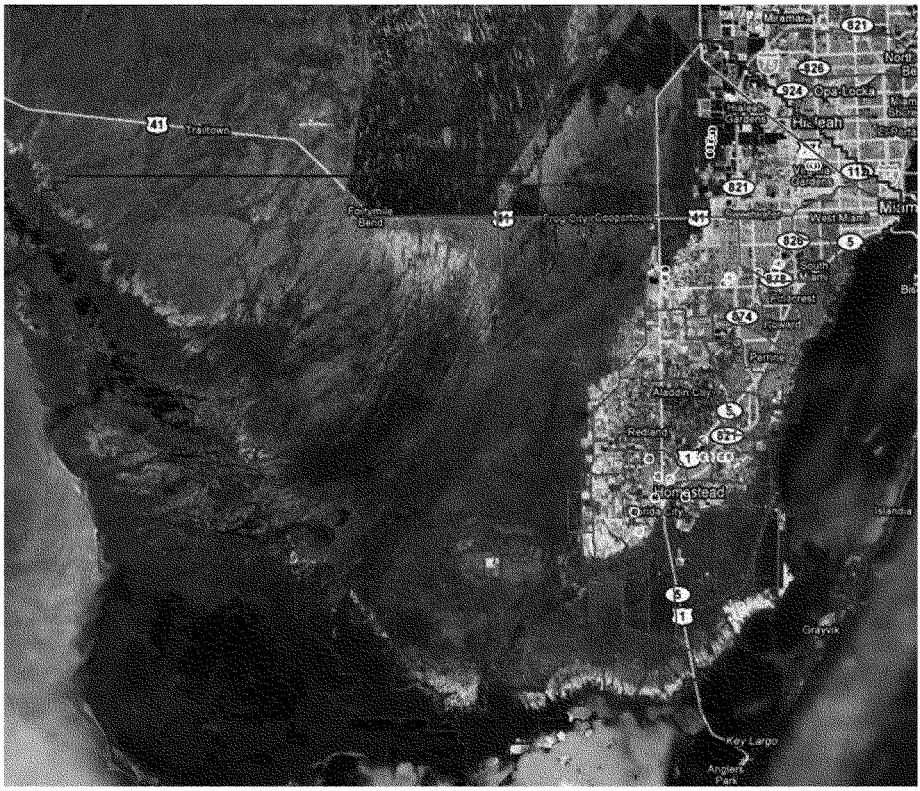


FIGURE A-20: MODBRANCH MODEL DOMAIN

Both, ground water and overland flow are simulated by the MODFLOW part of MODBRANCH. MODFLOW is a pseudo-three-dimensional, finite difference, ground water model (McDonald and Harbaugh, 1988). This model requires defining a model "grid" of specified numbers of rows, columns, and layers. The width of each row or column is determined by required resolution in specific areas.

The model grid is shown in ***FIGURE A-21*** with major canals superimposed. The model is bounded by the Biscayne Bay to the east; Florida Bay to the south; and, the Gulf of Mexico to the west. The northern boundary is roughly 2 miles north and parallel to the following canals: C-6, L-30, L-67C and L-29. The model grid is made up of 239 rows, 259 columns, and 5 layers. The grid resolution varies horizontally from a minimum of 207 feet to a maximum of 5000 feet. Levees are defined by using the horizontal flow barrier package of MODFLOW.

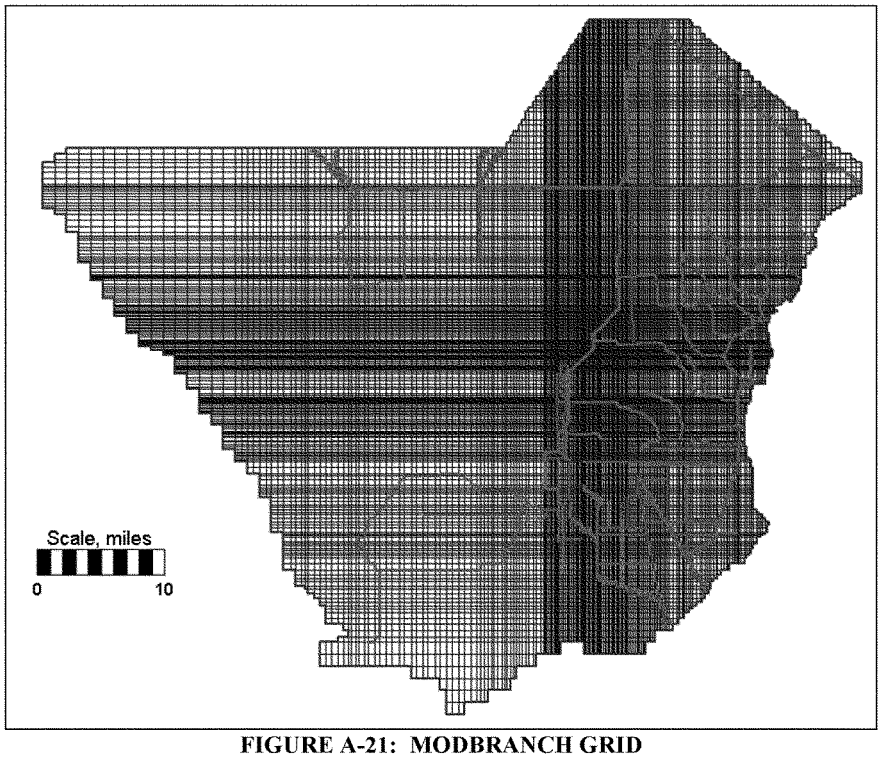


FIGURE A-21: MODBRANCH GRID

The primary aquifers in the study area are the Biscayne and the Gray Limestone aquifers. The Biscayne aquifer is the dominant feature in the eastern part of the model while the Gray Limestone aquifer is the dominant feature of the west. Other hydrogeologic layers include the Gray Limestone confining unit and the surficial sediments (peat, muck, caprock, fine sand, marl, and marsh sediments).

A.10.2.1 Model Calibration and Verification

Model Development and Calibration

The U.S. Army Corps of Engineers, Jacksonville District, made additional model refinements and extended the model domain which was used in previous studies. Further information on the model development and the calibration can be found in "Calibration and Verification of the MODBRANCH (MB_2006) Numerical Model of South Florida" (Robert A. Evans, July 2007).

A.10.2.1.1 Model Inputs and Assumptions

A large amount of data is required to construct any numerical model. For the MODBRANCH model the input data and the assumptions are critical. For this study the required input data included topography, hydrogeology, rainfall, evapotranspiration, water sources, water sinks and behavior of various canal structures.

Topography

The topography used in this model was produced from a variety of sources (***FIGURE A-22***) which include LIDAR ("Light Detection and Ranging") data collected for the C-111, the CSOP, the WPA projects and USGS Helicopter data. The data collected were processed and the USACE Jacksonville GIS staff created a 100 foot topographic model of south Florida. This data set was sampled to a 200 foot model prior to being used to create the MB_2006 topographic data. Major roads, canals and levees were digitally removed from the data sets. Using the 200 foot model, a median value of land elevation for each MB_2006 cell was calculated and assigned to the cell. ***FIGURE A-22*** shows the domain of each data source. ***FIGURE A-23*** shows the topography within the model domain.

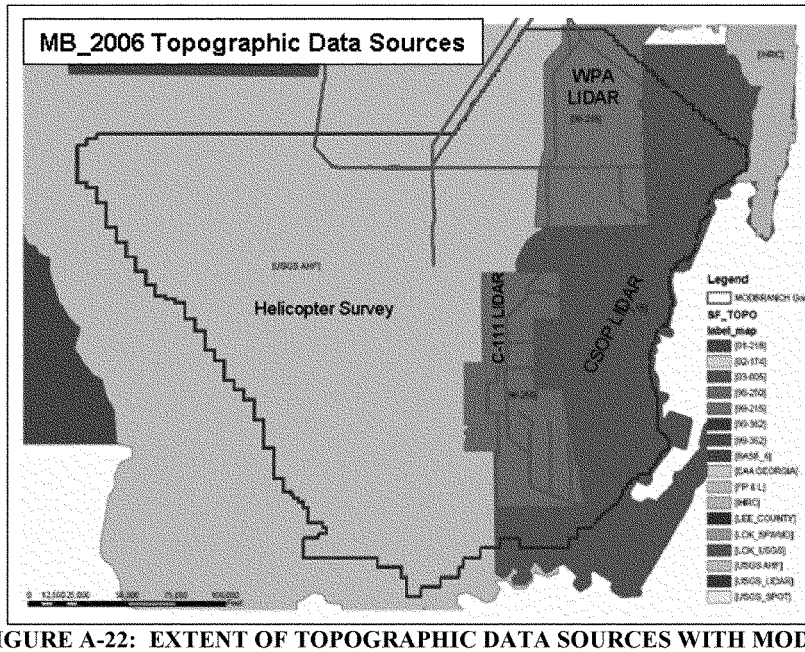


FIGURE A-22: EXTENT OF TOPOGRAPHIC DATA SOURCES WITH MODEL DOMAIN

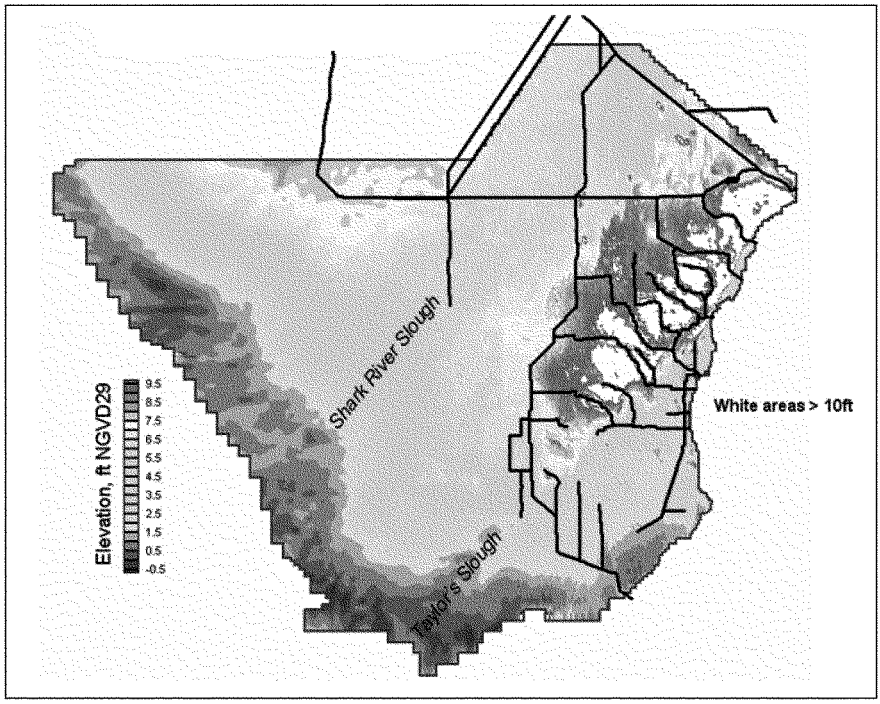


FIGURE A-23: MODBRANCH TOPOGRAPHY

Hydrogeology

The hydrogeology of the study area has been studied extensively by many investigators. The study area is underlain by the porous Biscayne Aquifer, which is part of the Surficial Aquifer system. The location and extent of the Surficial Aquifer system was defined by the Florida Geologic Survey based on recommendations of the Southeastern Geological Society in 1986. It consists of undifferentiated sand and gravel or marine limestone. In this case, the marine limestone of primary importance is the Biscayne Aquifer. The Biscayne Aquifer, of Pleistocene age, is the main potable aquifer in South Florida. It covers an area of approximately 4,000 square miles including all of Dade County (Randazzo & Jones, 1997). The Biscayne Aquifer consists of beds of highly permeable limestone and sandy-limestone of marine origin. The bottom of the Biscayne Aquifer is characterized by an abrupt change in sediment type where clays and marls of the Tamiami Formation or Hawthorn Formation are present. The Biscayne Aquifer is mostly an unconfined aquifer, although segments may exhibit semi-confined conditions initially. In general, the Biscayne Aquifer is

well connected to surface water features including the various drainage canals that are located in the study area.

The MODBRANCH model utilizes five layers to define the hydrogeology of the study area. The top layer of the grid is used to simulate free surface, overland flow. As such, it is defined with a bottom elevation that is set at ground surface.

The stratigraphic sequence of aquifers varies throughout the model and is not uniform. There are "lenses" and "pinch-out" zones that are not known, but are obviously present. In order to build MODFLOW input files that described the layering certain assumptions had to be made. The domain was divided into five regions (***FIGURE A-24***). The layers of each region were defined differently and are listed in ***TABLE A-41***.

Note that the first layer is designated as "overland flow." This indicates that this layer uses modified Kadlec equation to simulate flow. Layer two is specified as "surficial sediments."

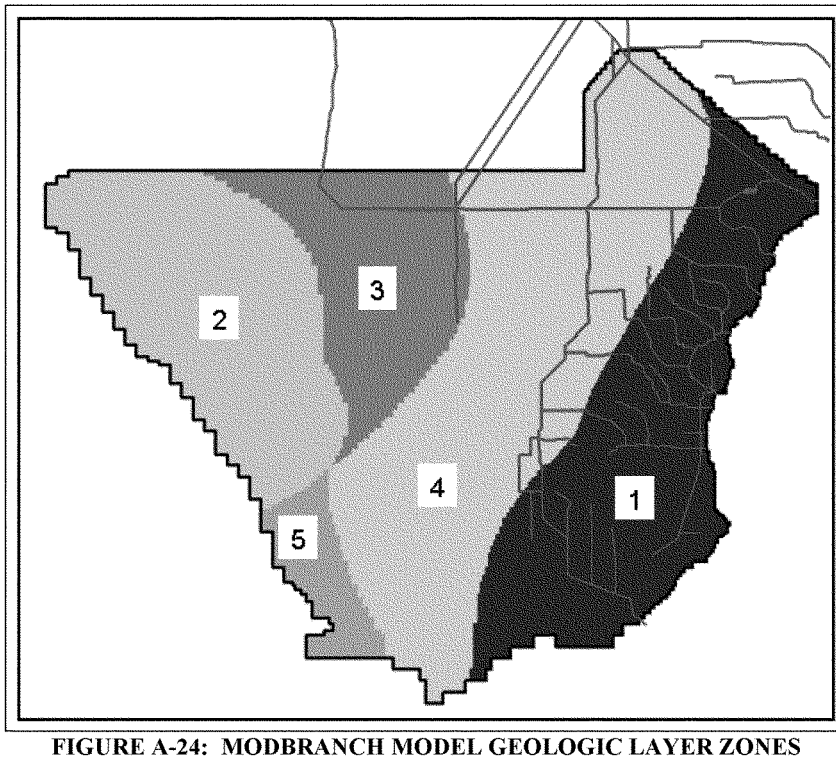


FIGURE A-24: MODBRANCH MODEL GEOLOGIC LAYER ZONES

TABLE A-41: SEQUENCE BY ZONE

Sequence #	*Direction of increasing depth* →				
	Layer 1	**Layer 2**	**Layer 3**	**Layer 4**	**Layer 5**
1	Overland Flow	Surficial Sediments	Biscayne Aquifer		Lower Clastics of Tamiami
2			Gray Limestone		
3			Gray Limestone Confining Unit	Gray Limestone	
4			Biscayne Aquifer	Gray Limestone Confining Unit	Gray Limestone
5			Biscayne Aquifer		Gray Limestone

Rainfall, Recharge and Evapotranspiration

The rainfall inputs were obtained directly from the SFWMM 2x2 inputs. The maximum potential ET was defined on a daily basis by using the same data the SFWMD uses for the SFWMM2x2. ***FIGURE A-25***, ***FIGURE A-26***, and ***FIGURE A-27*** show the monthly total PET values at each of the nine locations for the average (1978), dry (1989) and wet (1995) years, respectively. ***FIGURE A-28*** shows a triangulated irregular network (TIN) with the vertices located at points with daily PET values. The MODBRANCH cells within each triangle were assigned daily PET values based on the equation of a plane through the three vertices.

Based on assigned extinction depths, rainfall and ET, net water flow into or out of the model is calculated. This water provides one of the driving forces in the model.

The application of both the rainfall and the ET can dramatically affect the ground water head fluctuations on both a day to day and long term basis. The values and approach used in this study were the best available at the time. The actual aerial variation over time of both ET and rainfall is not known and the amount of error induced by this lack of information is not known.

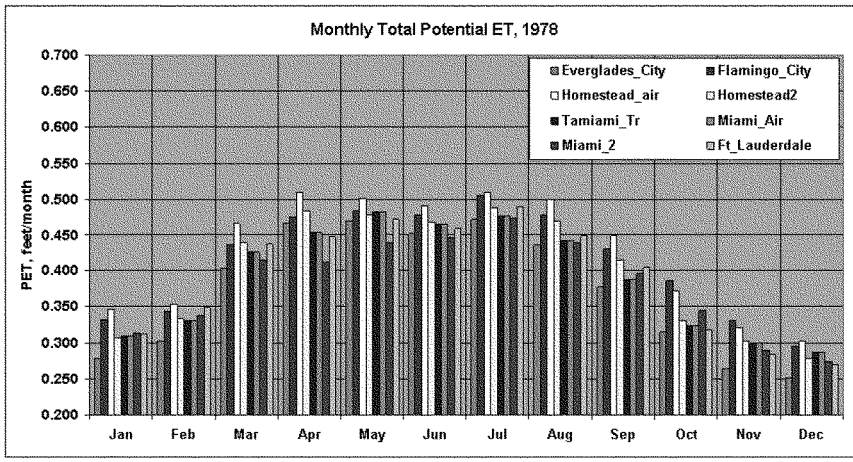


FIGURE A-25: MONTHLY TOTAL POTENTIAL EVAPOTRANSPIRATION, 1978

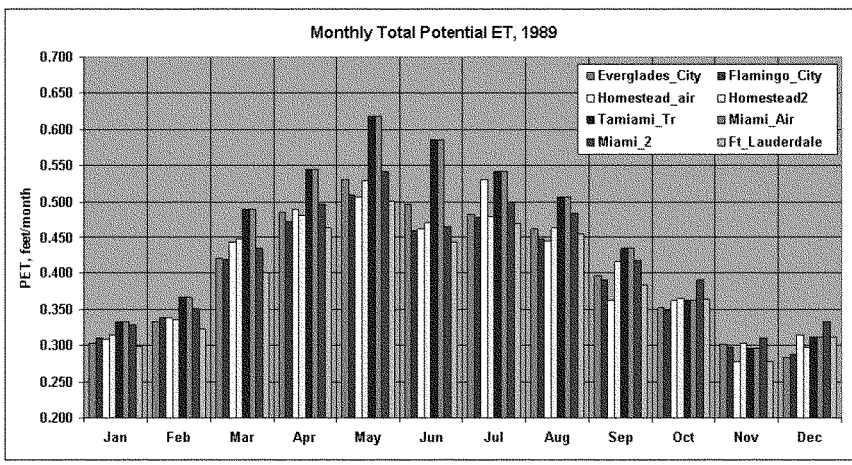


FIGURE A-26: MONTHLY TOTAL POTENTIAL EVAPOTRANSPIRATION, 1989

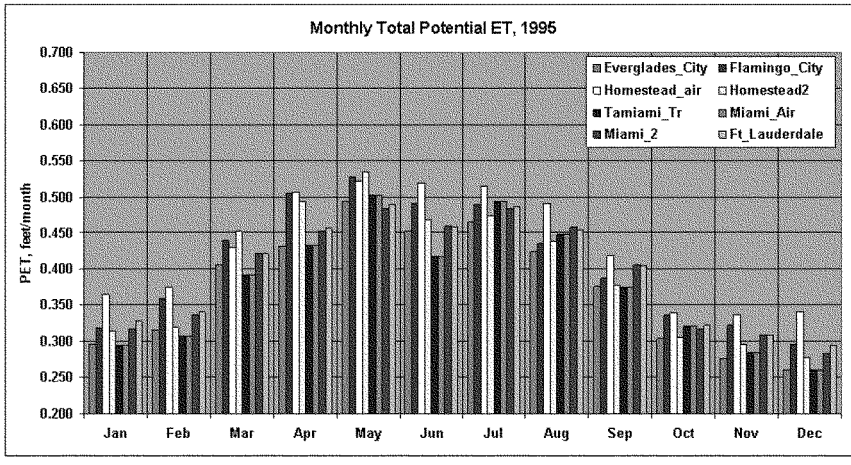


FIGURE A-27: MONTHLY TOTAL POTENTIAL EVAPOTRANSPIRATION, 1995

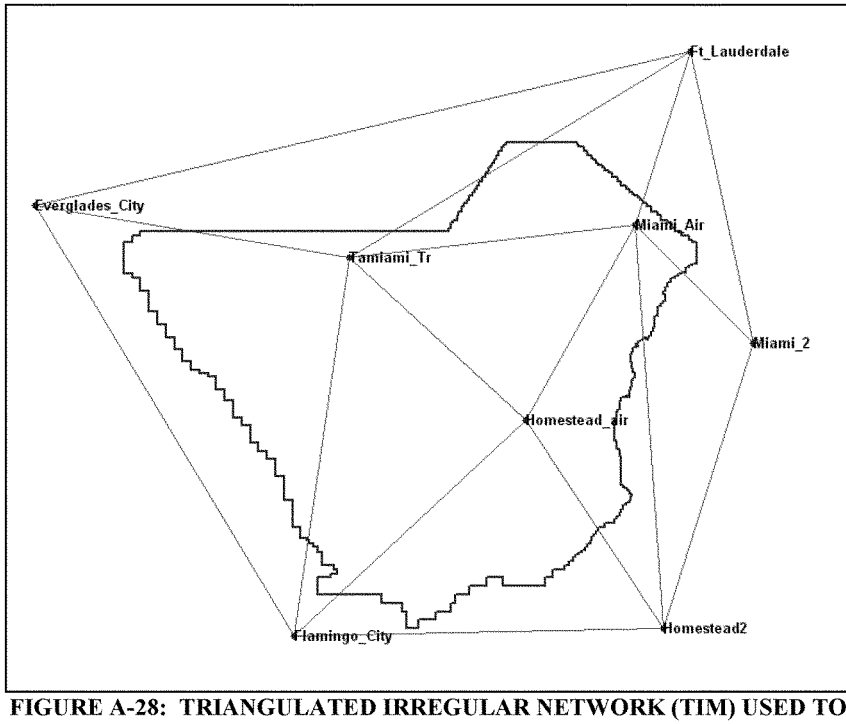


FIGURE A-28: TRIANGULATED IRREGULAR NETWORK (TIM) USED TO ESTIMATE PET

Water Sources and Sinks

Important aspects of any model are the various boundary conditions. The boundaries represent sources or sinks for groundwater and surface water. Various types of boundary conditions can be used with MODBRANCH. For the purposes of this study variable head boundaries were applied along the northern edge of the model boundary, while the eastern, western and southern boundaries utilized values representing the daily mean tide elevation. The data utilized to assign the boundaries on the northern model edges were imported from the SFWMM 2X2 model and interpolated to the model grid. The variable tidal heads assigned along the coastal side of the model were defined at a constant 0.5 feet. Additional boundary inputs include the flow and stage in various canals (discussed below) and the location of municipal water wells. Further information of the development of various boundaries for the model is available in the MODBRANCH model Calibration report (Evans, 2007).

A.10.2.1.2 Model Uncertainty

All numerical model studies have limitations. Many of these are related to the specific computer code chosen for a particular study. Other limitations are related to the field data that is available or lack thereof. Lastly, model studies are also limited by the schedule dictated by project requirements. All of these limitations impart various sources of error or limit the evaluation to an appropriate level of detail. This model study does have limitations and should be used with caution.

A brief discussion of the limitations of this model study is included in the following paragraphs.

Rainfall boundary conditions

Rainfall is an important parameter, especially in the region of south Florida. The amount and timing of rainfall greatly affects the increase or decrease in stage (ground water and canal) and flows within the system. The rainfall boundary conditions used for this study were the same that are used as inputs for the SFWMM 2x2, as mentioned above. The spatial resolution of the data is 2 miles x 2 miles and the temporal resolution is 1 day. The MODBRANCH model could potentially give better results if finer resolution rainfall information were available. The fine data resolution is especially important for simulating ground water stages. Unfortunately, these data are not presently available. Future studies could include rainfall derived from NEXRAD or other methods, which would give rainfall at fine resolutions in both temporal and spatial terms.

Evapotranspiration boundary conditions

The total yearly evapotranspiration can equal or exceed the total rainfall for average and dry years, which means that evapotranspiration is an equally important boundary condition.

Variable head boundary conditions

The variable head boundaries, as mentioned above, were generated as a hybrid of SFWMM 2x2 output and tide data. Future model accuracy could be improved by using more observation wells and eliminating the inherent error found in using model output and harmonic tide data as boundary conditions.

Geologic parameters

South Florida's geology is extremely heterogeneous. Measurements and tests performed at one location can give distinctly different values when done 500 feet away. It is important to keep this in mind when considering the model results. The model considers the hydrogeologic parameters to be homogenous within each grid cell. While hydraulic conductivity and transmissivity vary from cell to cell, each is isotropic within the cell. Additionally, the parameters do not vary significantly between adjacent cells, increasing the degree of homogeneity of the model. The real world is not homogenous. There are indications that there are preferential flow paths within the surficial aquifer including voids, fractures and cavities. These preferential flow paths are not represented by the model inputs.

Canal leakance and hydraulic parameters

The canal leakance and other hydraulic parameters, which affect canal stage and flow, include Manning's n (roughness) and momentum coefficient. Nominal values of each were used throughout the study.

Structure operations and implementation

The effect of how the structures are operated and how they are numerically implemented is discussed in the numerical simulation report. Future refinement of structure operation routines, especially in opening and closing could result in better replication of field stages and flows.

Topography

The topography used (as stated above) is a composite derived from a variety of data sources. The accuracy of these data (some areas have exceeding 1.5 ft) can significantly affect both the results of the MODBRANCH model and the

interpretation of the results. The model results can be affected by slight variations in elevations, since this would change the local land slope. A small change in topography could cause a significant change in flow direction due to the small water gradients found in the area. All elevation data used are referenced to NGVD29.

A.10.2.2 Base and Alternative Simulations

A.10.2.2.1 Base Configurations

There were five base model configurations simulated. These were:

- Pre-Drainage (NSMMB),
- Existing Condition Base (ECB),
- Initial Operating Regime (IOR),
- Future without CERP (FwoCERP), and
- Pre-CERP Baseline (PCB1).

The pre-drainage condition is representative of the time before canals, levees, and roads were built within the model domain. The Pre-Drainage simulation is commonly referred to as the NSM condition. However, this is confusing to some people who are used to using the term "NSM" for the SFWMD "Natural Systems Model." In fact, this version of MODBRANCH does use the SFWMD NSM model for boundary conditions (version used is NSM4.6F). The Pre-Drainage model uses the same MODBRANCH domain and inputs with the exception of the branches and rules files and some of the parameter files that are affected by land use (ET parameters and overland flow parameters).

The Pre-Drainage results are used as a target for a number of the performance measures. The most significant exceptions are the CSSS PMs; under the NSM or Pre-drainage conditions, the CSSS would not do well.

FIGURE A-29 shows the configuration of the Existing Condition Base (ECB). ECB includes pumps S332B and S332C which put water into the C-111 detention areas (see zoom in). In addition, there are various detention areas and flow ways created out of the Frog Pond area. The structure operations are defined by the "Interim Operating Plan" (IOP), which was put into place to help protect the endangered Cape Sable seaside sparrow.

Boundary data is extracted from the SFWMD 2x2 model known as: ECB2.0_2006-2007_WMM5.6.4_LO_0613089. In addition, a number of structures are operated to match the 2x2 flows. These structures are: S-333, S-334, S-343a, S-343b, and S-335.

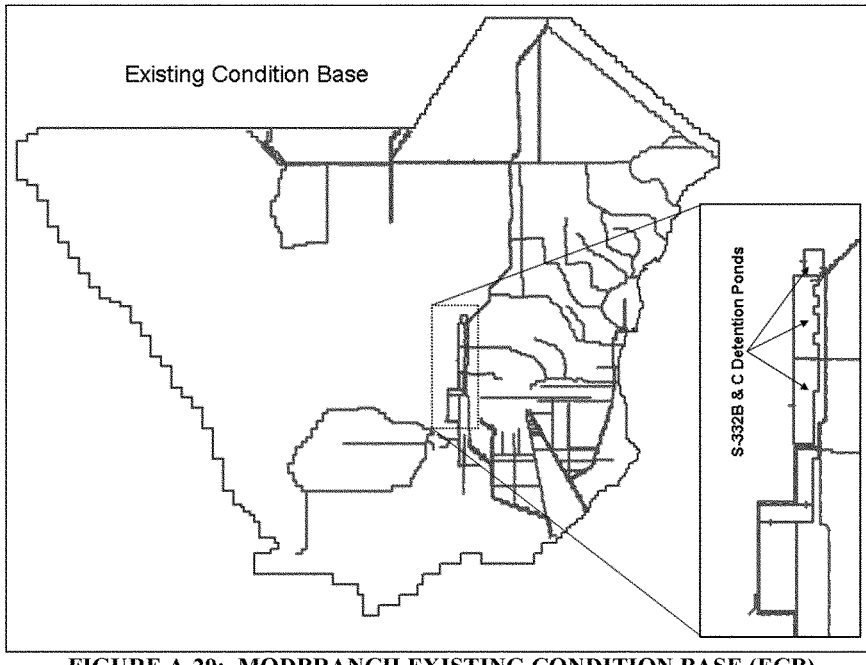


FIGURE A-29: MODBRANCH EXISTING CONDITION BASE (ECB) CONFIGURATION

The Initial Operating Regime (IOR) configuration is similar to the ECB configuration but there are changes in the Frog Pond area. ***FIGURE A-30*** shows the configuration differences between the ECB and the IOR. Boundary conditions for the IOR simulations are extracted from the SFWMD 2x2 simulation of IORBs2.0_WMM5.6.4_LO_0613089. Operational rules for S-333, S-334, S-343a, S-343b, and S-335 are based on the 2x2 flows.

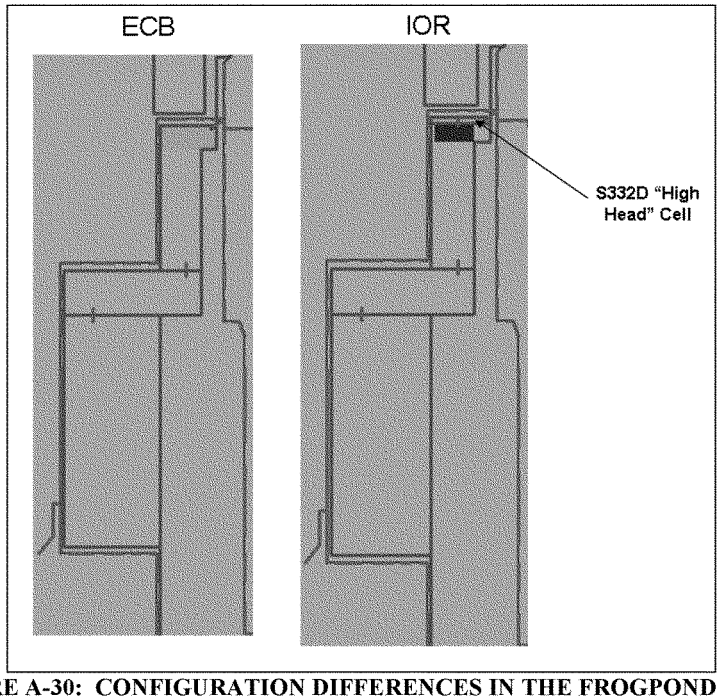


FIGURE A-30: CONFIGURATION DIFFERENCES IN THE FROGPOND AREA, ECB AND IOR

The Future without CERP (FwoCERP) is an attempt to define the system as it would be in 2050 without CERP projects. ***FIGURE A-31*** shows some of the details in the project area. Model input changes are made reflecting predicted land use, well pumpage and stages. These changes affect the hydraulic conductivity (overland flow), the ET parameters, and the production wells. The rule files are changed slightly depending on the structures rules that are based on flows. The horizontal flow barrier (HFB) files are changed to reflect that culverts will be installed along US-1; these are represented as gaps in the barriers that represent US-1. In addition, L31W is backfilled from the upper end to S-175; below the S-175 structure the canal is plugged. Both S-175 and S-332 are removed.

The stage and canal boundary conditions are obtained from the SFWMM2x2 2050B3_NORD0_WMM5.4.3_053105 simulation.

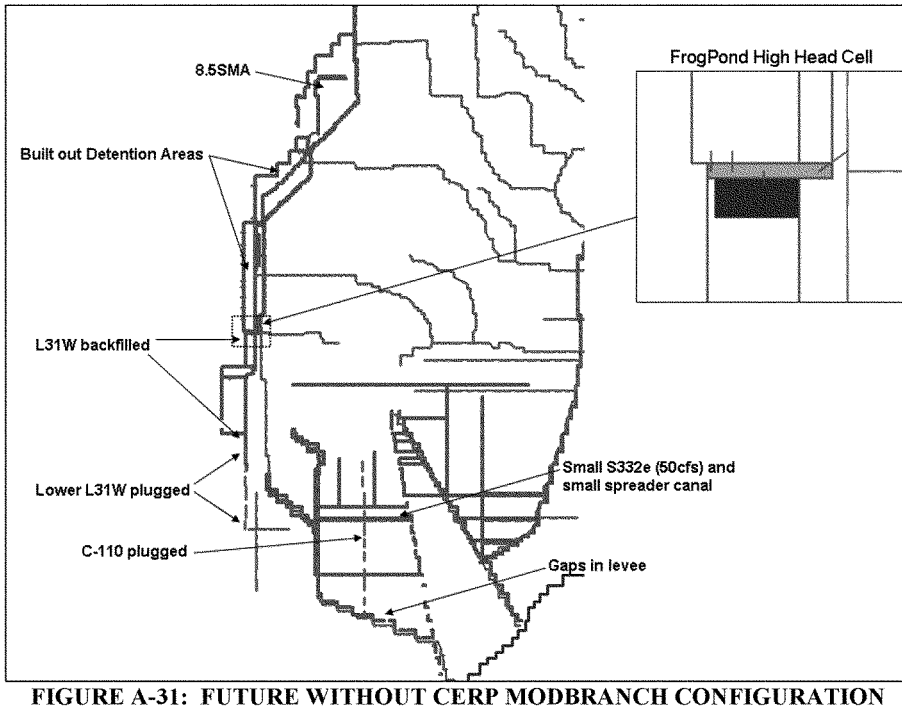


FIGURE A-31: FUTURE WITHOUT CERP MODBRANCH CONFIGURATION

The pre-CERP baseline (PCB1) is defined by the hydrologic conditions on the date of enactment of WRDA 2000. The operations are based on the 2000 ISOP v5.4 rules. The boundary conditions are based on the PCB1_V5.4.2_111604 SFWMM 2x2 simulation. The PCB1 configuration is shown in ***FIGURE A-32***. Note that there is only a small detention pond (S332B) and that L31W is not backfilled.

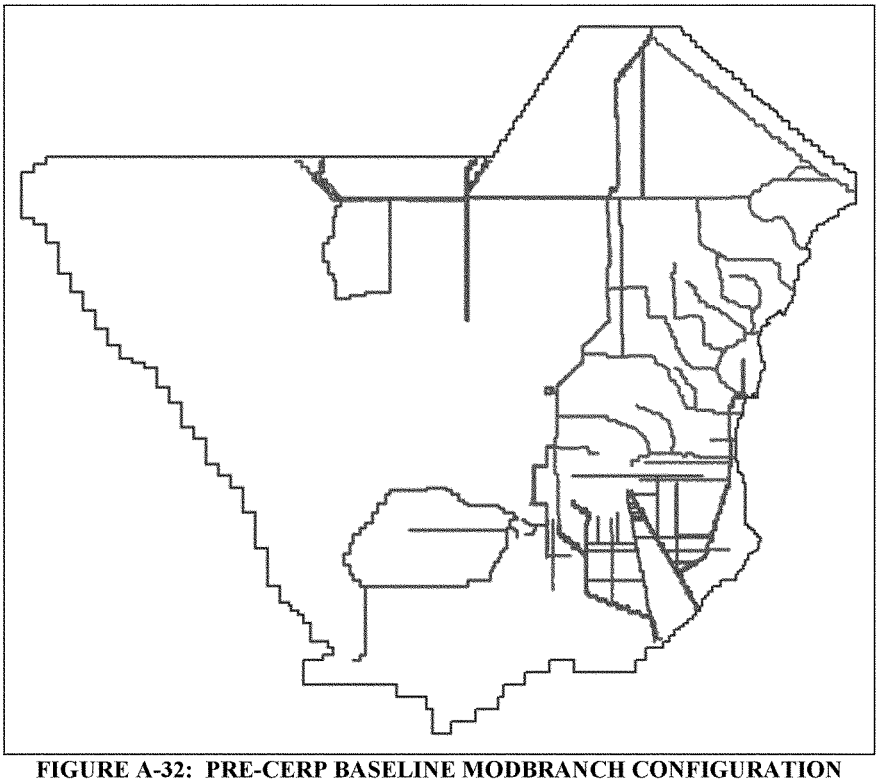


FIGURE A-32: PRE-CERP BASELINE MODBRANCH CONFIGURATION

A.10.2.2.2 Alternative Configurations

Six final alternatives were selected for in-depth analysis under PIR1. These were designated as Alternatives 1C, 1D, 2Dshort, 2Dlong, 3D, and 6D. Each was simulated for the wet, dry and average years (1995, 1989, and 1978, respectively). A short description of the test alternatives is given here for informational purposes

Formulation and evaluation of the alternatives requires that the base is the FwoCERP configuration. However, savings clause analyses require using the ECB configuration. In both cases, the only changes to the base configuration, rules or boundary conditions are due to the specific modifications required for each alternative.

Alternatives 1C, 1D, 2D (short and long), and 3D will include a new pump station (S-200) to be constructed downstream of S-176. When triggered by

increased stages between S-176 and S-177, the pump station will route water to a 510-acre (exterior dimension) (~560-acres in MODBRANCH model) above-ground impoundment Frog Pond Detention Area, (FPDA) which will be constructed within the southern portion of the South Florida Water Management District (SFWMD)-owned Frog Pond lands. The MODBRANCH configuration of the FPDA is shown in ***FIGURE A-33***.

For Alternatives 1C, and 1D, the pump station will include three 150 CFS pumps, at total of 450 CFS. For alternatives 2D (short and long) and 3D, the pump station will include three 75 CFS pumps, a total of 225 CFS.

For all the aforementioned alternatives, the pumps will be modeled to pump sequentially at elevations at or above 3.8', 3.9', and 4.0' (all ref NGVD). For all the aforementioned alternatives, pumping will be discontinued if the water elevation within the southernmost header canal exceeds two and a half feet above the local GSE (ground elevation 5.2' NGVD). Pumping at S-200 will also cease if the water depth at a point (***FIGURE A-34***) within the CSSS area C/U2 exceeds a depth of ten centimeters during the critical portion of the CSSS nesting season (February 1st thru July 15th). The model ground elevation at that point is 5.6' NGVD; the "off" trigger is then 5.93' NGVD.

The western portion of the FPDA will consist of a header canal with cascading water levels maintained by a series of internal weirs. As modeled, two 80' long east-west weirs are at 1/3 points along the length of the header canal. The weir elevations will be 0.5' above adjacent existing grades (ground el. 5.71' NGVD and 5.23' NGVD, respectively). Just upstream of the header weirs, and just upstream of the southern levee of the southern detention area cell, 80' long header overflow weirs will be modeled at elevations 1.2' above adjacent existing grades (ground el. 5.71' NGVD, 5.23' NGVD, and 4.8' NGVD, respectively). The conveyance from pump station S-200 to the header cell will be modeled as a fully lined channel. This minimizes the leakage between the channel and the aquifer; it is not possible in the model to have an "above ground" channel.

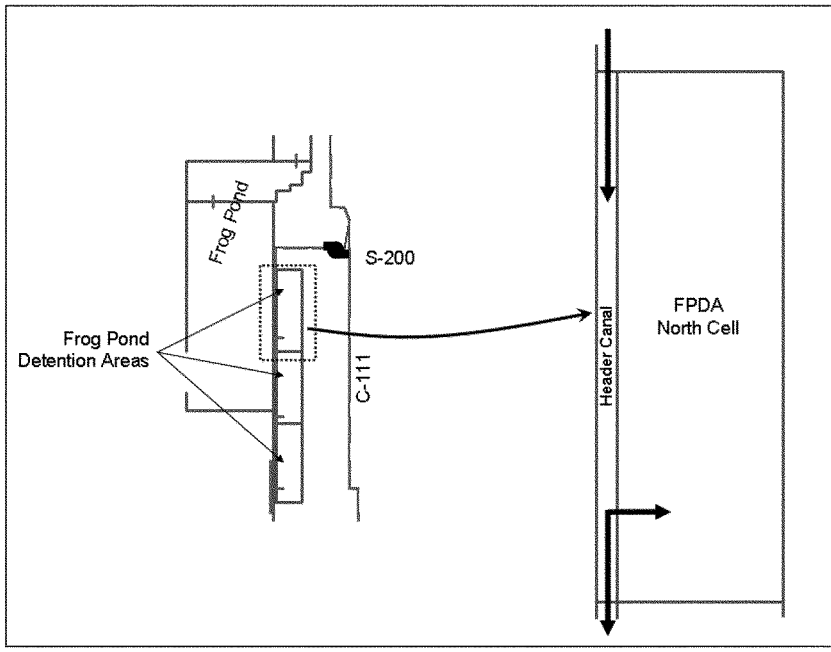


FIGURE A-33: DETAIL OF FROG POND DETENTION AREA

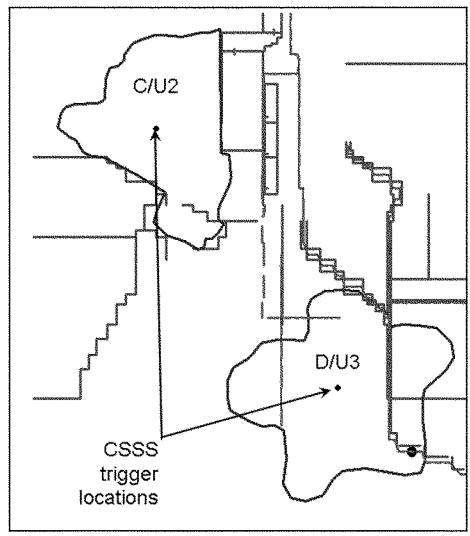


FIGURE A-34: LOCATION OF CAPE SABLE SEASIDE SPARROW TRIGGER LOCATIONS

Note that all the "D" alternatives have three features in common, shown in ***FIGURE A-35***. These features are S-198, a plug in L31E near S-20a, and operational changes to S-20.

The S-198 structure will be constructed in the C-111 Canal just upstream of the C-110 Canal. The operable "S-197 like" structure is intended to reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction. From a modeling perspective, the structure will be modeled exactly the same as S-197. A permanent plug will be installed within the L-31E just upstream of S-20A. From a modeling perspective, the plug will be a structure that is always closed and never passes any water.

S-20 normal operation is divided into wet and dry periods. During the dry period (15 October to 15 April) a maximum flow of 450 CFS is passed when the headwater is greater than 1.4' NGVD and up to 750 CFS when it is greater than 1.9' NGVD. During the wet period (15 April to October 14) a maximum flow of 450 CFS is passed when the headwater is greater than 2.4' NGVD and up to 750 CFS when it is greater than 2.9' NGVD. For all "D" alternatives, the open and close triggers were raised 0.5'.

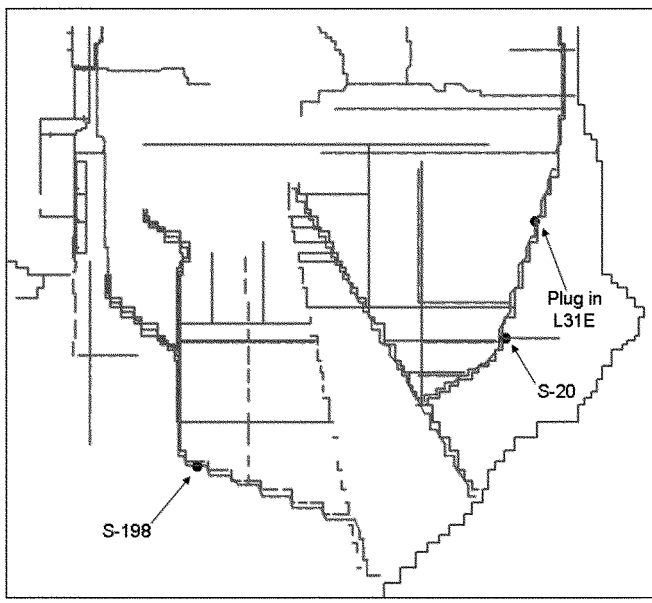


FIGURE A-35: "D" FEATURES: S-198, L31E "PLUG", AND S-20 OPERATIONAL CHANGES

Alternatives 2D Short and 2D Long differ in the extent of the Aerojet Canal that is utilized. ***FIGURE A-36*** shows the difference between the alternatives.

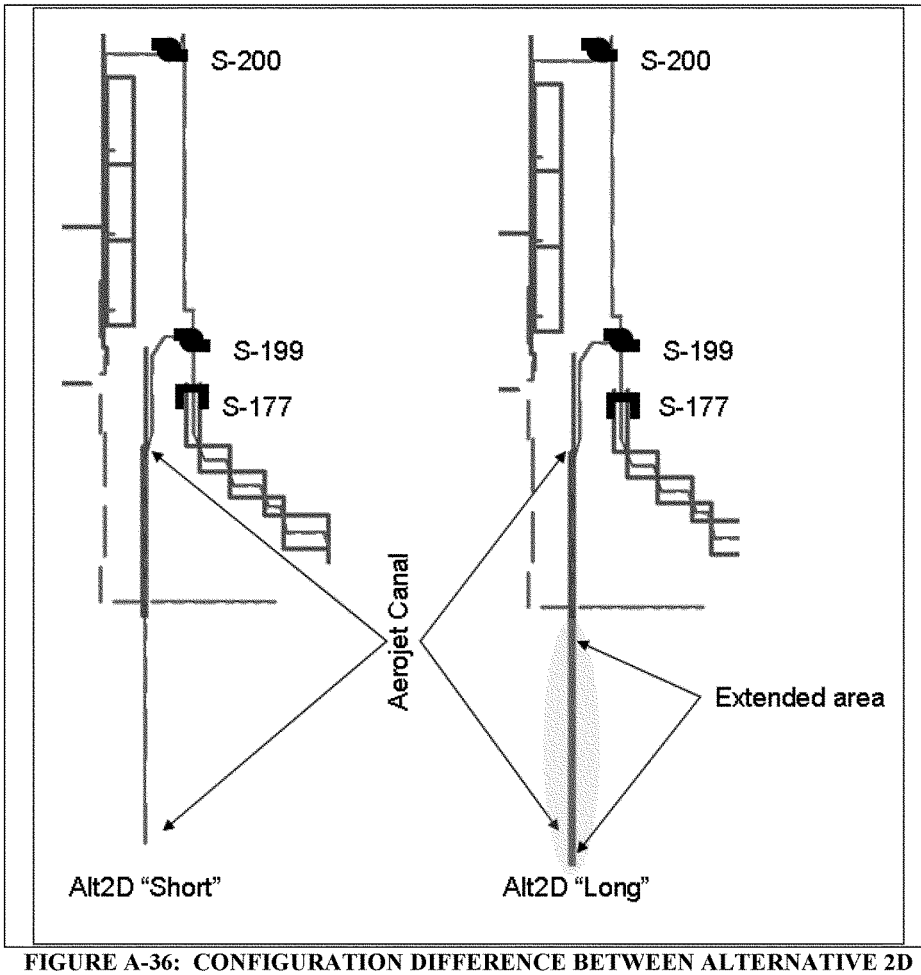


FIGURE A-36: CONFIGURATION DIFFERENCE BETWEEN ALTERNATIVE 2D "SHORT" AND 2D "LONG"

The Aerojet Road Canal begins approximately one mile south of Ingraham Highway (SR 9336). Although the canal spans a distance of approximately 4.8 miles, the canal is effectively plugged at six areas described as existing plugs 1-6 on SFWMD's Figure 4-6 dated 11/19/08. Plugs 1-6 will be modeled as earthen

plugs (with crest elevations matching adjacent existing grades). Since the ground elevations vary elevations used to determine operations will be interpolated from a linear fit to the local elevations (*FIGURE A-37*).

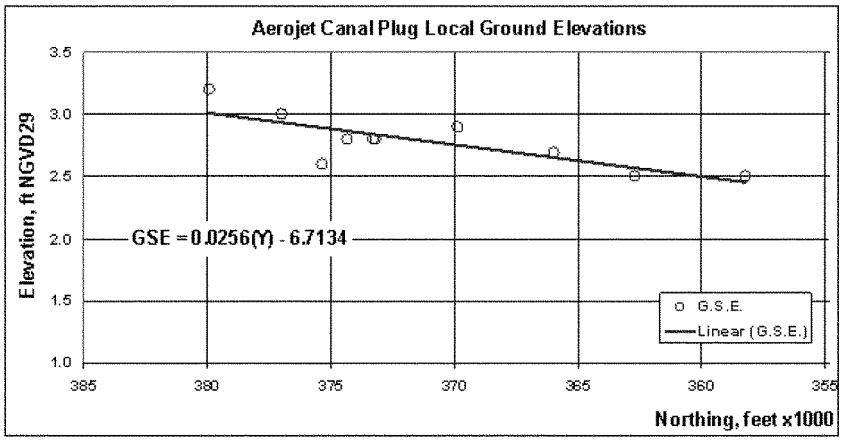


FIGURE A-37: LINEAR FIT TO GROUND ELEVATIONS ALONG AEROJET CANAL

FIGURE A-38 shows the locations of both the existing and proposed plugs for the alternatives 2D Short, 2D Long and 3D.

In Alternative 2D Short, three new plugs will be inserted; one ("proposed 3") is within the main Aerojet Canal and two ("proposed 2" and "proposed 4") are in the east-west borrow canal). The proposed 3, and existing 6, 5, and 4, will be modeled as weirs with crest elevations 1' below adjacent existing grades (ground elevations are 2.8, 2.87, 2.84, and 2.82 ft. NGVD, respectively). The proposed plug 2 will be closed always due to the fact that the berm will be crossing this canal; proposed plug 4 will be set at local ground elevation, 3.2' NGVD. From a modeling perspective, water in either of the Alternative 2D's will not overtop the berm that surrounds the Aerojet Canal.

In Alternative 2D long new plugs will be constructed at the locations described as Proposed 1 and 3 (on the same figure), and the new plugs, and existing 6, 5, 4, 3, and 2 will all be modeled as weirs with crest elevations 1' below adjacent existing grades (ground elevations 2.5, 2.8, 2.87, 2.84, 2.82, 2.8, and 2.73 ft NGVD, respectively). Both alternatives 2D Short and 2D Long will also receive the plugs in the east-west borrow canal described as proposed 2 and 4. Proposed

plug 2 is closed always due to the berm passing over it. Proposed plug 4 will be modeled with crest elevations matching adjacent existing grades.

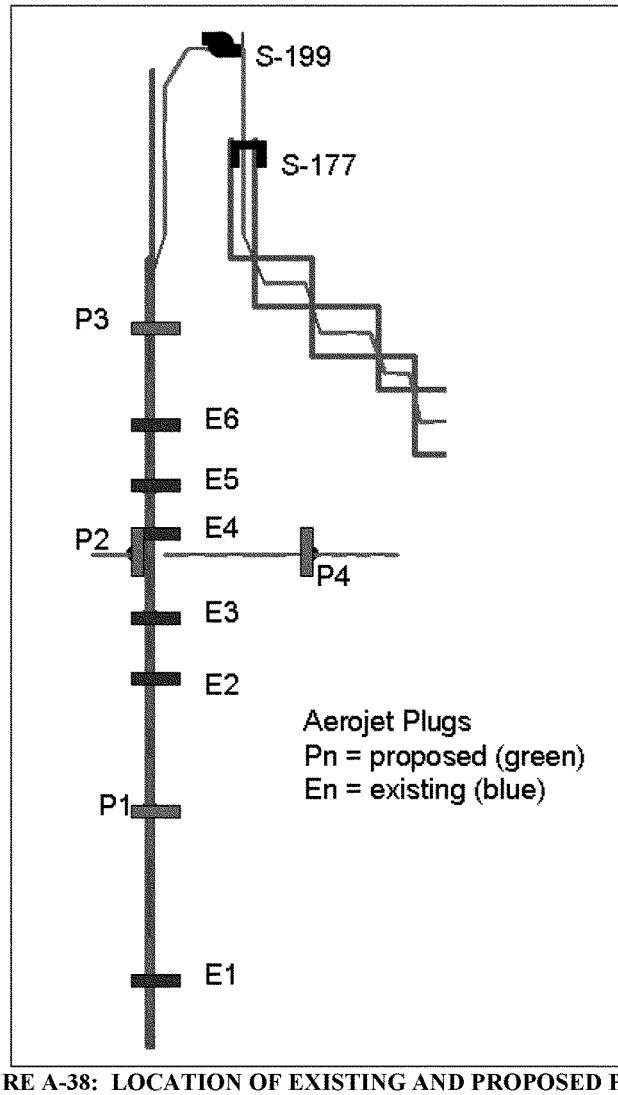


FIGURE A-38: LOCATION OF EXISTING AND PROPOSED PLUGS, MODBRANCH CONFIGURATION

Alternative 3D is similar to Alternative 2D Short except water is not put into the Aerojet Canal, but is put into a reservoir (designated as the "Aerojet Reservoir") (***FIGURE A-39***). In alternative 3D, existing plugs 6, 5, and 4 (***FIGURE A-38***) will be removed and 75 cfs pump station will be installed to collect seepage from the adjacent detention area to the west. The pump station will feature three 25 cfs pump stations which incrementally turn on at Aerojet Canal elevations above 2.5, 2.6 and 2.7 ft NGVD.

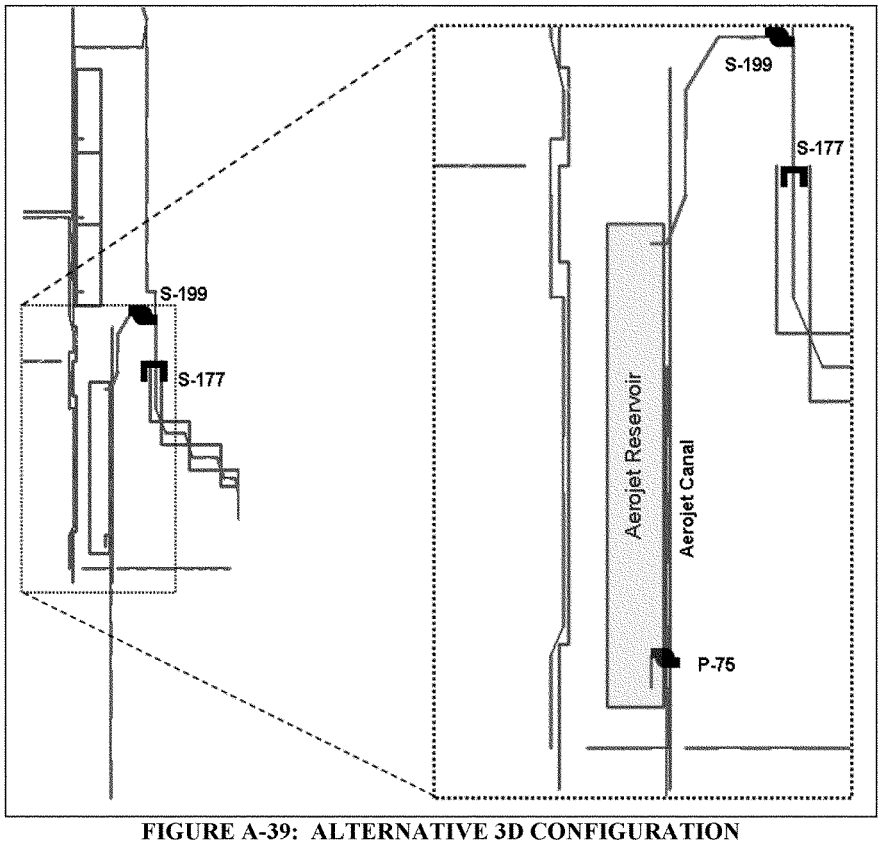


FIGURE A-39: ALTERNATIVE 3D CONFIGURATION

Alternative 6D includes the "D" options (S-20, S198, and the plug near S-20A) and an approximately 10 mile long, fully penetrating barrier. This barrier runs from the top of the Frog Pond area south to the approximate latitude of S-18C (***FIGURE A-40***). It is just west of the Aerojet Canal.

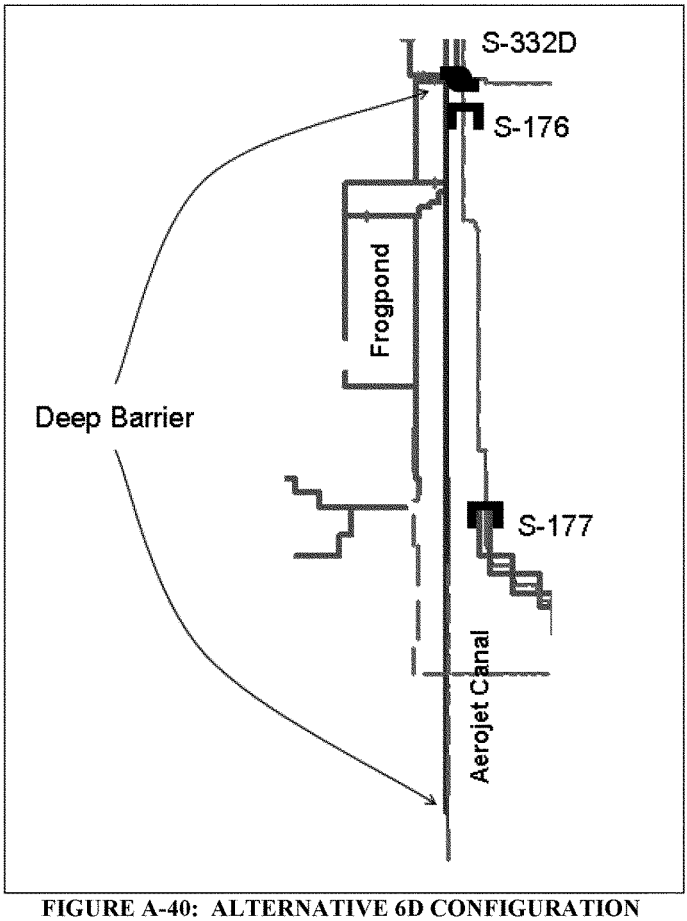


FIGURE A-40: ALTERNATIVE 6D CONFIGURATION BARRIER LOCATION IS IN BLUE

A.10.2.2.3 Performance Measures (PMs)

The MODBRANCH model outputs stage and flow for both 3D groundwater/ surface water and the 1D canal flow. Stage (ground water and canal) and flow (canal) values can be compared directly to field measurements to validate the model. These are representative of directly measured data and could be considered a "first-order PMs."

However, analysts in different disciplines require values that are derived functions of stage and/or flow and cannot always be directly measured. These values vary from flow rates/volumes across transects, hydroperiods, and various

"habitat units" which generally are "pure numbers" and are useful in relative comparisons between alternatives. A PM such as hydroperiod, which is dependent on a first order value (stage) and a constant (land elevation) can be considered more accurate than a PM computing salinity outside of the model domain by the use of regression equations. Although both PMs may be useful, the hydroperiod could be viewed as a 2nd order PM while the estimated salinity values would necessarily be higher order. In general, the more manipulation required to produce the performance measure, the less useful it will be.

A number of post-processing utilities have been created to convert the MODBRANCH output into "performance measures." These data sets were provided to the end users to evaluate the alternatives. The data were provided as Excel spreadsheets, text files of "comma-separated-values" (*.csv), short video files of stage and stage differences, and posted on interactive GIS web site.

A short discussion on the types of data provided follows; more detail on the analysis can be found by contacting the end users.

Spreadsheet File: MB_2006_C111SC_CSSS_drywet_data_2D.xls

This is a spreadsheet (***FIGURE A-41***) with data applicable to the Cape Sable seaside sparrow habitat. For each cell in the MODBRANCH model, the location, the row & column, the cell ground elevation, the size and the unit ID (U1, U2, U3, U4, and U5) are given (***FIGURE A-42***). The data presented here can be manipulated by the end users (USFWS) either in Excel or via a GIS package.

For each simulation the following information is presented:

Yearly Hydroperiod;
Maximum continuous dry period (1 March to 15 July);
Total number of dry days (1 March to 15 July); and,
Maximum continuous period that the depth > 20 cm (15 March to 30 June).

C111 Spreader Canal PM E.C. 3.3 Cape Sable Seaside Sparrow Nesting Condition
Longest dry period & number of dry days (1 March to 15 July)
Yearly Hydroperiod and Maximum Period depth > 20cm (15 March to 30 June)

X	Y	Row	Column	Ground Elevation (ft)	Area (acres)	CSSS Habitats (Units 1-5)	NSM_1978				NSM_1989			
							Hydroperiod	Max Dry Period (days)	Total Number of Dry Days	Max Period (days) Depth > 20cm	Hydroperiod	Max Dry Period (days)	Total Number of Dry Days	Max Period (days) Depth > 20cm
585500	529131.6	33	1	0.7	207.5	na	0	136	136	0	0	136	136	0
585500	527113.8	34	1	0.9	255.7	na	0	136	136	0	0	136	136	0
585500	524725.1	35	1	0.7	292.6	na	0	136	136	0	0	136	136	0
585500	522225.1	36	1	0.8	281.3	na	0	136	136	0	0	136	136	0
585500	520663.4	37	1	1.2	77.2	na	0	136	136	0	0	136	136	0
585500	520041.6	38	1	1.2	65.5	na	0	136	136	0	0	136	136	0
585500	519376.2	39	1	1.2	87.2	na	0	136	136	0	0	136	136	0
585500	518569.3	40	1	1.1	98	na	0	136	136	0	0	136	136	0

FIGURE A-41: EXAMPLE OF POST-PROCESSED MODBRANCH DATA IN AN EXCEL SPREADSHEET

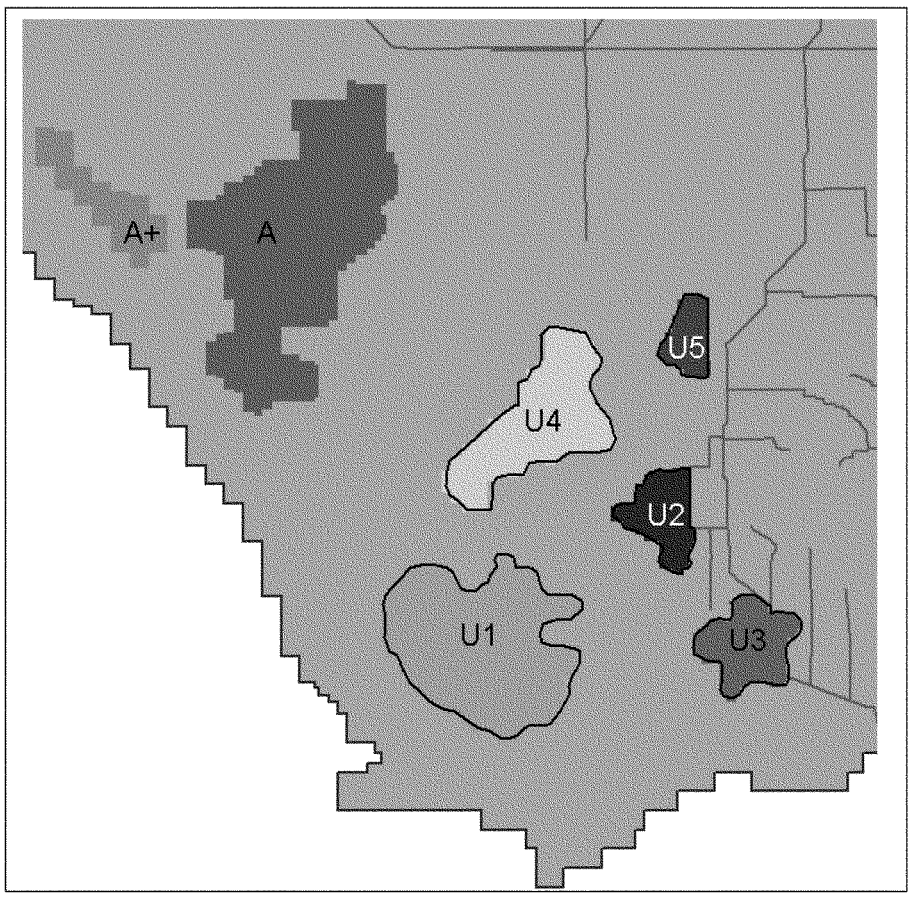


FIGURE A-42: CAPE SABLE SEASIDE SPARROW (CSSS) CRITICAL HABITAT

Spreadsheet File: MB_2006_C111SC_CSSS_binned_areas_2D.xls

This file contains similar data as **MB_2006_C111SC_CSSS_drywet_data_2D.xls**, but is not on a cell-by-cell basis. Instead it is binned according to number of days and acreage. The file contains: direct post-processed data from the simulations and a summary of the results as requested by the USFWS.

Spreadsheet File: MB_2006_C111SC_CSSS_score_E.C.3.3_FwoCERP.xls

This file (and the one called **MB_2006_C111SC_CSSS_score_E.C.3.3_EXTRA.xls**) contains performance score based on longest dry period 1 March to 15 July. A score is assigned based on the original CSSS habitat indicator areas (B, C, and D) (***FIGURE A-43***). This is related to the CSSS nesting condition. The basic score and number of acres with that score are given. Area weighted scores and summary (***FIGURE A-44***) are also given. In the files with FwoCERP in the name, only files necessary for alternative evaluation are included. The files with EXTRA in the name include the results for other simulations.

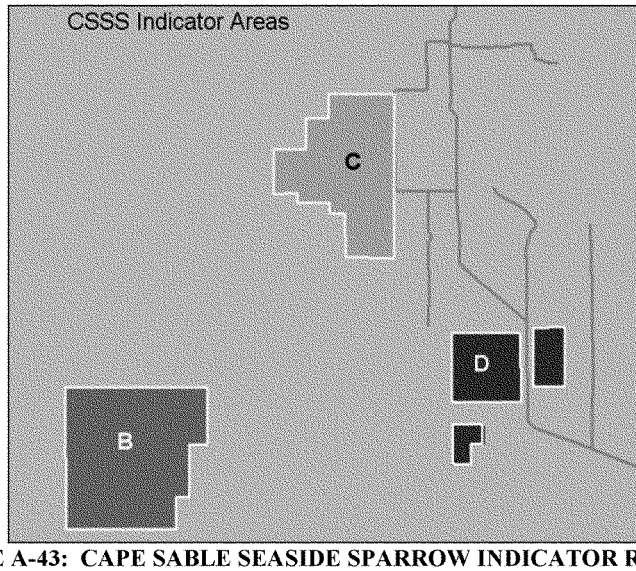


FIGURE A-43: CAPE SABLE SEASIDE SPARROW INDICATOR REGIONS, PRE-2007

Simulation	CSSS Nesting Area Weighted Scores for Area B acres =			
	Average Year	Dry Year	Wet Year	3-year Composite Score
NSM	0.48	1.00	0.14	0.52
FwoCERP	0.69	1.00	0.47	0.71
FwoCERP_1C	0.69	1.00	0.47	0.71
FwoCERP_1D	0.69	1.00	0.47	0.71
FwoCERP_2DL	0.68	1.00	0.46	0.71
FwoCERP_2DS	0.69	1.00	0.46	0.71
FwoCERP_3D	0.68	1.00	0.46	0.71
FwoCERP_6D	0.68	1.00	0.47	0.71

Scale	
0.1 to 0.5	Degraded to Declining
>0.5 to 0.7	Sustainable
>0.7 to 1.0	Target

FIGURE A-44: EXAMPLE OF THE CSSS "SCORE"

Spreadsheet File: MB_2006_C111SC_WadingBirds_E.C._3.2.xls

This file contains wading bird performance measures by "indicator region" based on recession rate, reversals, and prey productivity. The indicator regions are shown in ***FIGURE A-45***. There are two "summary" tables. The first ('summary') gives the score as calculated and each indicator region weighed the same, regardless of the size. The second is an area weighted summary. Although the spreadsheet has a summary that ranks the alternatives, this is not the official ranking of the USFWS.

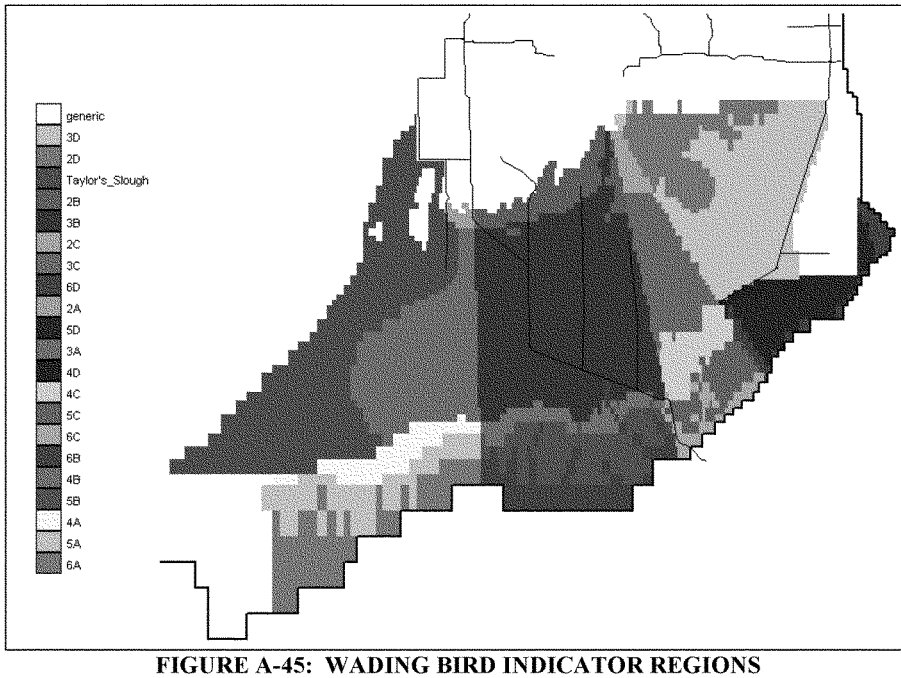


FIGURE A-45: WADING BIRD INDICATOR REGIONS

Spreadsheet File: Wading_Bird_Habitat_units.xls

This file contains wading bird habitat units computed as instructed by the USFWS. The data by alternative and by week are presented. These values are normalized by dividing by the total area in each indicator region. Scores for each indicator region (***FIGURE A-45***) are computed and shown (***FIGURE A-46***). The area-weighted scores were devised by the USACE and are for informational purposes only.

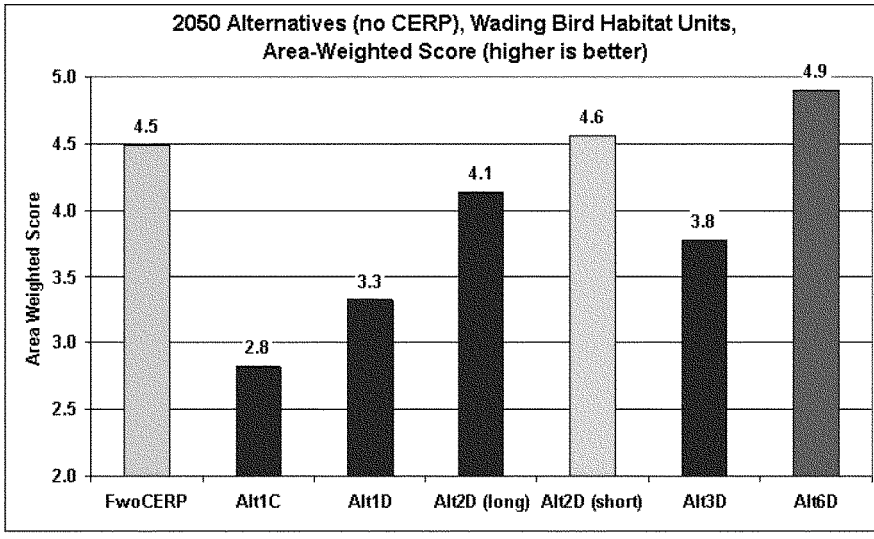


FIGURE A-46: WADING BIRD HABITAT UNITS (AREA-WEIGHTED)

Spreadsheet File:
MB_2006_C111SC_MarlPrairie_VegMosaic_E.C._2.1_FwoCERP.xls

This has the Marl Prairie performance measures for the FwoCERP base and alternatives. This is comprised of the fraction of indicator region area within specified hydroperiod ranges. There is also a similar file (**MB_2006_C111SC_MarlPrairie_VegMosaic_E.C._2.1_EXTRA.xls**) with other simulations.

Spreadsheet File:
MB_2006_C111SC_HP_areas_general_PM_FwoCERP.xls

This file contains tabular data showing area (acres) within Indicator Regions with hydroperiods in specified ranges. It also contains the percentage of the indicator region area within the hydroperiod bin. An analysis that computes the correlation between the alternatives and the NSM simulation is also presented.

Spreadsheet File:
MB_2006_C111SC_Annual_Inundation_E.C._1.1_FwoCERP.xls

This file contains tabular data with yearly values of the maximum, 25%, 50%, 75%, and minimum ponding depths in each indicator region. Also presented are a summary of the data, the maximum, 25%, 50%, 75%, and minimum ponding

depths in each indicator region for each day of the simulated year and the daily average ponding depth in each indicator region.

Spreadsheet File:
MB_2006_C111SC_IR_HiLo_Area_E.C._1.3.xls

Shows the number of days in each year in which the water is either below or above the low or high water stage criteria. Data are delineated based on indicator regions. The data show the number of days in each year in which the water is either below or above the low or high water stage criteria, respectively. The stage criteria are based on the MB_2006 "pre-drainage" or NSM simulations. The criteria represent the 95% low or high stages in each cell.

Spreadsheet File:
MB_2006_C111SC_IR_PMs_E.C._1.3.xls

This contains data related to high and low water events for each cell in the indicator regions. The values for the various alternatives are relative to the **NSM** 95% high and low for each of the three years simulated. For each alternative the number of days out of 365 the stage is either below the low or above the high of **NSM**. The number of times the water rises above or goes below the high and low **NSM** levels is also included.

Additional Files

There are a number of files that are found in "zipped" folders.

CSSS_area_stage_exceed.zip contains 6 spreadsheets. Each contains an analysis of CSSS habitat area average stage and frequency of exceedance. A typical file name is *CSSS_HabitatUnit_AveStage_and_FreqExceed_1978_FwoCERP.xls*. This particular file will have data for all the alternatives based on the future without CERP. An example of the results found here is shown in ***FIGURE A-47***.

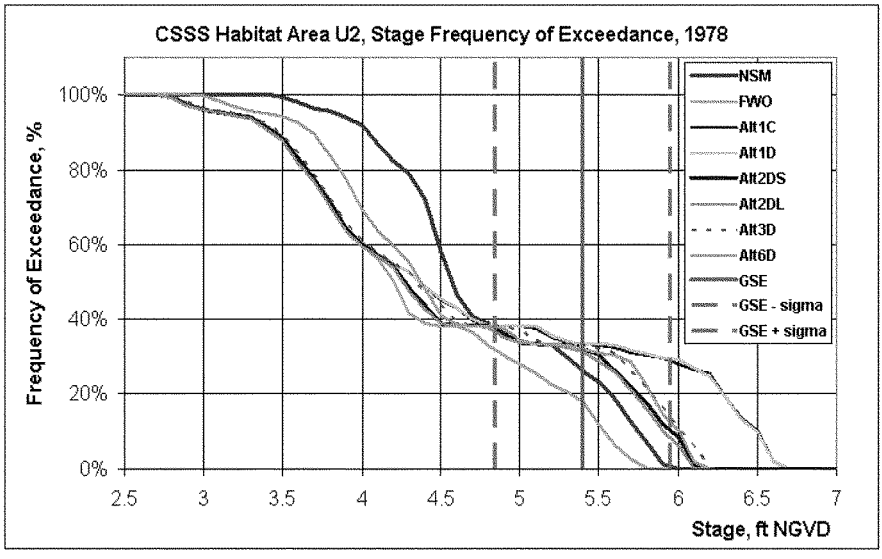


FIGURE A-47: FREQUENCY OF EXCEEDANCE CURVE, CSSS AREA U2, 1978 (FWOCERP BASE)

FWS_csv.zip contains a separate data file (comma separated variable format) for each simulation. The data include Wading Bird Recession Rate and Foraging Depth Suitability Indices (Jan-Apr & Nov-Dec) by week. These values are given for each cell in the indicator regions. These files can easily be imported to GIS programs or Excel.

Flows_PM_1.5_FwoCERP.zip and Flows_PM_1.5_ECB.zip are zipped folders of *.csv files. These files can be imported directly into Excel spreadsheets. The data are flows across various transects. Figures 48–54 show the flow transects found in these files. Many transects were specified in earlier phases of the study and are generally not used. However, they are provided here to maintain continuity.

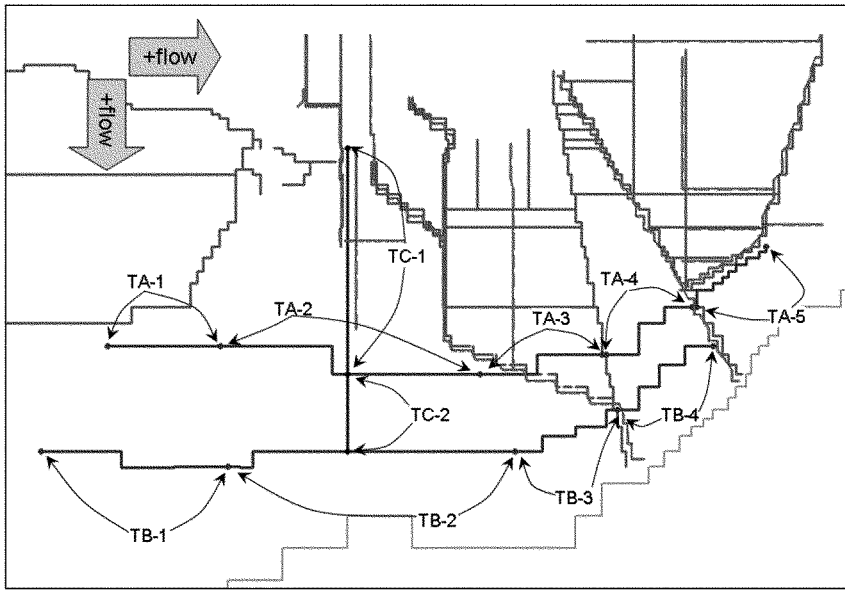


FIGURE A-48: PRIMARY TRANSECTS OF INTEREST

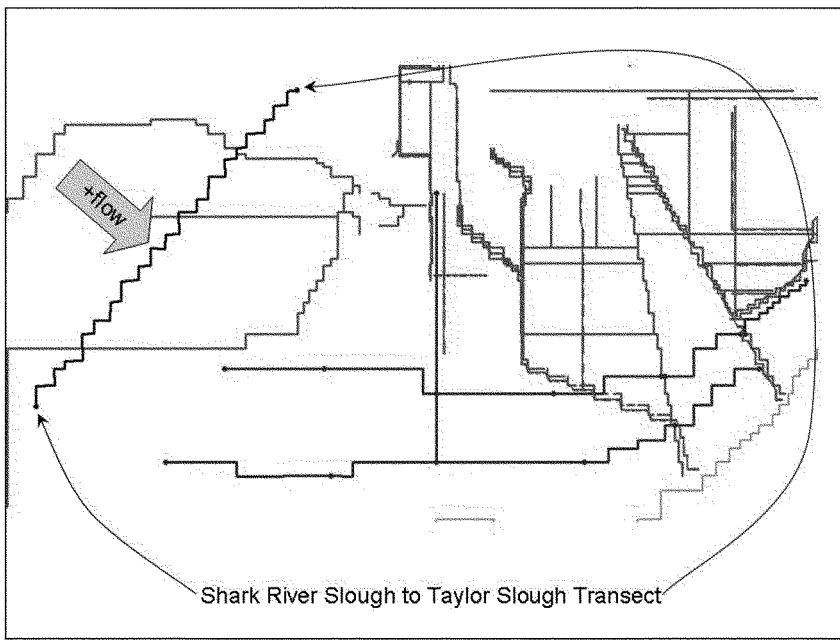


FIGURE A-49: TRANSECT BETWEEN SHARK RIVER AND TAYLOR SLOUGH

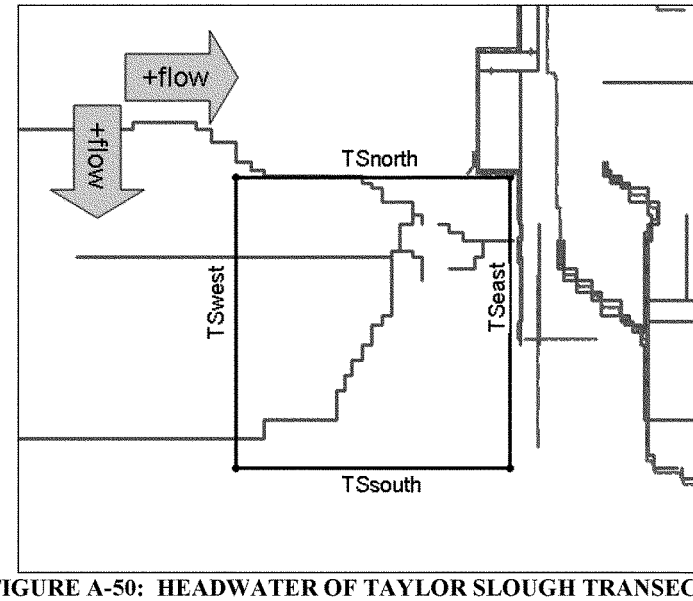


FIGURE A-50: HEADWATER OF TAYLOR SLOUGH TRANSECTS

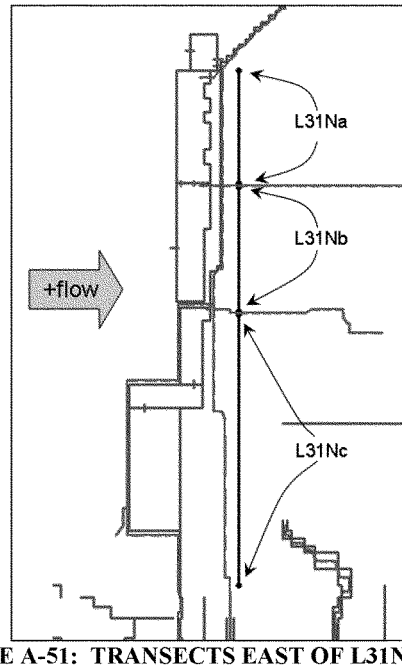


FIGURE A-51: TRANSECTS EAST OF L31N CANAL

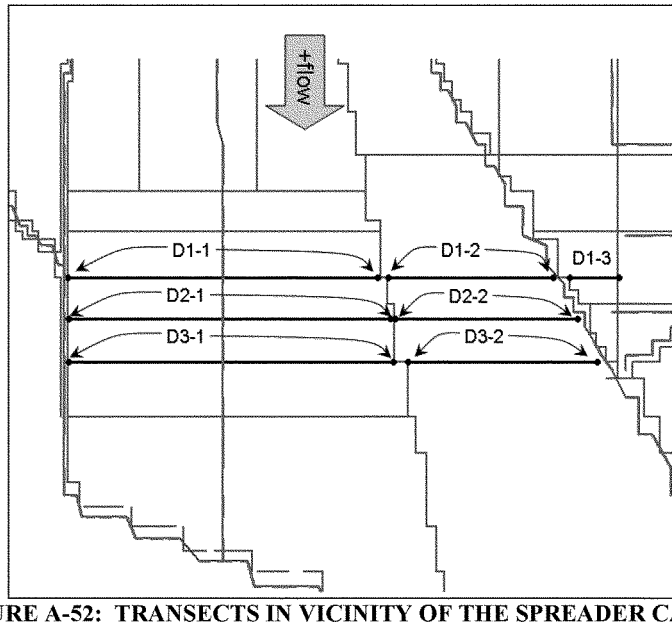


FIGURE A-52: TRANSECTS IN VICINITY OF THE SPREADER CANAL

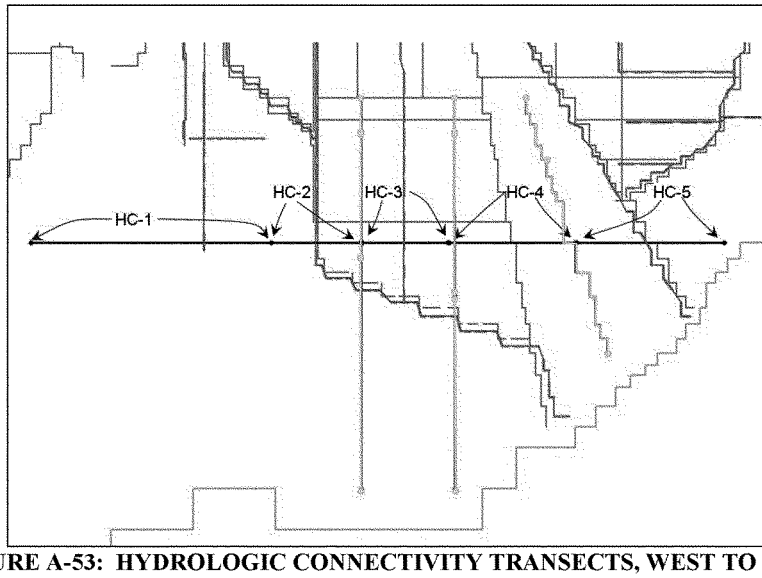


FIGURE A-53: HYDROLOGIC CONNECTIVITY TRANSECTS, WEST TO EAST

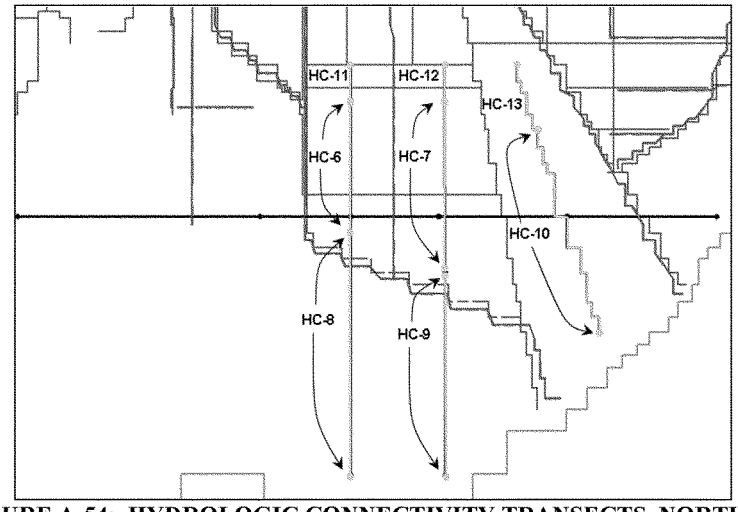


FIGURE A-54: HYDROLOGIC CONNECTIVITY TRANSECTS, NORTH TO SOUTH

Flood Impacts

Various PMs were developed for the flood impacts. Normal hydroperiods used for ecological impacts are based on the number of days in a year that the stage is above the ground. However, for flood impact analysis, hydroperiods are computed as the number of days within a specified season that the water depth exceeds a specified value. The data are divided into two seasons (wet and dry) and eleven depth values are used (+/-2.0, +/-1.5, +/-1.0, +/-0.5, +/-0.25, 0.0 ft).

A second flood impact PM is the longest single duration water is above a stage that is specified between 0 and 24" below the ground, in increments of 2". This PM is useful in determination of impacts on various crops.

Both types of data were provided for each cell to allow further post-processing using GIS packages.

A.10.2.2.4 Discussion of Results

The MODBRANCH model performed adequately for this study. Stages and flows predicted for the various bases and alternatives are as expected. New features and structures operations caused impacts as expected. As an example, ***FIGURE A-55*** and ***FIGURE A-56*** show the depth for the FwoCERP base and FwoCERP Alternative 2D Short. The addition of the Frog Pond Detention Area

and the Aerojet Canal clearly show increased stages in the headwaters of Taylor's Slough.

Discussion of the results of more extensive analysis can be found in the sections on biological impacts, economics, and savings clause.

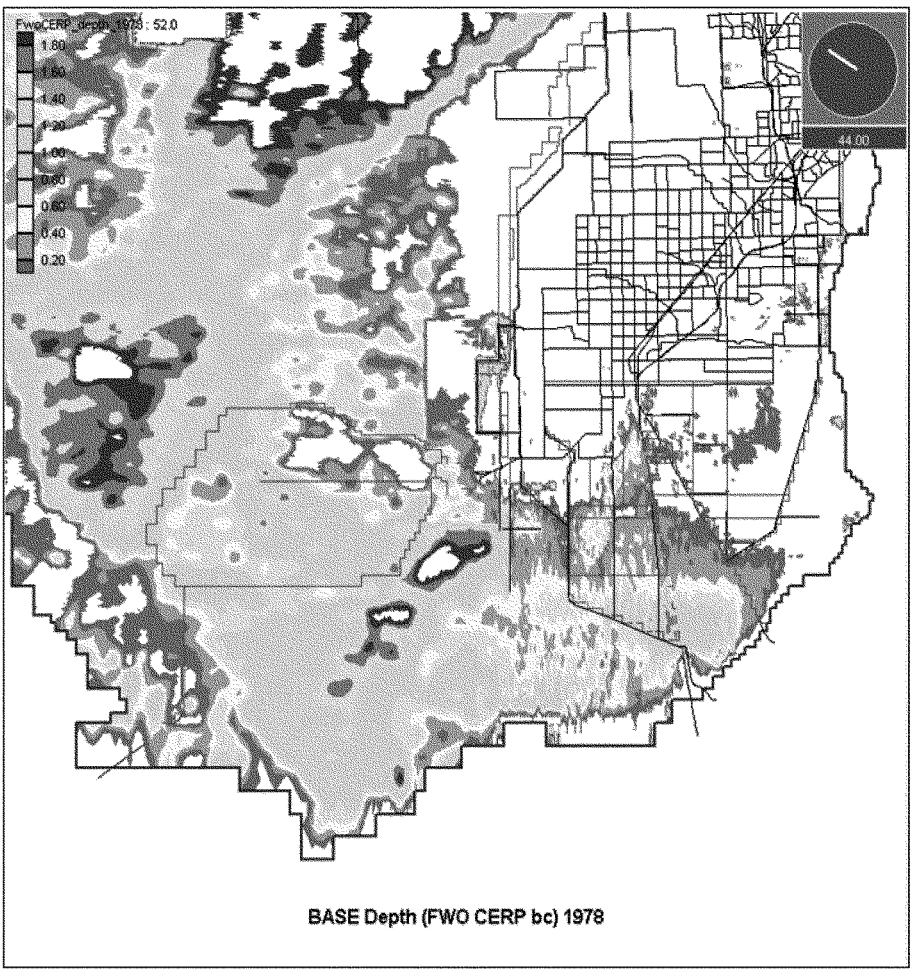


FIGURE A-55: MODBRANCH DEPTH, FUTURE WITHOUT CERP, 1978 (AVERAGE YEAR)

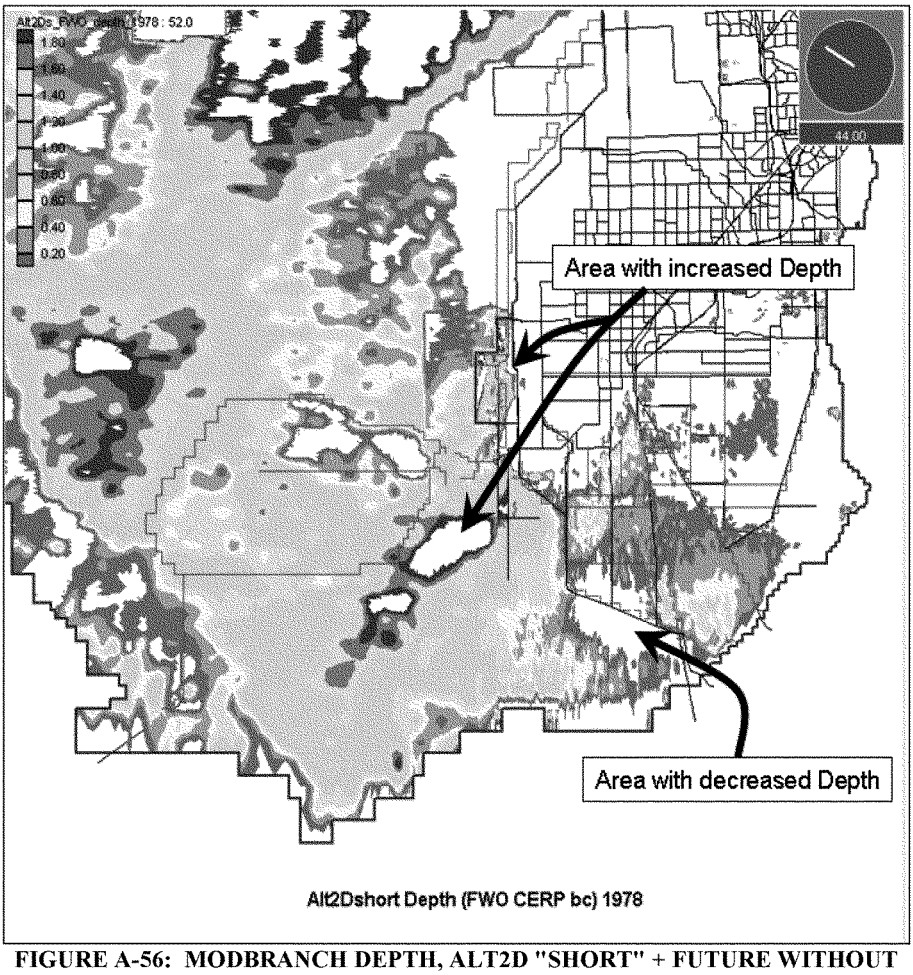


FIGURE A-56: MODBRANCH DEPTH, ALT2D "SHORT" + FUTURE WITHOUT CERP, 1978 (AVERAGE YEAR)

A.10.3 References

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A.11 HYDROLOGIC AND HYDRAULIC MODELING FOR FPDA

A.11.1 Overview

The purposes of the hydraulic modeling of the project north components are to:

- Size the weir structures in the header channel to allow water to fill the Frog Pond Detention Area cells evaluating the integrated procedures of pumping, rainfall, and groundwater seepage; and
- Evaluate pump operation under different hydrologic conditions. Pumping needs to stop when water levels in the pond cells reach elevations of +5.0 ft. NAVD88, or water mounding 4 in. (10 cm) above ground on the east side of the FPDA at Cape Sable seaside sparrow Subpopulation Habitat Area C.

A.11.2 Regional Modeling

Regional Simulation Model (RSM) is a regional hydrologic model developed by the SFWMD principally for application in south Florida. The RSM is developed on a sound conceptual and mathematical framework that allows it to be applied generically to a wide range of hydrologic situations. The RSM simulates the coupled movement and distribution of groundwater and surface water throughout the model domain using a Hydrologic Simulation Engine to simulate the natural hydrology and a Management Simulation Engine to provide a wide range of operational capability.

Since the RSM model was developed for the whole south Florida area, it is not detailed enough to be utilized to analyze the specific condition of the FPDA, however, RSM results were used to calibrate hydrologic/hydraulic model inputs if applicable.

A.11.3 Sub-Regional Modeling

A.11.3.1 Description of Models and Modeling Assumptions

To model the dynamic rainfall-runoff-infiltration process for the FPDA, WRScompass compared several widely accepted models such as ICPR, EPA-SWMM, XP-SWMM, HEC-RAS based on the following rules:

- Capacity to model all kinds of hydraulic routings;
- Capacity to model stormwater and groundwater dynamically;
- Capacity to model infiltration and to analyze mounding water;
- Capacity to accept large input files;
- Friendly interface, neat input and output reports; and
- Computational speed.

ICPR PercPack version 3.1 was chosen to create a hydraulic model for the FPDA project due to its ability to meet all of the above criteria. The HEC-RAS model was also used to compare the ICPR results with the Project's previous model outputs.

A.11.3.1.1 HEC-RAS Model

A HEC-RAS model was developed by Brown and Caldwell and the results are presented in the Draft Frog Pond Conceptual Design Technical Memorandum dated May 2007. However, HEC-RAS is not able to model groundwater and percolation, and its capability of modeling the hydrodynamic procedure of precipitation is limited.

A.11.3.1.2 ICPR Model

The Interconnected Channel and Pond Routing (ICPR) Model was developed by StreamLine Technologies, Inc. in 1983 and has been widely accepted by many organizations such as FEMA, the USACE, SFWMD, and state and local agencies.

The three primary building blocks of the model are **Basins**, **Nodes,** and **Links**. Stormwater runoff hydrographs are generated for basins and then assigned to nodes in the drainage network. Nodes are used to represent ponds and specific locations in the drainage network such as along channels, streams, rivers, and junctions in pipe systems. Links such as pipes, channel segments, weirs, and bridges are used to connect nodes together.

Once the model has been developed, stages are calculated at each of the nodes and links such as pipes, channel segments, weirs, and bridges are used to connect nodes together. Flow rates are calculated for links based on stages at nodes.

In 2008, ICPR PercPack V3.1 was released as the most updated package. This package allows the connection of each of the ponds to a groundwater sink with a Percolation Link. The data form for a percolation link includes information on the soils, the surficial aquifer, and the pond geometry.

Given this information, the model solves the surface and groundwater systems simultaneously, accounting for the interactions between both systems including groundwater mounding below and adjacent to the ponds.

A.11.3.2 ICPR Model Development and Modeling Assumptions

A.11.3.2.1 Hydrologic Parameters

Basin curve number (CN) and time of concentration (Tc) are two of the primary tasks under hydrologic parameterization for ICPR model input.

The curve number method was developed by the USDA Natural Resources Conservation Service (NRCS), which was formerly called the Soil Conservation Service or SCS. The number is still popularly known as a "SCS runoff curve number" in the literature. The NRCS curve number is an empirical parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess. The runoff curve number was developed from an empirical analysis of runoff from small catchments and hill slope plots monitored by the USDA. It is a widely used and efficient method for estimating the approximate amount of direct runoff from a rainfall event in the area of interest. The curve number is based on the area's hydrologic soil group and land use and hydrologic condition. These two characteristics are of greatest importance. Based on the land use and soil group, a standard CN was estimated using NRCS.

Six basins were designated in the header channel and detention cells as shown in ***FIGURE A-57.*** The Soil Map and Land Use Map for the FPDA are presented in ***FIGURE A-58*** and ***FIGURE A-59***, respectively. The majority of the soil types within the FPDA are Type B and Type B/D, and a portion of Cell S is Type A. Land use of the area is mainly cropland and non-forested wetland. Given this information, the CN of each basin was estimated based on the NRCS CN table.

Tc is generally defined as the time required for a drop of water to travel from the most hydrologically remote point in the subcatchment area to the point of collection. The most common approach is to follow the TR-55 Tc worksheet. This starts by determining the Tc path, as defined above. The path is then broken into segments according to the type of flow. This may include segments of sheet flow (limited to 300 ft maximum), shallow concentrated flow, and channel flow, depending on the site conditions. Adding the Tc for all segments yields the total Tc for the subcatchment area. For those channel basins WDC-N, WDC-C and WDC-S, Tc is set as 0.001 since the whole basin is with surface water and rainfall becomes runoff immediately.

FIGURE A-57: FROG POND DETENTION AREA BASIN BOUNDARIES

FIGURE A-58: FROG POND DETENTION AREA SOIL TYPE MAP

FIGURE A-59: FROG POND DETENTION AREA LAND USE MAP

A.11.3.2.2 Hydrologic Simulation

Four hydrologic conditions are considered:

The first design condition seeks to reduce the storm event peak flow at S-197 by pumping 225 cfs water from the C-111 Canal and storing it within the FPDA. The purpose of meeting this goal is to store a minimum of 1,000 acre-feet.

The second design condition is to ensure that the detention area can meet the appropriate dam safety requirements for the assigned dam hazard classification. Although the intent is to design and operate the Frog Pond Detention Area as a Low Hazard Potential (LHP) facility, a Probable Maximum Precipitation of 6-hr, 35.7-inch event was evaluated.

The third design condition seeks to evaluate the proposed design when the 100-yr storm is routed through the facility.

The fourth design condition simulates hurricane conditions. This event is based on the commonly accepted storm, Hurricane Easy (1950), recorded 24-hour depth of rainfall. In the town of Yankeetown a peak 24-hour rainfall of 38.7 inches was recorded (SFWMD, 2006).

A.11.3.2.3 Hydraulic Parameters

Hydraulic parameters include all hydraulic features and routings such as pond, stage-area relationship, channel, pipe, weir, drop structure, bridge, pump station, percolation and boundary condition.

Hydraulic features in the FPDA include 3 detention cells, a header distribution channel divided into 3 segments by 2 weirs within the channel, and overflow weirs connecting the header channel and the three detention cells.

Each basin was assigned a node to represent it and runoff is supposed to damp to the node within the basin. Node stage-area relationship was developed based on the design.

All of the six nodes are linked by weirs. All nodes are connected to a node GWT representing the groundwater table which was set as -0.4 ft NAVD88 based on the geotechnical survey.

Pump Station S-200 was modeled through a rating curve by specifying a constant flow of 225 cfs from Node PS to the Node WDC-N.

A Node-Link Diagram for the ICPR model for the FPDA is shown in ***FIGURE A-60.***

FIGURE A-60: FROG POND DETENTION AREA ICPR NODE LINK DIAGRAM

Based on topography and the geotechnical survey, the design parameters which were input to the ICPR model are as follows:

- Top of Levee: 9 ft NAVD88, 4:1 (H:V).
- Side slopes of both perimeter levee and intermediate levee are set as 4:1.
- Based on the topographic Survey conducted by Weidner Survey and Mapping (now Miller-Legg), dated August 13, 2007 the approximate ground elevations across the project site range from +2.4 ft to +3.8 ft NAVD88. Based on the geotechnical survey data, the proposed bottom of the detention area was set at 6 inches below existing ground surface. This depth represents removal of the surficial soil. The resulting FPDA elevation then varies linearly from south to north from 2.0 feet to 3.0 feet NAVD88, respectively.
- Bottom Area of each cell: 141.4 ac, 162.7 ac and 169.3 ac for Cells S, C and N, respectively.
- Surface area of each cell: 147.6 ac, 165.9 ac and 175.7 ac for Cells S, C and N, respectively.
- The header channel bottom area is 60 ac and surface area is 75.1 ac.
- Inlet channel (conveys inflow from the pump station approximately 4,500 feet to detention area) will be concrete-lined to reduce seepage.
- The unlined distribution channel bottom width is 180 ft with side slope of 4:1 and TOB elevation of 9.0 ft NAVD88.
- The header channel is divided into 3 segments by 2 weirs. The control elevations of the two weirs are set as 3.6 ft. NAVD at the north and 3.2 ft. NAVD at the south, both are 0.2 ft above ground, respectively.
- Three weirs connect the header channel's east levee and the three pond cells. Weir control elevation was set as 4.2 ft. NAVD.
- All weirs are set as rectangular. Weir discharge coefficient was set as 3.2 as recommended by ICPR model.

A.11.3.3 Assumptions

In the ICPR hydrologic/hydraulic model, the following assumptions are made:

- Peak rate factor of 256 was used for all basins.
- SCS Type III rainfall data was applied to all basins to be consistent with the BODR report.
- Horizontal and Vertical Hydraulic Conductivity for percolation calculation were taken from the BODR as of 20,000 ft/day and 5,000 ft/day, respectively.
- Effective porosity was estimated as 25 percent based on recommended typical value in ICPR model for the same type of soil (limestone).

A.11.4 Modeling Results

This section discusses the ICPR modeling results for FPDA. As mentioned in ***Section 4.4.4.2***, the model was run for the following four design conditions:

- Dry season, only 200 cfs water pumped from the Pump Station S-200.
- Wet season: Probable Maximum Precipitation (PMP) as 6-hr storm with a total depth of 38.7 in rainfall, plus 200 cfs water pumped from the Pump Station S-200.
- Wet season: 100-yr/24-hr storm with a total depth of 18 in rainfall, plus 200 cfs pumped from the Pump Station S-200.
- Wet season: hurricane storm as 100-yr/24-hr with a total depth of 38.7 in rainfall, plus 200 cfs pumped from the Pump Station S-200.

A.11.4.1 Dry Season with 225 cfs Water Pumped into the Header Channel

FIGURE A-61 shows the inflow and outflow of each segment of the header channel. It was found that during the first 80-hour pumping, percolation was equal or less than inflow, resulting in stage increase in the header channel, after 140 hours, percolation equals the inflow, resulting in stable stage at the header channel, as shown in ***FIGURE A-62***. From ***Figure A-62***, it was found that the stage in the header channel is 4.0 ft or lower which is lower than the weir control elevation, so no water enters into any of the three detention cells.

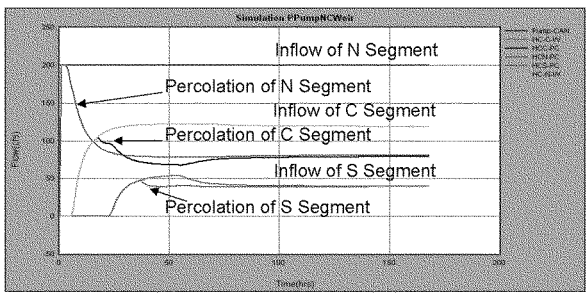


FIGURE A-61: INFLOW AND OUTFLOW (PERCOLATION) OF THE HEADER CHANNEL UNDER DRY SEASON CONDITIONS

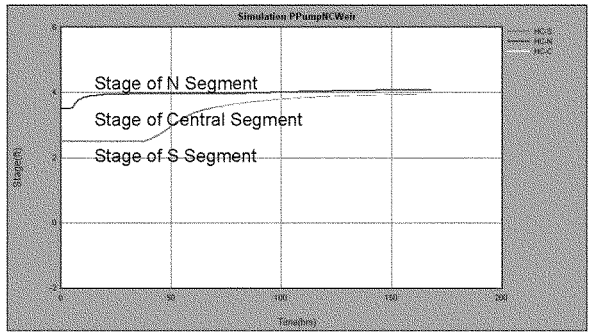


FIGURE A-62: STAGE AT THE HEADER CHANNEL UNDER DRY SEASON CONDITIONS

There is no water flowing to any of the detention cells, however, the 225 cfs water flowing through the header channel creates a mounding water area in the FPDA as shown in ***FIGURE A-63***. From ***FIGURE A-63***, it was found that groundwater elevation was raised by 3.4 to 0.5 ft. NAVD at locations from 100 ft to 1500 ft away, respectively, from the water edge of the header channel.

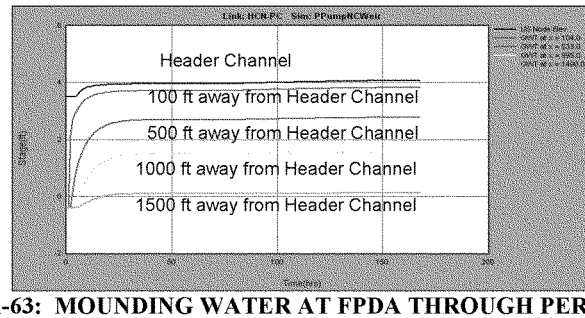


FIGURE A-63: MOUNDING WATER AT FPDA THROUGH PERCOLATION FROM HEADER CHANNEL UNDER DRY SEASON CONDITION

A.11.4.2 Wet Season, 100-yr/6-hr PMP Storm with 38.7 in. Rainfall Plus 225 cfs Pumped into Header Channel

FIGURE A-64 shows the stage changes at the header channel and the three detention pond cells. Due to the heavy rainfall, 38.7 in. in 6 hours, water elevation in the detention pond cells rose to 4.8 ft. NAVD after about 7 hours of raining, but dropped back to ground elevation due to a high percolation rate. It takes about 75 hrs, 85 hrs and 140 hrs to drop back to ground elevation with no water standing in Cell S, Cell N and Cell C, respectively. Stages in the header

channel rise to 4.8 ft. NAVD during the peak rainfall, and drop down to 4.0-4.1 ft. NAVD after 25 hours.

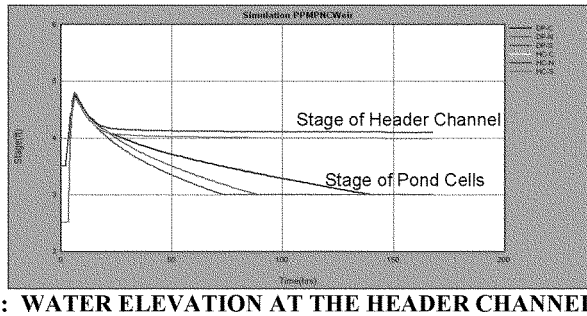


FIGURE A-64: WATER ELEVATION AT THE HEADER CHANNEL AND THREE DETENTION POND CELLS UNDER PMP CONDITION

Under the condition when there is no water flowing from the header channel into any of the detention pond cells, however, the 225 cfs water flowing through the header channel the result is a mounding effect in the FPDA as shown in ***FIGURE A-65.*** These results are similar to the dry season, raising groundwater elevations from 3.4 to 0.5 ft. NAVD at locations from 100 ft to 1500 ft away, respectively, from the water edge of the header channel.

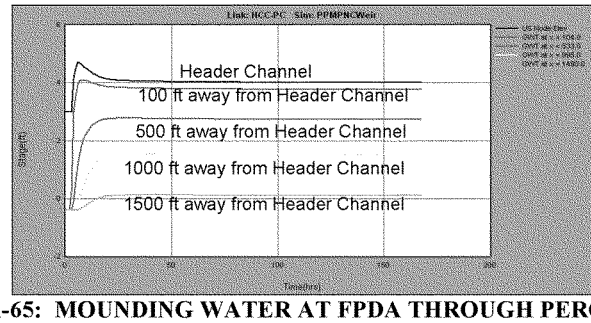


FIGURE A-65: MOUNDING WATER AT FPDA THROUGH PERCOLATION FROM THE HEADER CHANNEL UNDER PMP CONDITION.

A.11.4.3 Wet Season: 100-Yr/24-Hr Storm with A Total Depth of 18 In Rainfall, Plus 225 cfs Pumped Into The Header Channel

FIGURE A-66 shows the stage changes at the header channel and the three detention pond cells in the 100-yr/24 hr storm event (18 inches). It was found that the water elevation in the detention pond cells rose 0.2 ft above natural ground during the storm event and dropped back to ground elevation due to high percolation rate. Stages in the header channel rise to between 3.95-4.1 ft. NAVD after 150 hours of pumping.

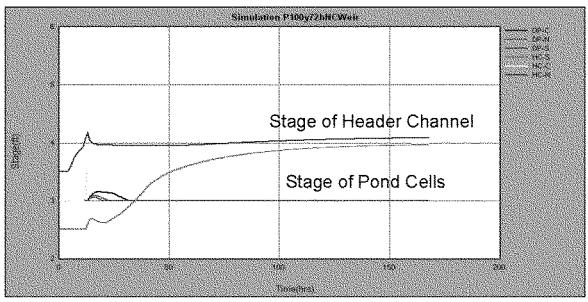


FIGURE A-66: WATER ELEVATION AT THE HEADER CHANNEL AND THE THREE DETENTION POND CELLS UNDER 100-YR/24-HR STORM CONDITIONS

There is no water flowing from the header channel to any of the detention pond cells, however, the 225 cfs water flowing through the header channel creates a mounding water area in the FPDA as shown in ***FIGURE A-67***. It shows similar results under the dry season conditions, raising groundwater elevation from 3.4 to 0.5 ft. NAVD at locations from 100 ft to 1500 ft, respectively, away from the water edge of the header channel.

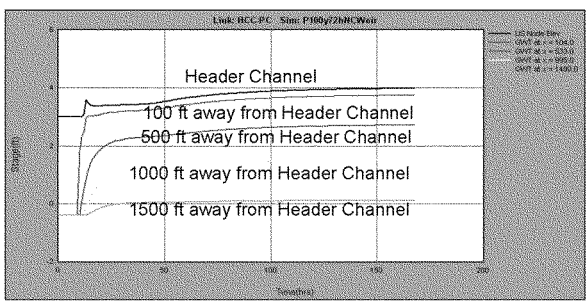


FIGURE A-67: MOUNDING WATER AT FPDA THROUGH PERCOLATIONFROM HEADER CHANNEL UNDER 100-YR/24-HR STORM CONDITIONS

A.11.4.4 Wet Season: Hurricane Storm As 100-Yr/24-Hr with A Total Depth of 38.7 In Rainfall, Plus 225 cfs Pumped In

FIGURE A-68 shows the stage changes at the header channel and the three detention pond cells. It was found that the water elevation in the detention pond cells rose 1.5 ft above natural ground during the heavy rainfall event and then dropped back to ground elevation due to the high percolation rate. It takes 90 hrs, 110 hrs and 160 hrs to drop back to ground elevation with no water standing in the Cell S, Cell N and Cell C, respectively. Stages in the header channel rose up to 4.7 ft. NAVD and dropped back down to 3.95-4.1 ft. NAVD after about 100 hours of pumping.

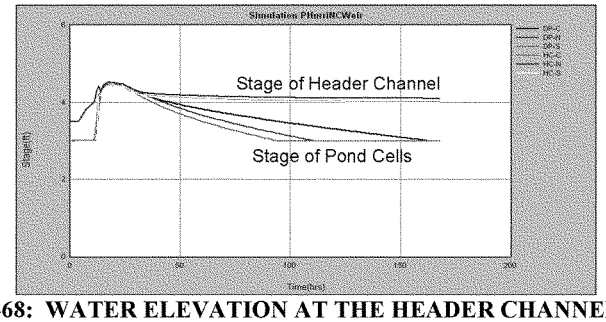


FIGURE A-68: WATER ELEVATION AT THE HEADER CHANNEL AND THE THREE DETENTION POND CELLS UNDER HURRICANE STORM CONDITIONS

There is no water flowing from the header channel to any of the detention pond cells, however, the 225 cfs water flowing through the header channel creates a mounding water area in the FPDA as shown in *FIGURE A-69*. It shows similar results under dry season conditions, raising groundwater elevations from 3.4 to 0.5 ft. NAVD at locations from 100 ft to 1500 ft away, respectively, from the water edge of the header channel.

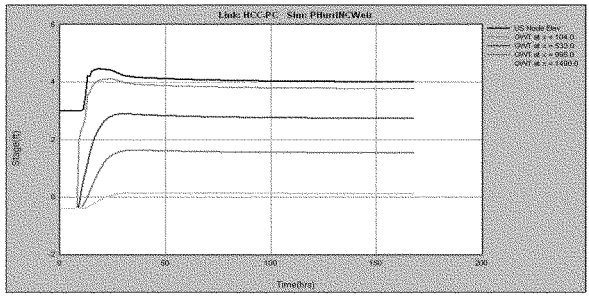


FIGURE A-69: MOUNDING WATER AT FPDA THROUGH PERCOLATION FROM HEADER CHANNEL UNDER HURRICANE STORM CONDITIONS

A.11.4.5 Conclusions

Based on the modeling results and analysis, it was found that 225 cfs water pumped from C-111 will maintain an elevation of 3.95-4.1 ft. NAVD in the header channel due to the balance of inflow and infiltration, staying about 0.6-1.5 ft above ground from north to south. If the control elevation of the weirs entering the pond detention cells is higher than 4.1 ft. NAVD, no water will flow into the cells. However, a lower weir elevation is not going to let surface water build up either, because water entering the pond cells is going to infiltrate to ground due to the high percolation rate. As a result, during dry season, there is no water in the pond cells, but the head in the header channel will create hydration of the FPDA.

Under different storm conditions, stages at the FPDA area will not exceed 5 ft. NAVD. The storms will let the cells hold water temporarily up to 4.8 ft. NAVD (1.8 ft above ground) under PMP storm condition, but will drop back to natural ground elevation after the storm. As a result, the storm is not going to affect the FPDA design.

A.12 HYDROLOGIC/HYDRAULIC MODELING FOR AEROJET CANAL

A.12.1 Introduction

Included herein is the analysis performed by WRScompass related to modeling the hydraulics and designing properly sized plugs for the Aerojet Canal as features of South Component for this Project.

The South Component of the Project includes the following design elements:

- Pump Station S-199 with a total capacity of 225 cfs, located on the west side of the C-111 Canal near the north end of Aerojet Canal, designed as a permanent structure to convey water from the C-111 Canal to the Aerojet Canal
- Weirs/Plugs along Aerojet Canal to promote the mounding of water levels beneath and adjacent to the Aerojet Canal
- Structure S-198
- Plugs along C-110 Canal to promote sheet flow of water in the vicinity of the C-110 Canal

Task objectives of the South Component are to:

- Reduce the flow rate in C-111 Canal by pumping 225 cfs of water from the C-111 Canal into the Aerojet Canal
- Create hydraulic mounding in the vicinity of the Aerojet Canal area
- Minimize groundwater flow from Taylor Slough to east

A.12.2 ICPR Model Development and Modeling Assumptions

A.12.2.1 ICPR Model Description

In order to conduct these analyses, WRScompass utilized the software program, Interconnected Channel and Pond Routing (ICPR) Model. The ICPR model was developed by StreamLine Technologies, Inc. in 1983 and has be widely accepted by many organizations such as FEMA, ACOE, SWFMD, and numerous municipalities throughout the State of Florida. The three primary building blocks of the model are Basins, Nodes and Links. Stormwater runoff hydrographs are generated for the basins and then assigned to the nodes in the drainage network. Nodes are used to represent ponds and specific locations in the drainage network such as along channels, streams, rivers, and junctions in pipe systems. Links such as pipes, channel segments, weirs, and bridges are used to connect the nodes together.

Once the primary building blocks have been developed, stages are calculated at each of the nodes and links. Flow rates can then be determined for links (pipes, weirs channel, etc.) based on stages previously calculated at the system nodes.

In 2008, PercPack V3.1 was added as an option the ICPR software package. PercPack allows the connection of each of the ponds to a "groundwater sink" with a "Percolation Link". The data form for a percolation link includes information on the soils, the surficial aquifer, and the pond and computational geometry.

http://www.streamnologies.com/products/percpack/percpack_percolation_links_01.htm

Given this information, the model solves the surface and groundwater systems simultaneously, accounting for the interactions between both systems including groundwater mounding below and adjacent to the ponds.

http://www.streamnologies.com/products/percpack/percpack_gw_mounding_01.htm

A.12.2.2 Hydrologic Parameters

Basin curve number (CN) and time of concentration (T_c) are two of the primary tasks under hydrologic parameterization for ICPR model input.

The curve number method was developed by the USDA Natural Resources Conservation Service (NRCS), which was formerly called the Soil Conservation Service or SCS—the number is still popularly known as a "SCS runoff curve number" in published literature. The NRCS curve number is an empirical

parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess. The runoff curve number was developed from an empirical analysis of runoff from small catchments and hill slope plots monitored by the USDA. It is a widely used and efficient method for determining the approximate amount of direct runoff from a rainfall event in the area of interest. The curve number is based on the area's hydrologic soil group, land use and hydrologic condition, the two former being of greatest importance. Based on the land use and soil group, a standard CN was estimated by NRCS, as shown in Attachment I (CN Table).

Basins were delineated based on the topography and assumption that water within the area between C-111, Aerojet and L-31W distributes to three vicinities equally. ***FIGURE A-70*** shows the basin map of the project area. The Soil Map and Land Use Map for the Aerojet Canal area are presented in ***FIGURE A-71*** (Soil Map) and ***FIGURE A-72*** (Land Use Map). The maps are used for determination of the basin curve number.

The T_c is generally defined as the time required for a drop of water to travel from the most hydrologically remote point in the subcatchment area to the point of collection. The most common approach is to follow the TR-55 T_c worksheet. This starts by determining the T_c path, as defined above. The path is then broken into segments according to the type of flow. This may include segments of sheet flow (limited to 300 feet in length), shallow concentrated flow, and channel flow, depending on the exact site conditions. Adding the T_c for all segments yields the total T_c for the sub-catchment area.

A.12.2.3 Hydrologic Simulation

Two hydrologic conditions are considered in the analyses as follows:

- The first design condition seeks to reduce the storm event peak flow at C-111 by pumping 200 cfs of water into the Aerojet Canal.
- The second design condition seeks to evaluate the proposed design when the 100-yr storm is routed through the facility.

FIGURE A-70: PROPOSED BASIN BOUNDARIES–AEROJET CANAL

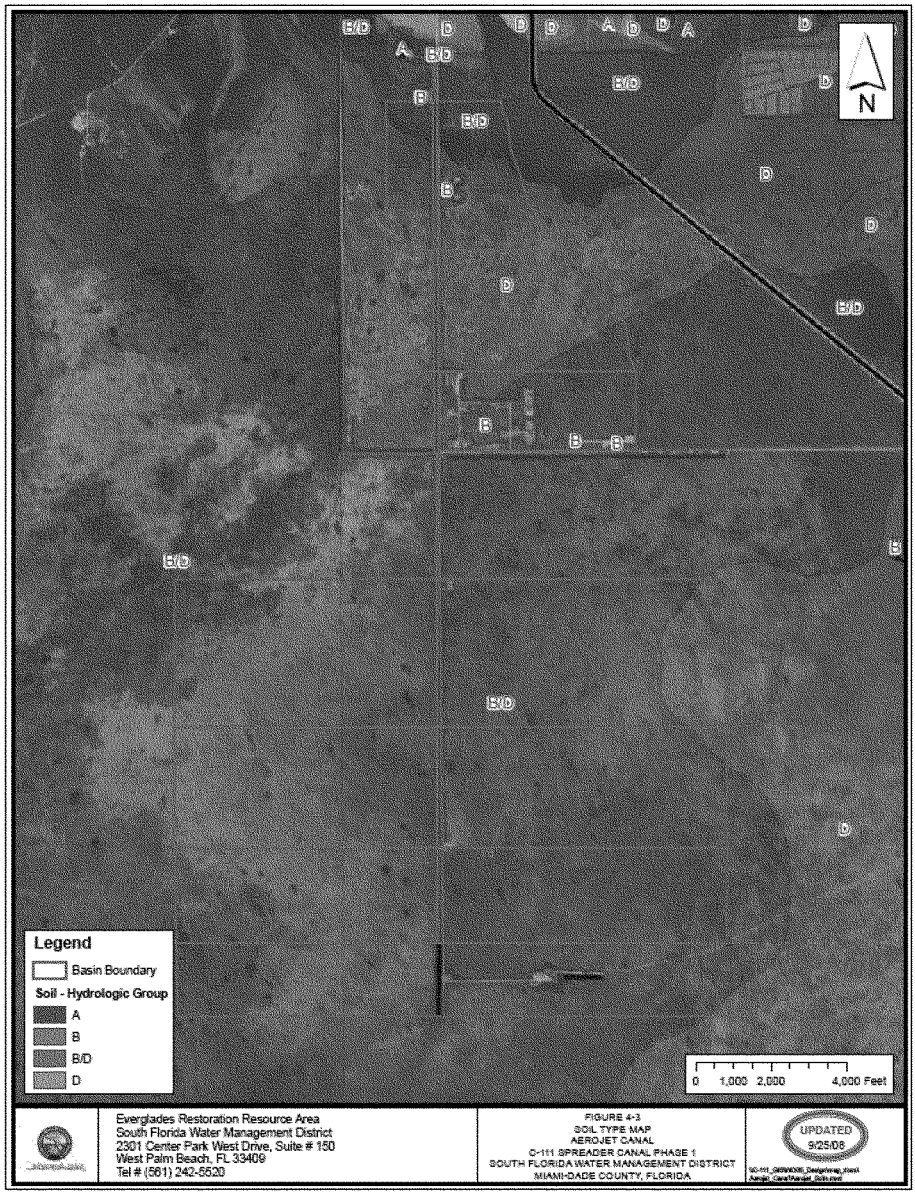


FIGURE A-71: SOIL TYPE–AEROJET CANAL

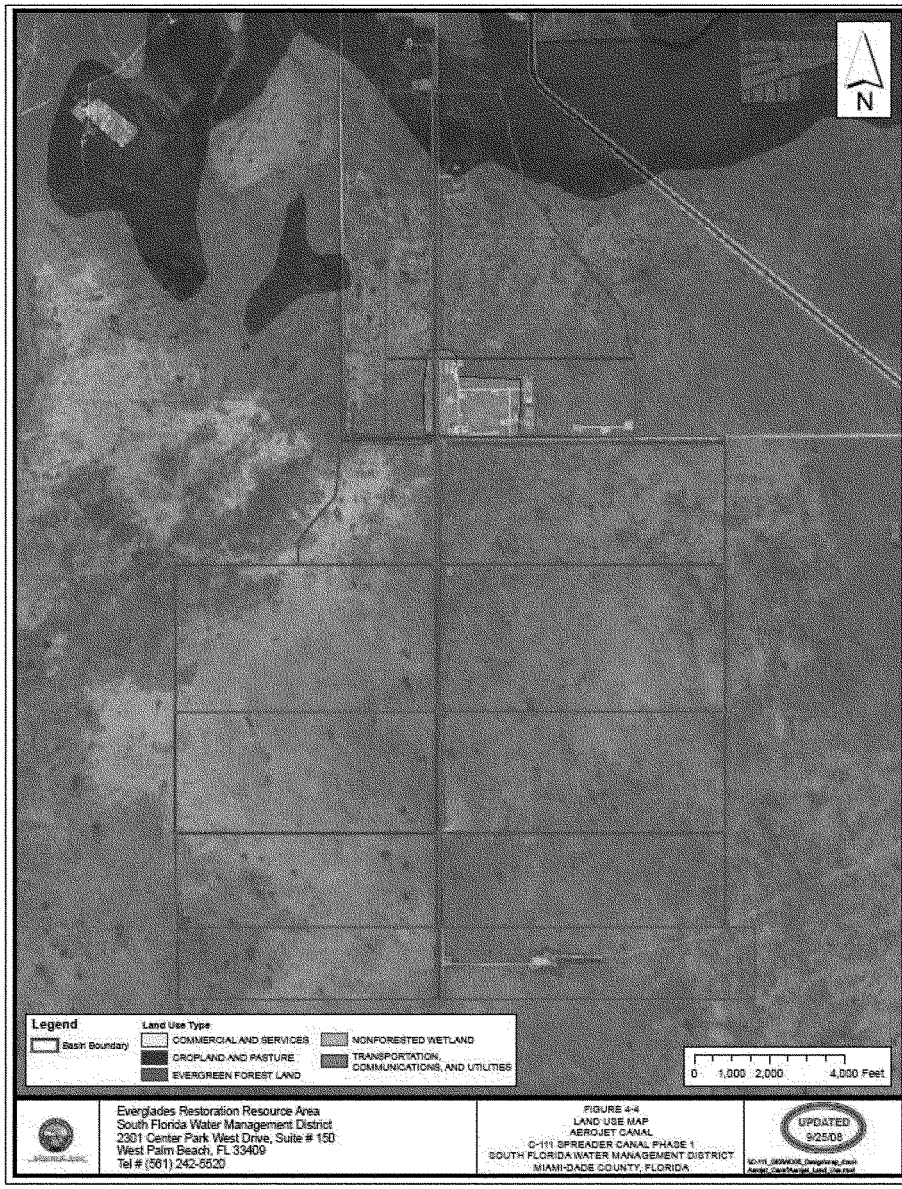


FIGURE A-72: LAND USE–AEROJET CANAL

A.12.2.4 Hydraulic Parameters

Hydraulic parameters include all hydraulic features and routings such as pond, stage-area relationship, channel, pipe, weir, drop structure, bridge, pump station, percolation and boundary conditions. In the Aerojet Canal area, hydraulic features include the Aerojet Canal, weir/plugs and pump station characteristics.

Nodes are assigned to each basin and all the nodes are linked by: a pipe, a channel or a weir. Nodes within the Aerojet Canal are connected to a node GWT representing the groundwater table. For this analysis a groundwater table elevation of -0.4 feet, NAVD88, was used as determined by the geotechnical exploration conducted at the project site.

Pump Station S-199 was modeled through a rating curve by specifying a constant flow of 200 cfs from Node PS to Node 190, at the north end of Aerojet Canal.

A Node-Link Diagram for the ICPR model for the Aerojet Canal area is shown in ***FIGURE A-73***.

The design parameters which were input in ICPR model are set up as follows:

- Five (5) existing plugs and five (5) proposed plugs, as shown in Aerojet Plug Locations, ***FIGURE A-74***. Control elevation of Proposed Plugs 2, 3 and 5 matches the ground elevation. The control elevations of the Proposed Plug 1 (south end of the Aerojet Canal) and Plug 4 (plug L-31W) were set at elevation 1.5 ft and 4.5 ft. NAVD88, respectively.
- A constructed berm is proposed adjacent to the Aerojet Canal. For modeling purposes, a berm elevation of at least 3.5 ft. NAVD88, was determined.

A.12.2.5 Assumptions

In the ICPR hydrologic/hydraulic model, the following assumptions are made:

- Peak rate factor of 256 was used for all basins.
- SCS Type III rainfall data was applied to all basins to be consistent with the BODR report.
- The survey data showed that the existing ground surface ranged from 0.0 to 3.0 feet in elevation, NAVD88.
- The Groundwater elevation used in the model varied between -0.2 to -0.6 ft NAVD88 along the Aerojet Canal.
- Horizontal and vertical hydraulic conductivity for percolation calculation were taken from the BODR as 20,000 ft/day and 5,000 ft/day, respectively.

- Aquifer depth was assumed to be 50 ft NAVD88.
- Effective porosity, was estimated as 25 percent based on recommended typical values noted in the ICPR model for the same type of soil (limestone).
- Weir discharge coefficient was set as 3.2.

FIGURE A-73: NODE LINK–AEROJET CANAL

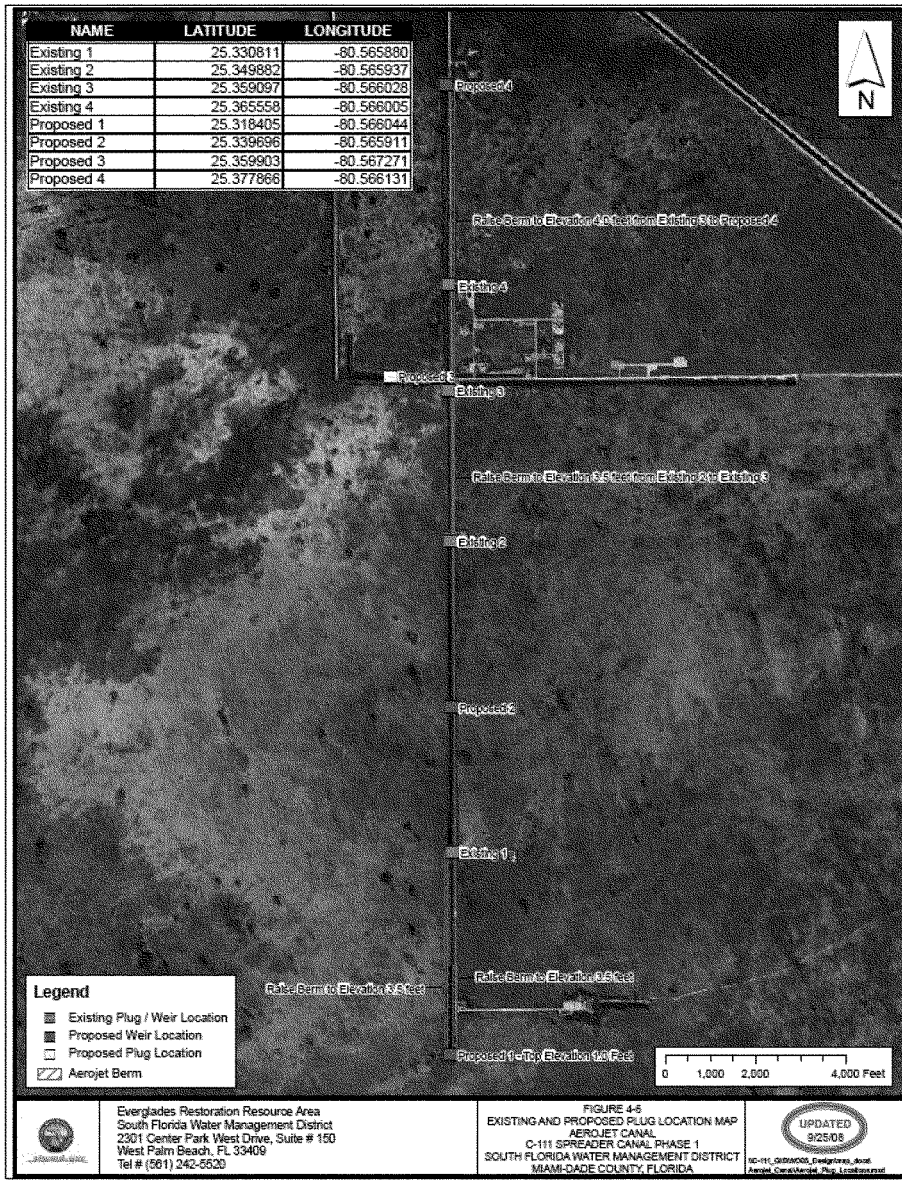


FIGURE A-74: AEROJET PLUG LOCATIONS

A.12.3 Modeling Results

This section discusses the results from the Aerojet Canal Area ICPR Percpack hydraulic model analysis. The model was used as a design tool to determine the type and size of the detention area's hydraulic structures. As mentioned in Section 3, the model was run for the following four design conditions:

- Dry season, only 200 cfs water pumped from the Pump Station S-199.
- Wet season with 100-yr/24-hr storm with a total depth of 18 in rainfall, plus 200 cfs water from Pump Station S-199

A.12.3.1 Water Elevation Profile along Aerojet Canal

With 200 cfs water pumped in, water elevations along Aerojet Canal are shown in ***FIGURE A-75*** for both dry and wet seasons.

It was determined that the existing south end 4000-ft long berm elevation of west side was below water elevations, as a result, this berm should be raised to at least elevation 3.5 ft. NAVD88.

The analysis also shows that under the 100-yr storm condition, the north portion (approximately 10,000-ft) of the east side berm needs to be raise to an elevation of 4.5 ft NAVD88.

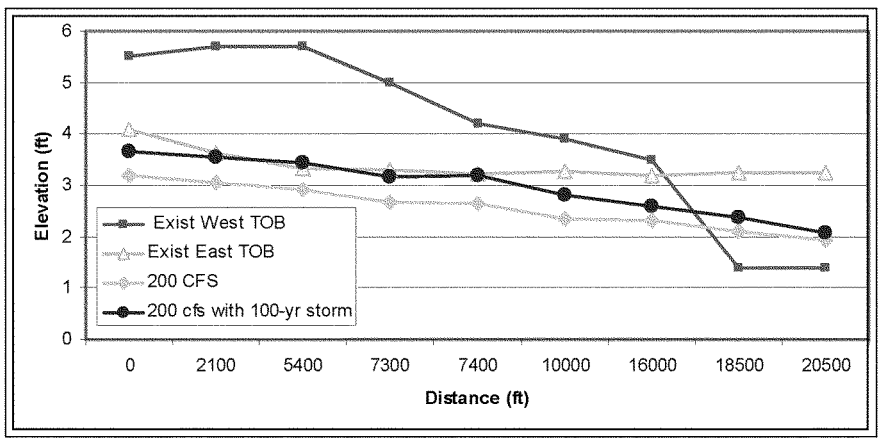


FIGURE A-75: AEROJET CANAL WITH 200 CFS PUMPED IN

FIGURE A-76 below shows the flow balance at the south end of Aerojet Canal. It shows that 140 cfs remaining after flowing through the Canal from the north

end, which means that 60 cfs was percolated along the Aerojet Canal. At the south end, simulation results indicate that 50 cfs of water percolated and the rest of 90 cfs overflowed the end plug.

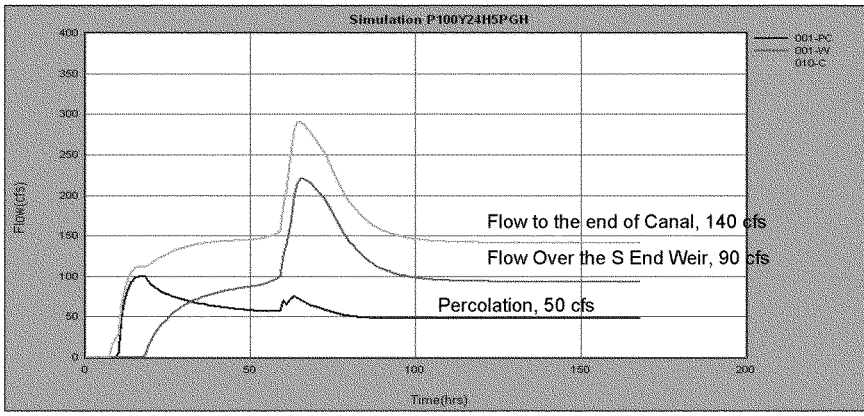


FIGURE A-76: AEROJET CANAL FLOW BALANCE WITH 200 CFS PUMPED IN

A.12.3.1.1 Mounding Water Analysis

FIGURE A-77 below shows a water mounding condition at the south end of the Aerojet Canal. It shows that groundwater elevations rose from 0.24 ft. to 2.3 ft. NAVD88 for locations from 100 ft to 4000 ft away from the water's edge of the Canal.

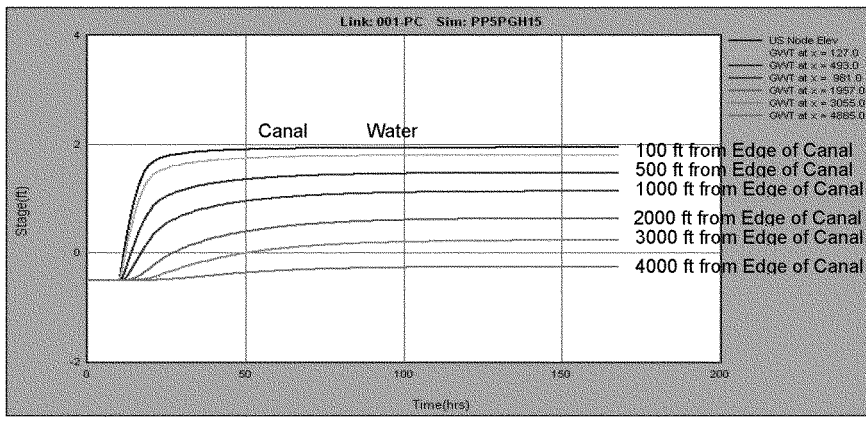


FIGURE A-77: EFFECTS OF MOUNDING AT SOUTH END OF AEROJET CANAL WITH 200 CFS PUMPED IN

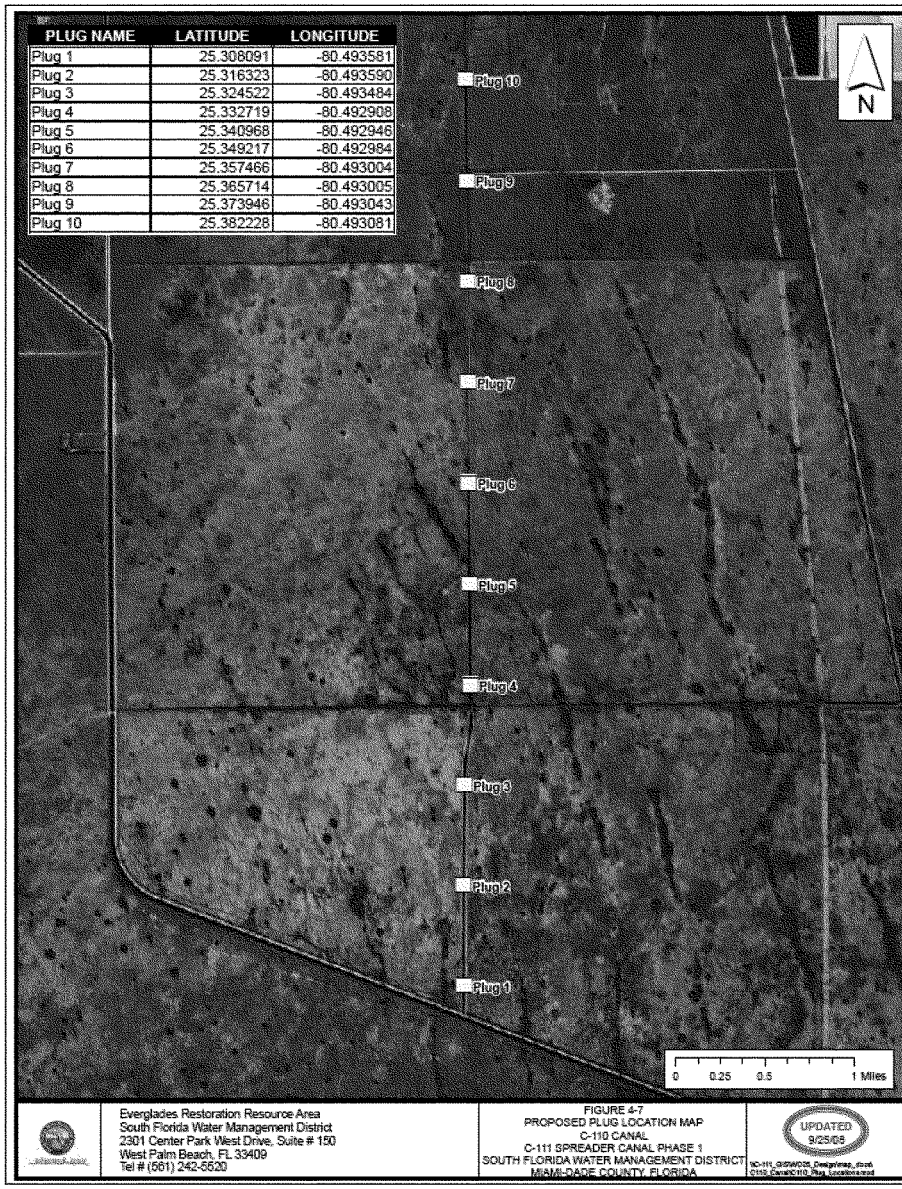
A.12.4 Conclusions

The following conclusions have been determined based on the outcome of the modeling results presented herein.

- Berms need to be constructed along portions of the Aerojet Canal.
  - Along the West side approximately, 4,000-ft at the South end, raised to at least 3.5 ft NAVD 88.
  - Along the East side approximately 10,000 ft at the North end, raised to at least 4.5 ft NAVD88.
- Mounding water is possible to create a hydration area along both sides of the Aerojet Canal, however, only 110 cfs will be percolated, the rest of the 90 cfs will overflow the south end plug.

A.12.5 C-110 and L-31E Canals Modeling

Modeling similar to that conducted and presented above is currently being conducted for the C-110 and L-31E Canal. The proposed locations of the plugs in these canals are shown in ***FIGURE A-78*** and ***FIGURE A-79***, respectively.



PLUG NAME	LATITUDE	LONGITUDE
Plug 1	25.308091	-80.493581
Plug 2	25.316323	-80.493590
Plug 3	25.324522	-80.493484
Plug 4	25.332719	-80.492908
Plug 5	25.340968	-80.492946
Plug 6	25.349217	-80.492984
Plug 7	25.357466	-80.493004
Plug 8	25.365714	-80.493005
Plug 9	25.373946	-80.493043
Plug 10	25.382228	-80.493081

FIGURE A-78: C-110 PLUG LOCATIONS

FIGURE A-79: L-31E PLUG LOCATION

A.13 INSTRUMENTATION AND CONTROL ANALYSIS AND DESIGN

A.13.1 System Description

The I&C system for the pump station consists of the SCC with an Ethernet/IP based communications network per plans and specifications. The SCC provides the pump station operator with a central location to monitor and control all pump station systems. The SCC provides monitoring and control for each individual pumping system and will be located in the electrical room. Each pumping system consists of a motor driven pump and auxiliaries. Hard-wired I/O to the SCC will include I/O from the pumping system monitors and auxiliaries required for the proper and safe operation system.

The pump drivers have three modes of operation, automatic, manual and remote. Automatic operation consists of the pump drivers with the auxiliary systems automatically controlled by the suction pool stage. Manual operation consists of operating each component of the pumping system by using manual controls. Remote operation consists of operating the pump drivers via the SFWMD's telemetry system with the auxiliaries automatically controlled. Typically for stage control involving small capacity water supply stations (similar to seepage return pumps), the automatic mode is the primary mode of operation where the pump drivers come on and are shut off based on the suction pool stage. There is an on/off sequencing of the pump drivers to ensure uniform hours of operation.

The various auxiliary functions such as low water level shut-down, trash rake operation and alarm, and high motor temperature are monitored and controlled by the station's SCC. The SCC's PLC has the capability to automatically shut the motor down given an alarm condition. The PLC is connected via an Ethernet network to the RTU (ACE 3600) for communication to the SFWMD operational center.

An upstream in-bank stilling well with stage monitoring equipment is provided for continuous water level input to the SCC and the PLC. The SCC operates the pumps as per the selected mode of operation. There is an intake stage monitor for shut-off of the pump driver given low-water on the pump side of the trash rack. This stilling well low level water transmitter is for protection of the pump to prevent water levels less than that prescribed by the design standard. In addition, a stilling well and monitor in the discharge chamber are provided that will shut-down the pump operation given a high water stage in the chamber. This monitor is to protect the pumps from an overload condition given a problem with the downstream conveyance facilities. There is, also, a water level monitor at the discharge structure and at the spreader structure to shut down the pumps, given a water stage that exceeds preset maximum to avoid the possibility of flooding existing roads or pedestrian walkways.

A.13.2 Control Equipment

A.13.2.1 Station Control Center (SCC)

The station control center controls and monitors the operation of each pumping system and is connected to the SCADA Ethernet/IP network. The SCC includes a microprocessor based controller and display, mounted in a single door enclosure located in the electrical room. The panel is powered by 24 VDC for use in non-hazardous areas. The controller is programmed to communicate to the RTU to control and monitor each pump and its auxiliaries. A 24 VDC power supply, with float charger, gel-type batteries, UPS, and 24 VDC distribution panel is provided. In addition, the SCC controls and monitors station auxiliaries or monitors are not directly associated with the pumping systems. The SCC is connected to the SCADA Ethernet/IP network. The control center includes a fully programmed and configured PLC, HMI, Ethernet hub, uninterruptible power supply, power supplies of the various voltages required by the equipment, terminal blocks, operator interface devices, plastic slotted sidewall wiring duct, over current protective devices, interconnecting wiring, communications equipment and appurtenances housed within a free standing enclosure(s).

The SCC is equipped with a MANUAL-OFF-AUTO selector switch to select between manual and automatic operation of the auxiliary pump systems. A LOCAL-REMOTE selector switch is provided to select between local and remote operation of the pumping system via the SFWMD's telemetry system. MANUAL operation consists of an operator manually controlling each component of the pumping system through the use of manual controls independent of the PLC.

AUTO operation consists of the PLC controlling the pumping system. This includes start-up and shutdown and steady state operation via programmed software. When the AUTO-MANUAL selector switch is in AUTO, the pumps will start and stop based on inflow canal stages. Other stage monitors including the low water intake stage, high water discharge chamber level and high water discharge structure stage will automatically stop the pump. In addition, the SCC has an EMERGENCY STOP (mushroom red head – pull to reset) pushbutton for emergency shutdown activation. The emergency stop pushbutton will be able to activate in both MANUAL and AUTO modes. The EMERGENCY STOP push-button will shutdown the pump and the trash collection system.

The SCC has, at a minimum, the following safety alarms and shutdowns for each pumping system:

- Pump motor fault alarm
- Intake low water level alarm
- Discharge chamber high water level alarm
- Discharge structure high water level alarm/shutdown
-

A screen that displays real time information will include:

- Cumulative pump run time,
- Control status – AUTO or MANUAL,
- Pump - on or off, and
- Trash rake status – on or off.

A.13.2.2 Programmable Logic Controller (PLC)

The microprocessor based controller (PLC) is mounted in the SCC and will provide control and monitoring of the motor pump driver and the auxiliary systems. The PLC and its appurtenances will be equal to or exceed the quality and capabilities of the following models:

- Logic Controller (PLC): The microprocessor based controller will be fully programmed and configured Allen-Bradley "ControlLogix" for the SCC. The PLC and appurtenances will be DIN rail mounted on the back panel of the enclosure.
- Digital DC Input Module: Digital input module, Allen Bradley 1769 Series with 20% minimum spare input points.
- Digital DC Output Module: Digital output module, Allen Bradley 1769 Series with 20% minimum spare output points.
- Analog I/O Module: Analog I/O module(s), Allen Bradley 1769 Series with 20% minimum spare input points.
- Resistance Input Module: Analog resistance input module(s), Allen Bradley 1769 Series with 20% minimum spare input points.
- Power Supplies: Furnish Allen Bradley 1769 Series power supplies to supply the load requirements of the system.
- Human Machine Interface (HMI): Furnish Allen-Bradley Panel-View Plus series HMIs. The HMI for the SCC will be fully programmed and configured Allen Bradley Panel-View Plus 1250 Color Keypad/Touch with standard communications (Ethernet and RS-232), DC input, 128 MB Flash, and 128 MB RAM, Allen Bradley 2711P Series.
- A surge suppressor will protect the I/O modules of the PLC from lightning induced surges, electrical fast transients and EMI/RFI noise. The surge suppressor will meet or exceed highest class severity level of IEC 1000-4-4 and 1000-4-5. The suppressor will be UL-497B listed.

A.13.2.3 Generator Control and Monitoring

The generator set is provided with a microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system is designed to allow local monitoring and control of the generator set, and remote monitoring and control. The control is mounted on the generator set. The control is vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control panel includes the following features and functions:

- Mode Selector Switch: The mode select switch will initiate the following control modes. When in the Run or Manual position the generator set will start, and accelerate to rated speed and voltage as directed by the operator. In the Off position the generator set will immediately stop, bypassing all time delays. In the Auto position the generator set will be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
- Emergency Stop Switch: The emergency stop switch will be red "mushroom-head" push-button. Depressing the emergency stop switch will cause the generator set to immediately shut down, and be locked out from automatic restarting.
- Reset Switch: The reset switch will be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
- Panel Lamp Switch: Depressing the panel lamp switch will cause the entire panel to be lighted with DC control power. The panel lamps will automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

The generator set is provided with a metering set which includes the following features and functions:

- Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter will display all three phases. Ammeter and KW meter scales will be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
- Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor.
- Generator output voltage will be available in line-to-line and line-to-neutral voltages, and will display all three phase voltages (line-to-neutral or line-to-line) simultaneously.

- Both analog and digital metering is required. The analog and digital metering equipment will be driven by a single microprocessor, to provide consistent readings and performance.

The generator set is provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps are high-intensity LED type. The lamp condition will be clearly apparent under bright room lighting conditions. The generator set control will indicate the following alarm and shutdown conditions on an alphanumeric digital display panel:

• Low oil pressure	alarm
• Low oil pressure	shutdown
• Oil pressure sender failure	alarm
• Low coolant temperature	alarm
• High coolant temperature	alarm
• High coolant temperature	shutdown
• Engine temperature sender failure	alarm
• Low coolant level	alarm or shutdown—selectable
• Fail to crank	shutdown
• Fail to start/over-crank	shutdown
• Over-speed	shutdown
• Low DC voltage	alarm
• High DC voltage	alarm
• Weak battery	alarm
• Low fuel	alarm
• High AC voltage	shutdown
• Low AC voltage	shutdown
• Under frequency	shutdown
• Over current	warning
• Over current	shutdown
• Short circuit	shutdown
• Over load	alarm
• Emergency stop	shutdown

The following information will be available from a digital status panel on the generator set control:

Engine oil pressure (psi or kPA):

- Engine coolant temperature (degrees F or C),
- Engine oil temperature (degrees F or C),
- Engine speed (rpm),
- Number of hours of operation (hours),

- Number of start attempts, and
- Battery voltage (DC volts).

A.13.2.4 Engine Control Functions

The engine control system includes a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings will be for three cranking periods of 15 seconds each, with 15-second rest period between cranking periods. The control system includes an engine governor control, which functions to provide steady state frequency regulation. The governor control includes adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The control system includes time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions. The control system will include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

A.13.2.5 Alternator Control Functions

The generator set includes an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It is immune from mis-operation due to load-induced voltage waveform distortion. The voltage regulation system is equipped with three-phase RMS sensing and will control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system includes a torque-matching characteristic, which will reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator includes adjustments for gain, damping, and frequency roll-off.

Provisions are provided to shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided will be in compliance to the requirements of NFPA 70 article 445. Controls are provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.

An AC over/under voltage monitoring system that responds only to true RMS voltage conditions is provided. The system initiates shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown occurs when the output voltage of the alternator is less than 85% for more than 10 seconds.

A battery monitoring system will be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit is disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm is initiated.

A.13.2.6 Control Interfaces for Remote Monitoring and Control

All control and interconnection points from the generator set to remote components will be brought to a separate connection box. No field connections will be made in the control enclosure or in the AC power output enclosure.

The control system will have a form "C" dry common alarm contact set rated 2A @ 30 VDC to indicate existence of any alarm or shutdown condition on the generator set. It will also contain one set of contacts rated 2A @ 30 VDC to indicate generator set is ready to load. The contacts will operate when voltage and frequency are greater than 90% of rated condition. A fused 10 amp switched 24 VDC power supply circuit will be provided in the control system for customer use. DC power will be available from this circuit whenever the generator set is running. A fused 20 amp 24 VDC power supply circuit will be provided for customer use. DC power will be available from this circuit at all times from the engine starting/control batteries.

A.13.3 Monitoring Equipment

A.13.3.1 Water Level Monitors

A stilling well with a level transmitter provides analog water level data of the Spur Canal extension. The water level transmitters provide a proportional 4 – 20 ma signal. The stilling well level transmitters are normally continuously powered from a 120 VAC to 24 VDC power supply. Upon the loss of 120 VAC service, the RTU's "Pulse Analog Circuit" program will intermittently power and scan the analog water level transmitters. The canal stage monitor is housed in an in-bank stilling well in accordance with the SFWMD standard construction of Box Type Stilling Well. The typical water level monitor is a linear potentiometer as manufactured by Water Log, Inc.

A stilling well with a float level switch is provided in each pump intake to monitor low water levels as well as in the discharge chamber to monitor high water levels. The intake low water and the discharge chamber high water pump shut-off stilling wells consist of a 12-inch diameter schedule 80 PVC pipe secured to the intake wall with stainless steel straps and anchor bolts. The level control is provided by a polypropylene float switch. A high level float switch is also provided in the spreader structure.

A.13.3.2 Submersible Pump Monitors

A leakage monitor is provided to detect the presence of water in the stator chamber. Three motor winding thermostats will be in the stator windings, one switch in each stator phase. The pump is equipped with moisture detection in three locations: the oil chamber, the motor housing, and the motor junction box. The moisture detection system will operate an alarm and shut down the pump.

A.13.4 Telemetry Analysis and Design

A.13.4.1 Telemetry Network

The SFWMD's existing microwave telemetry system is used for the communication to the station's monitoring control systems. As per discussions with SFWMD staff the existing system has sufficient capacity for the addition of this new data site. The closest VHF communication hub is the SFWMD's Homestead field station. The station coordinates are: Lat 25° 37' 24.45" and Long 80° 18' 41.64".

A.13.4.2 Communications Equipment

A.13.4.2.1 Remote Terminal Unit

A RTU will be provided and installed that consists of devices and instrumentation to control the operation and to provide monitoring of a pumping system per plans and specifications. The RTU panel is modular in design and includes power supply, battery, radio, antenna, processor, I/O cards, relays, and surge protection. The RTU will include a Motorola ACE 3600 CPU supplied with 24 VDC power supply fed by the lighting panel with generator back up and include the following components:

- CPU Module,
- Digital Input Module,
- Digital Output Module,
- Analog Input Module,
- Radio,
- Amplifier,
- Power Supply,
- Communication Interface Module, and
- Antenna.

The Motorola STS program will be installed to the new RTU to functionally test each input and output. Following the successful completion of the field tests, SFWMD personnel will furnish and install the control program and communication parameters necessary to integrate the site RTU.

The Remote Terminal Unit provides the following discrete outputs:

- Motor Start/Stop
- Gen Set Disable

The Remote Terminal Unit monitors the following discrete data points:

- Motors Alarms
- Motor Run Indication
- Auxiliary System Alarms
- Auxiliary Run Indication
- Low Intake Water
- Discharge Chamber High Water Level
- Discharge Structure High Stage

The following instruments/discrete data points are directly connected to the ACE 3600 unit and will be transmitted to the SFWMD's SCADA system:

- Headwater Stilling Well Level
- 24 VDC Power Supply Fail
- Commercial Power Fail
- Gen Set Run
- RTU Enclosure Tamper Switch

The digital radio/antenna final selection is based upon RF analysis performed by the SFWMD's Communications Network Analyst of the Infrastructure Systems Division. The antenna will be mounted on the SFWMD standard antenna pole. Appurtenances required for installation of the ACE 3600 CPU, radio, antenna, coaxial cable, coaxial connectors, terminal blocks, mounting hardware, etc. will be determined in the next phase of the design.

A.13.4.3 Operational Testing

All systems will be exercised through an operational test with simulation at the factory in order to demonstrate achievement of the specified performance. All primary element inputs will be simulated (inputs will be adjustable by switch, if discrete; by potentiometer or similar device, if analog). Primary outputs will be monitored via output devices (pilot lights, for discrete; a meter, a digital display [12-bit min. resolution]) or other such analog devices for analog outputs.

A.13.4.3.1 Operational Readiness Test

Prior to start-up of the pumping systems, the entire instrumentation and control system will be inspected and tested to ensure it is ready for operation. The instrumentation and control system will be inspected for proper installation,

calibration, and adjustment on a loop-by-loop and component-by-component basis. All instruments and systems will be calibrated after installation, in conformance with the component manufacturer's recommendation. The tests will utilize the recommended test equipment to prove accuracy and/or performance. A loop sheet or calibration sheet for each loop and device with tested results will be provided.

A.14 RECREATIONAL USE OF PROJECT FEATURES

The C-111 SC Western Storage Reservoir proposed recreation was discussed with study team members. It consists of a trailhead with parking, traffic controls, a shade shelter with interpretive board, approximately 6.8 miles of multi-use levee trails atop the impoundment cell levees and levees adjacent to the Aerojet Canal. Restoration compatible recreation use would include: hiking, biking, bank fishing, nature study, birdwatching, FWC managed hunts and equestrian use. The proposed recreation would help to fill existing and projected SCORP 2000 recreation deficits for Region 11 and public needs recorded during the CERP Master Recreation Plan Outreach in 2006 and 2008. Recreation total investment costs are estimated to be $203,000.

A.15 REFERENCES

Intermediate Design Report, C-111 Spreader Canal Phase 1 Project, Basis of Design Report, SFWMD, Brown and Caldwell, Inc., 2 March 2007

Intermediate Design Report, C-111 Spreader Canal Project, Phase 1, Frog Pond Detention Area Preliminary Design Report, SFWMD, Brown and Caldwell, Inc., ADD DATE

Preliminary construction plans (30% Submittal), C-111 Spreader Canal, Phase 1, South Components, SFWMD, 15 September 2008

Preliminary construction plans (30% Submittal), C-111 Spreader Canal, Phase 1, Pump Station No. 2, SFWMD, 15 September 2008

Preliminary construction plans (30% Submittal), C-111 Spreader Canal, Phase 1, S197B Control Structure, SFWMD, 26 September 2008

Intermediate construction plans (60% Submittal), C-111 Spreader Canal, Phase-1, Pump Station No. 1, SFWMD, 15 September 2008.

Intermediate construction plans (60% Submittal), C-111 Spreader Canal, Phase-1, North Components, SFWMD, 15 September 2008.

Following is a summary of organizations with codes and standards referenced for this report Section.

- American Society for Testing and Materials (ASTM) for soil and rock testing
- Florida Department of Transportation (FDOT) for Soil and Foundation Hand Book 2004
- South Florida Water Management District (SFWMD) Permit Manual IV
- Federal Highway Administration (FHWA), Publication No. NGHI-00-0045 "Soil and Foundation Workshop"
- United States Department of the Army Corp of Engineers
  - EM 1110-2-2300, General Design and Construction Considerations for Earth and Rock-Fill Dams
  - EM 1110-2-1902, Slope Stability
  - EM 1110-2-1908, Instrumentation of Embankment Dams and Levees
  - EM 1110-2-1911, Construction Control for Earth and Rock-Fill Dams
  - EM 1110-2-1913, Design and Construction of Levees
  - EM 1110-2-4000, Engineering and Design, Sedimentation Investigations of Rivers and Reservoirs
  - EM 1110-2-1420, Hydrologic Engineering Requirements For Reservoirs

- EM 1110-2-1601, Engineering and Design - Hydraulic Design of Flood Control Channels
- Fundamentals of Geotechnical Analysis, I.S. Dunn, Loren R. Anderson and F.W. Keifer, John Wiley and Sons, 1980
- Soil Mechanics, T. William Lambe and Robert V. Whitman, 1969
- Determination of Hydraulic Conductivity of Porous Media from Grain-Size Composition, Milan Vukoic and Andjelko Soro, 1992

A.16 MODBRANCH MODEL DOCUMENTATION REPORT

US Army Corps
of Engineers
Jacksonville District

Model Documentation Report, MODBRANCH and the C-111 Spreader Canal

Prepared by the U.S. Army Corps of Engineers, Jacksonville District

Prepared by

Robert A. Evans, Water Resources Engineering Branch

June 2009

Table of Contents

1.0 ..... Overview and Introduction
1.1 ..... Model Selection & Utilization
1.1.1 ..... Model Calibration and Verification
1.1.1.1 ..... Model Inputs & Assumptions
1.1.1.2 ..... Model Limitations
1.1.2 ..... Base and Alternative Simulations
1.1.2.1 ..... Base Configurations
1.1.2.2 ..... Alternative Configurations
1.1.3.1 ..... Performance Measures
1.1.3.2 ..... Discussion of Results

1.0 Overview and Introduction

This report documents the primary features for the MODBRANCH simulation of the alternatives developed for the C-111 Spreader Canal (C111SC) PIR1 project. The MODBRANCH model was used to estimate the environmental and flooding impacts of various planning conditions and alternatives.

For PIR1, five base conditions were used:

Pre-Drainage (NSMMB),
Existing Condition Base (ECB),
Initial Operating Region (IOR),
Future without CERP (FwoCERP), and
Pre-CERP Baseline (PCB1).

In addition to the base conditions, there were many preliminary configurations simulated. Analysis of these preliminary simulations resulted in a selection of six final alternatives. These were designated as Alternatives 1C, 1D, 2Dshort, 2Dlong, 3D, and 6D. The planning conditions and the final alternatives are described in more detail below.

1.1 Model Selection & Utilization

Because of the complex interaction between the Biscayne Aquifer and various drainage canals in the study area, simulations were done using the MODBRANCH model. MODBRANCH is a hybrid code that couples MODFLOW, a three-dimensional groundwater flow model with Branch, a one-dimensional canal routing model. The model code was originally developed by the United States Geological Survey (USGS). E. D. Swain and E. J. Wexler of the USGS coupled the models. More information on the creation of MODBRANCH may be found in "A Coupled Surface-Water and Ground-Water Flow Model for Simulation of Stream-Aquifer Interaction," (Swain and Wexler, USGS Open File Report 92-138). The U.S. Army Corps of Engineers further modified the model to more accurately represent the characteristics of the South Florida area.

Figure 1 shows the model domain (blue line) superimposed on an aerial photograph of the area. Major canals are shown in red. This figure illustrates the complexity of the area. Land elevations vary from the high Atlantic Ridge to the low Everglades. Land use varies from urban to suburban to agricultural to wilderness.

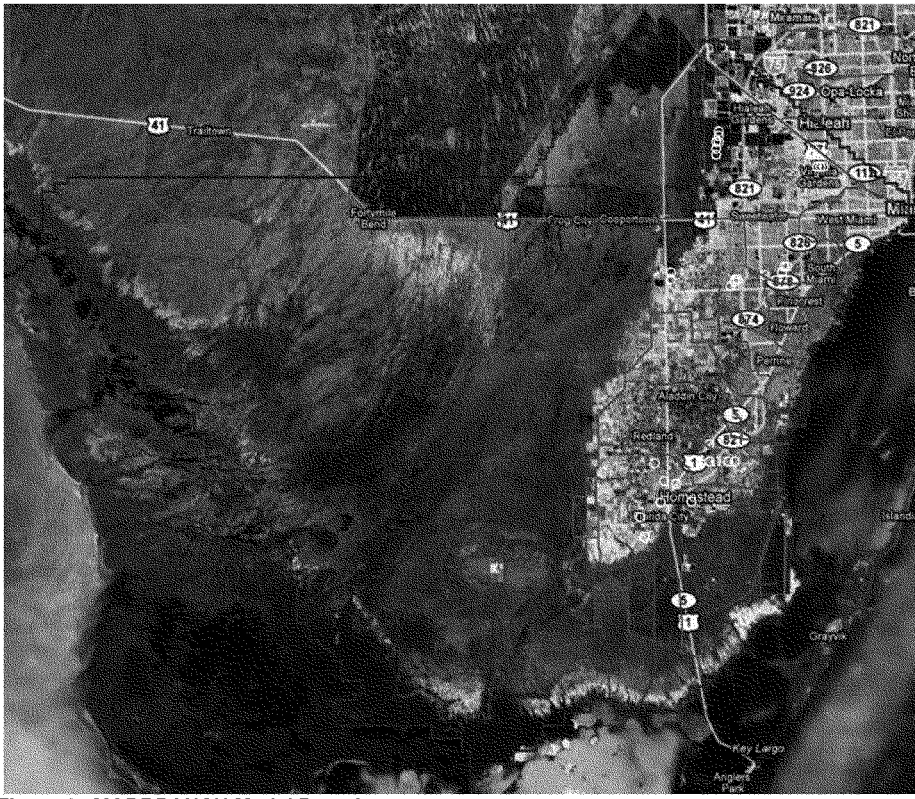


Figure 1. MODBRANCH Model Domain.

Both, ground water and overland flow are simulated by the MODFLOW part of MODBRANCH. MODFLOW is a pseudo-three-dimensional, finite difference, ground water model (McDonald and Harbaugh, 1988). This model requires defining a model "grid" of specified numbers of rows, columns, and layers. The width of each row or column is determined by required resolution in specific areas.

The model grid is shown in figure 2 with major canals superimposed. The model is bounded by the Biscayne Bay to the east; Florida Bay to the south; and, the Gulf of Mexico to the west. The northern boundary is roughly 2 miles north and parallel to the following canals: C-6, L-30, L-67C and L-29. The model grid is made up of 239 rows, 259 columns, and 5 layers. The grid resolution varies horizontally from a minimum of 207 feet to a maximum of 5000 feet. Levees are defined by using the *horizontal flow barrier* package of MODFLOW.

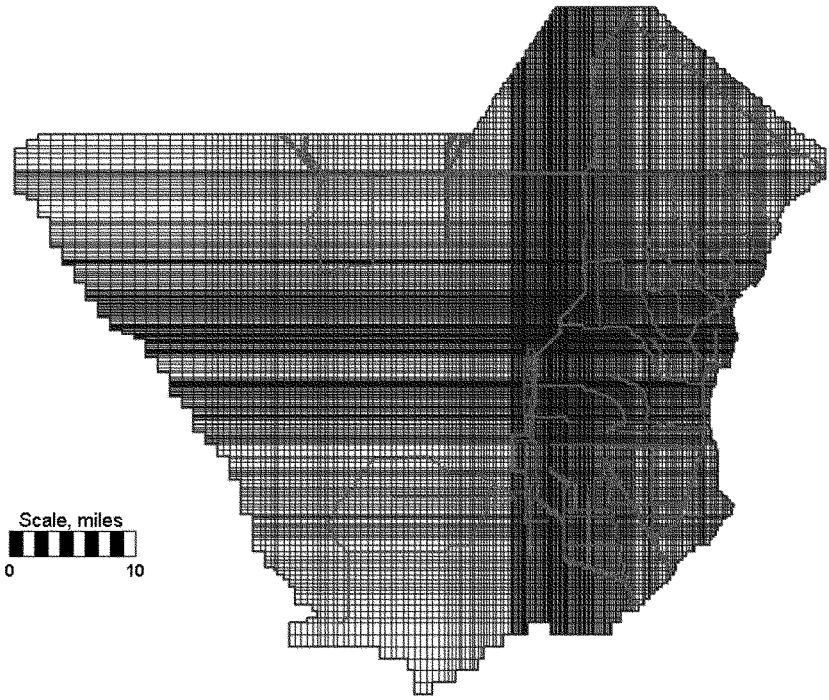


Figure 2. MODBRANCH grid.

The primary aquifers in the study area are the Biscayne and the Gray Limestone aquifers. The Biscayne aquifer is the dominant feature in the eastern part of the model while the Gray Limestone aquifer is the dominant feature of the west. Other hydrogeologic layers include the Gray Limestone confining unit and the surficial sediments (peat, muck, caprock, fine sand, marl, and marsh sediments).

1.1.1 Model Calibration and Verification

Model Development & Calibration

The U.S. Army Corps of Engineers, Jacksonville District, made additional model refinements and extended the model domain which was used in previous studies. Further information on the model development and the calibration can be found in "Calibration and Verification of the MODBRANCH (MB_2006) Numerical Model of South Florida" (Robert A. Evans, July 2007).

1.1.1.1 Model Inputs & Assumptions

A large amount of data is required to construct any numerical model. For the MODBRANCH model the input data and the assumptions are critical. For this study the required input data included topography, hydrogeology, rainfall, evapotranspiration, water sources, water sinks and behavior of various canal structures.

Topography

The topography used in this model was produced from a variety of sources (figure 3) which include LIDAR ("Light Detection and Ranging") data collected for the C-111, the CSOP, the WPA projects and USGS Helicopter data. The data collected were processed and the USACE Jacksonville GIS staff created a 100 foot topographic model of south Florida. This data set was sampled to a 200 foot model prior to being used to create the MB_2006 topographic data. Major roads, canals and levees were digitally removed from the data sets. Using the 200 foot model, a median value for each MB_2006 cell was calculated and assigned to the cell. Figure 3 shows the domain of each data source. Figure 4 shows the topography within the model domain.

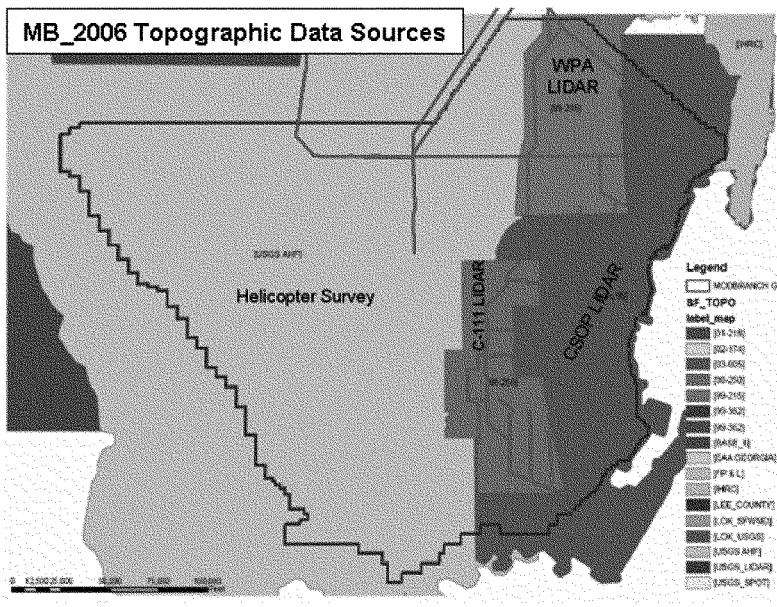


Figure 3. Extent of Topographic Data Sources with Model Domain.

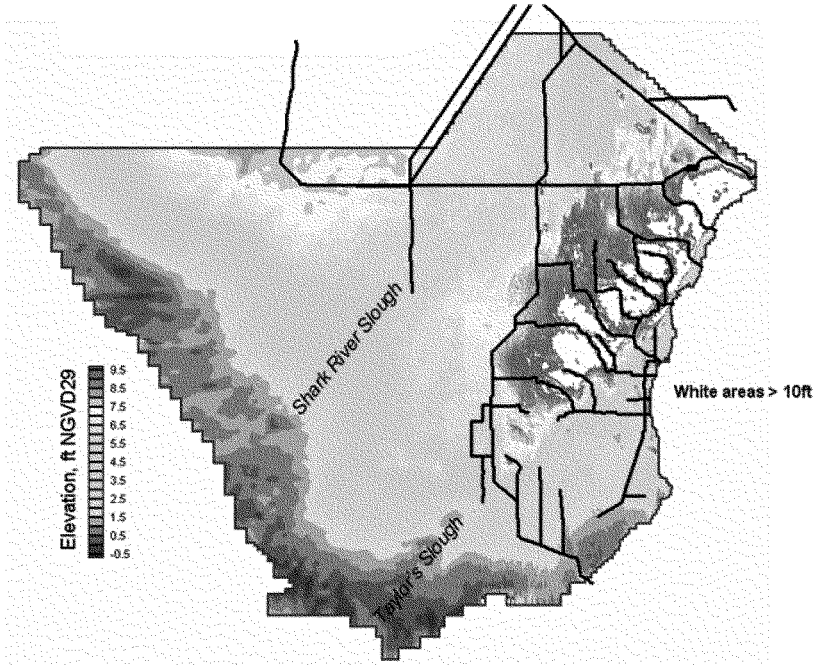


Figure 4. MODBRANCH topography.

Hydrogeology

The hydrogeology of the study area has been studied extensively by many investigators. The study area is underlain by the porous Biscayne Aquifer, which is part of the Surficial Aquifer system. The location and extent of the Surficial Aquifer system was defined by the Florida Geologic Survey based on recommendations of the Southeastern Geological Society in 1986. It consists of undifferentiated sand and gravel or marine limestone. In this case, the marine limestone of primary importance is the Biscayne Aquifer. The Biscayne Aquifer, of Pleistocene age, is the main potable aquifer in South Florida. It covers an area of approximately 4,000 square miles including all of Dade County (Randazzo & Jones, 1997). The Biscayne Aquifer consists of beds of highly permeable limestone and sandy-limestone of marine origin. The bottom of the Biscayne Aquifer is characterized by an abrupt change in sediment type where clays and marls of the Tamiami Formation or Hawthorn Formation are present. The Biscayne Aquifer is mostly an unconfined aquifer, although segments may exhibit semi-confined conditions initially. In general, the Biscayne Aquifer is well connected to surface water features including the various drainage canals that are located in the study area.

The MODBRANCH model utilizes five layers to define the hydrogeology of the study area. The top layer of the grid is used to simulate free surface, overland flow. As such, it is defined with a bottom elevation that is set at ground surface.

The stratigraphic sequence of aquifers varies throughout the model and is not uniform. There are "lenses" and "pinch-out" zones that are not known, but are obviously present. In order to build MODFLOW input files that described the layering certain assumptions had to be made. The domain was divided into five regions (see figure 5). The layers of each region were defined differently and are listed in table 1.

Note that the first layer is designated as "overland flow." This indicates that this layer uses modified Kadlec equation to simulate flow. Layer two is specified as "surficial sediments."

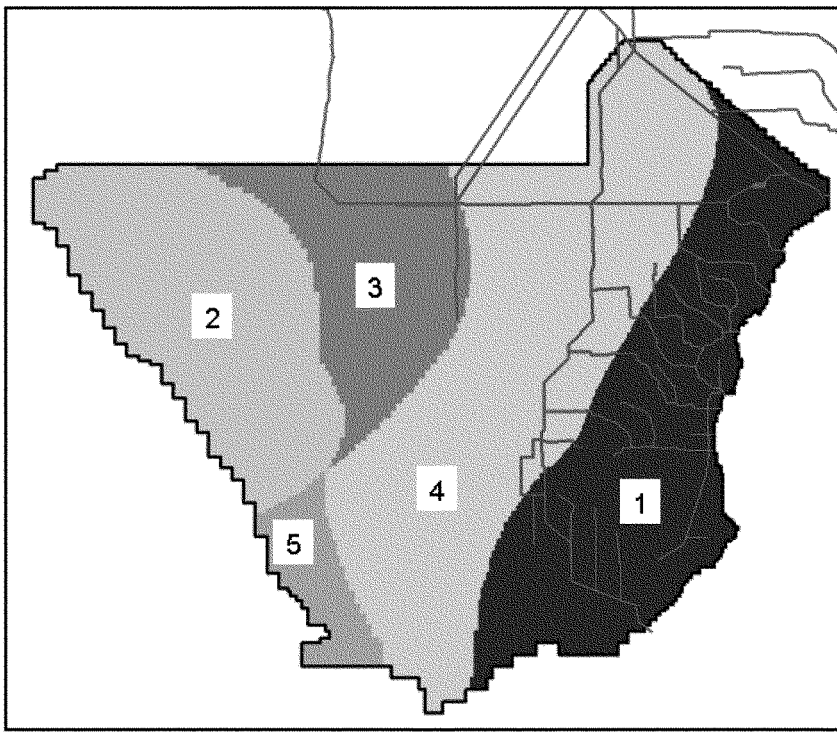


Figure 5. MODBRANCH Model Geologic Layer Zones.

Table 1. Layers by Sequence

Sequence #	*Direction of increasing depth →*				
	Layer 1	**Layer 2**	**Layer 3**	**Layer 4**	**Layer 5**
1	Overland Flow	Surficial Sediments	Biscayne Aquifer		Lower Clastics of Tamiami
2			Gray Limestone		
3			Gray Limestone Confining Unit	Gray Limestone	
4			Biscayne Aquifer	Gray Limestone Confining Unit	Gray Limestone
5			Biscayne Aquifer		Gray Limestone

Rainfall, Recharge and Evapotranspiration

The rainfall inputs were obtained directly from the SFWMM 2x2 inputs. The maximum potential ET was defined on a daily basis by using the same data the SFWMD uses for the SFWMM2x2. Figures 6-8 show the monthly total PET values at each of the nine locations for the average (1978), dry (1989) and wet (1995) years, respectively. Figure 9 shows a triangulated irregular network (TIN) with the vertices located at points with daily PET values. The MODBRANCH cells within each triangle were assigned daily PET values based on the equation of a plane through the three vertices.

Based on assigned extinction depths, rainfall and ET, net water flow into or out of the model is calculated. This water provides one of the driving forces in the model.

The application of both the rainfall and the ET can dramatically affect the ground water head fluctuations on both a day to day and long term basis. The values and approach used in this study were the best available at the time. The actual areal variation over time of both ET and rainfall is not known and the amount of error induced by this lack of information is not known.

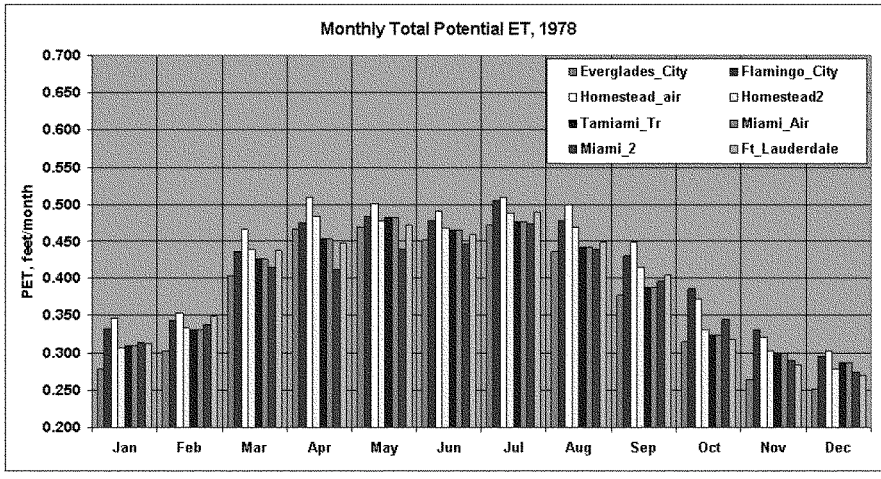


Figure 6. Monthly Total Potential Evapotranspiration, 1978.

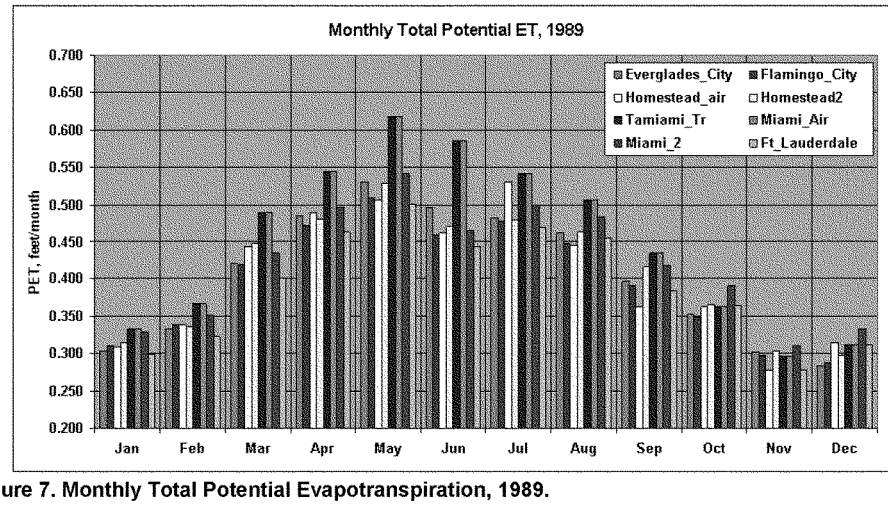


Figure 7. Monthly Total Potential Evapotranspiration, 1989.

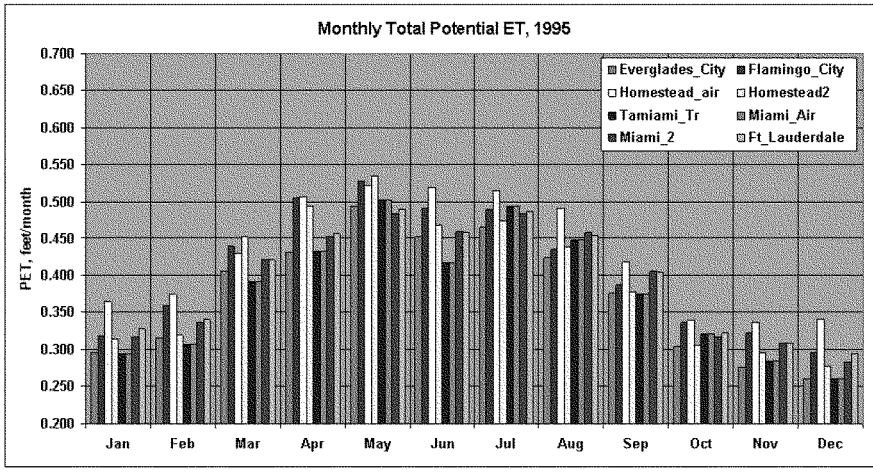


Figure 8. Monthly Total Potential Evapotranspiration, 1995.

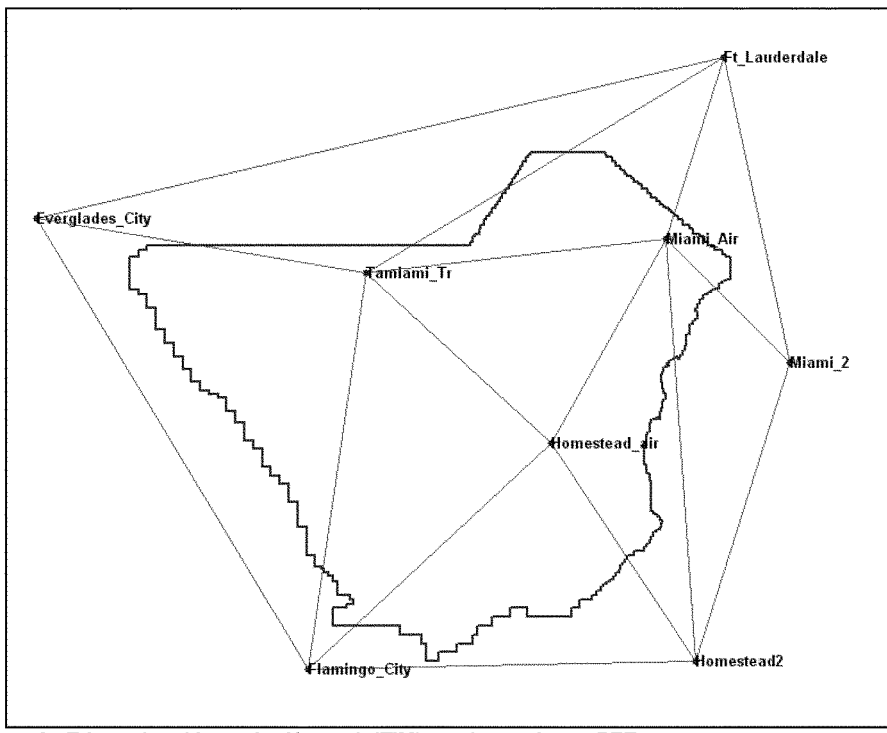


Figure 9. Triangulated Irregular Network (TIM) used to estimate PET.

Water Sources and Sinks

Important aspects of any model are the various boundary conditions. The boundaries represent sources or sinks for groundwater and surface water. Various types of boundary conditions can be used with MODBRANCH. For the purposes of this study variable head boundaries were applied along the northern edge of the model boundary, while the eastern, western and southern boundaries utilized values representing the daily mean tide elevation. The data utilized to assign the boundaries on the northern model edges were imported from the SFWMM 2X2 model and interpolated to the model grid. Note that the stress period for the MODBRANCH model is 1 day (subdivided into 24 time steps each), which matches the time steps of the SFWMM 2x2. Due to this 1 day stress period, the tidal heads assigned along the coastal side of the model were defined at a constant 0.5 feet, the approximate daily tide levels. Additional boundary inputs include the flow and stage in various canals (discussed below) and the location of municipal water wells. Further information of the development of various boundaries for the model is available in the MODBRANCH model Calibration report (Evans, 2007).

1.1.1.2 Model Limitations

All numerical model studies have limitations. Many of these are related to the specific computer code chosen for a particular study. Other limitations are related to the field data that is available or lack thereof. Lastly, model studies are also limited by the schedule dictated by project requirements. All of these limitations impart various sources of error or limit the evaluation to an appropriate level of detail. This model study does have limitations and should be used with caution.

A brief discussion of the limitations of this model study is included in the following paragraphs.

Rainfall boundary conditions

Rainfall is an important parameter, especially in the region of south Florida. The amount and timing of rainfall greatly affects the increase or decrease in stage (ground water and canal) and flows within the system. The rainfall boundary conditions used for this study were the same that are used as inputs for the SFWMM 2x2, as mentioned above. The spatial resolution of the data is 2 miles x 2 miles and the temporal resolution is 1 day. The MODBRANCH model could potentially give better results if finer resolution rainfall information were available. The fine data resolution is especially important for simulating ground water stages. Unfortunately, these data are not presently available. Future studies could include rainfall derived from NEXRAD or other methods, which would give rainfall at fine resolutions in both temporal and spatial terms.

Evapotranspiration boundary conditions

The total yearly evapotranspiration can equal or exceed the total rainfall for average and dry years, which means that evapotranspiration is an equally important boundary condition.

Variable head boundary conditions

The variable head boundaries, as mentioned above, were generated as a hybrid of SFWMM 2x2 output and tide data. Future model accuracy could be improved by using more observation wells and eliminating the inherent error found in using model output and harmonic tide data as boundary conditions. However, in order to implement harmonic tide data, the model stress period would need to be reduced from 1 day (24 hours) to less than 1 hour. Tide stage data is not available along every computation point. In order to define a tide stage at each point along the coast, a model of the ocean areas would need to be available.

Geologic parameters

South Florida's geology is extremely heterogeneous. Measurements and tests performed at one location can give distinctly different values when done 500 feet away. It is important to keep this in mind when considering the model results. The model considers the hydrogeologic parameters to be homogenous within each grid cell. While hydraulic conductivity and transmissivity vary from cell to cell, each is isotropic within the cell. Additionally, the parameters do not vary significantly between adjacent cells, increasing the degree of homogeneity of the model. The real world is <u>not</u> homogenous. There are indications that there are preferential flow paths within the surficial aquifer including voids, fractures and cavities. These preferential flow paths are <u>not</u> represented by the model inputs.

Canal leakance and hydraulic parameters

The canal leakance and other hydraulic parameters, which affect canal stage and flow, include Manning's n (roughness) and momentum coefficient. Nominal values of each were used throughout the study.

Structure operations and implementation

The model currently can simulate four types of structures: pumps, gated spillways, ungated culverts, and gated culverts. The current configuration uses only three: pumps, gated spillways, and gated culverts. When a structure is defined, it has a simple open/close (on/off) trigger level defined. However, all the structure definitions in the current configuration have an extended rule set which defines open (on) / close (off) criteria, maximum flow rates, and time periods that specific rules are in effect. Criteria for operation of a structure can be stage, flow, or relative difference between stage or flow. Stage criteria can be either canal or ground water stage. More detail on structure

operations can be found in the "Basic Procedure for Creating or Modifying a MODBRANCH MB_2006 Simulation" (Evans, 2007) and the "MODBRANCH 2000 manual" (Evans and Files, 2000). A short discussion of the operation of significant structures is found in Appendix A of this report.

Topography

The topography used (as stated above) is a composite derived from a variety of data sources. The accuracy of these data (some areas have σ exceeding 1.5 ft) can significantly affect both the results of the MODBRANCH model and the interpretation of the results. The model results can be affected by slight variations in elevations, since this would change the local land slope. A small change in topography could cause a significant change in flow direction due to the small water gradients found in the area. All elevation data used are referenced to NGVD29.

1.1.2 Base and Alternative Simulations

1.1.2.1 Base Configurations

There were five base model configurations simulated. These were :

Pre-Drainage (NSMMB),
Existing Condition Base (ECB),
Initial Operating Regime (IOR),
Future without CERP (FwoCERP), and
Pre-CERP Baseline (PCB1).

The Pre-Drainage simulation is commonly referred to as the NSM condition. However, this is confusing to some people who are used to using the term "NSM" for the SFWMD "Natural Systems Model." In fact, this version of MODBRANCH does use the SFWMD NSM model for boundary conditions (version used is NSM4.6F). The Pre-Drainage model uses the same MODBRANCH domain and inputs with the exception of the branches and rules files and some of the parameter files that are affected by land use (ET parameters and overland flow parameters).

The Pre-Drainage results are used as a target for a number of the performance measures. The most significant exceptions are the CSSS PMs; under the NSM or Pre-drainage conditions, the CSSS would not do well.

Figure 10 shows the configuration of the Existing Condition Base (ECB), which represents conditions in 2006-2007. ECB includes pumps S332B and S332C which put water into the C-111 detention areas (see zoom in). In addition, there are various detention areas and flow ways created out of the Frog pond area. The structure

operations are defined by the "Interim Operating Plan" (IOP), which was put into place to help protect the endangered Cape Sable Seaside Sparrow.

Boundary data is extracted from the SFWMD 2x2 model known as: ECB2.0_2006-2007_WMM5.6.4_LO_0613089. In addition, a number of structures are operated to match the 2x2 flows. These structures are: S-333, S-334, S-343a, S-343b, and S-335.

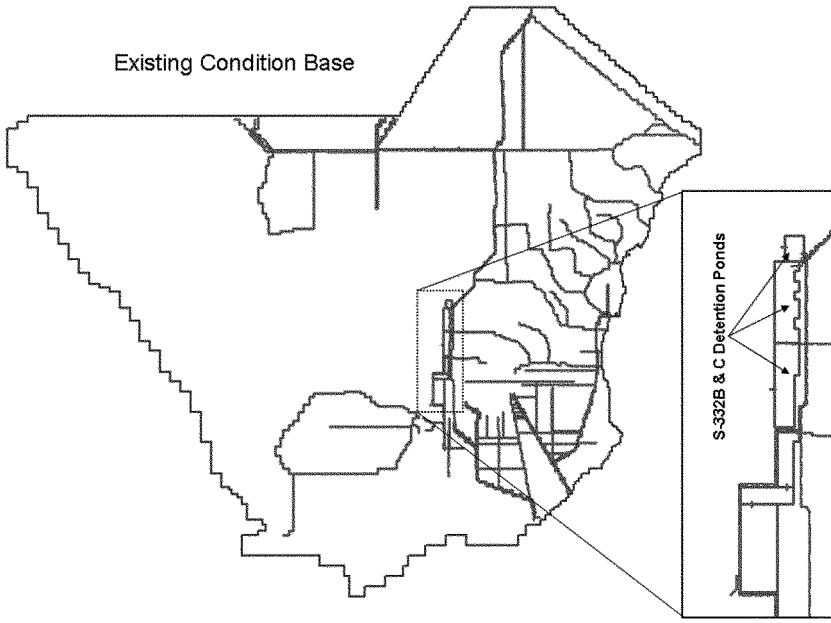


Figure 10. MODBRANCH Existing Condition Base (ECB) configuration.

The Initial Operating Regime (IOR) configuration is similar to the ECB configuration but there are changes in the Frog Pond area that have occurred since the ECB configuration and that will be in place by 2010. Figure 11 shows the configuration differences between the ECB and the IOR. Boundary conditions for the IOR simulations are extracted from the SFWMD 2x2 simulation of IORBs2.0_WMM5.6.4_LO_0613089. Operational rules for S-333, S-334, S-343a, S-343b, and S-335 are based on the 2x2 flows.

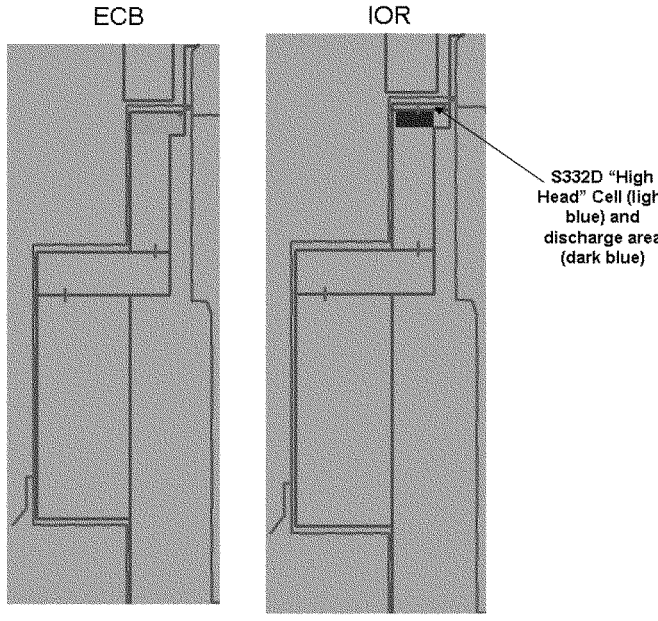


Figure 11. Configuration Differences in the Frogpond Area, ECB and IOR.

The Future without CERP (FwoCERP) is an attempt to define the system as it would be in 2050 without CERP projects. Figure 12 shows some of the details in the project area. Model input changes are made reflecting predicted land use, well pumpage and stages. These changes affect the hydraulic conductivity (overland flow), the ET parameters, and the production wells. The rule files are changed slightly depending on the structures rules that are based on flows. The horizontal flow barrier (HFB) files are changed to reflect that culverts will be installed along US-1; these are represented as gaps in the barriers that represent US-1. In addition, L31W is backfilled from the upper end to S-175; below the S-175 structure the canal is plugged. Both S-175 and S-332 are removed.

The stage and canal boundary conditions are obtained from the SFWMM2x2 2050B3_NORD0_WMM5.4.3_053105 simulation.

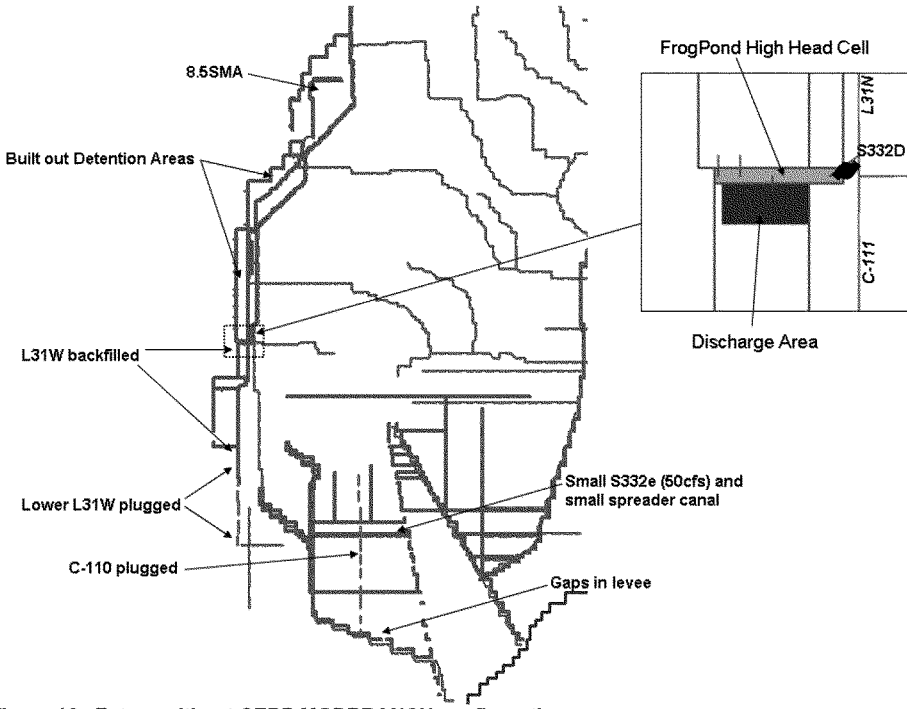


Figure 12. Future without CERP MODBRANCH configuration.

The pre-CERP baseline (PCB1) is defined by the hydrologic conditions on the date of enactment of WRDA 2000. The operations are based on the 2000 ISOP v5.4 rules. The boundary conditions are based on the PCB1_V5.4.2_111604 SFWMM 2x2 simulation. The PCB1 configuration is shown in figure 13. Note that there is only a small detention pond (S332B) and that L31W is not backfilled. This represents the system configuration and structure operations on 11 December 2000. The canal and levee configuration differs from the ECB in that the latter has the S332B/C detention ponds (compare to figure 10). There are also operational differences.

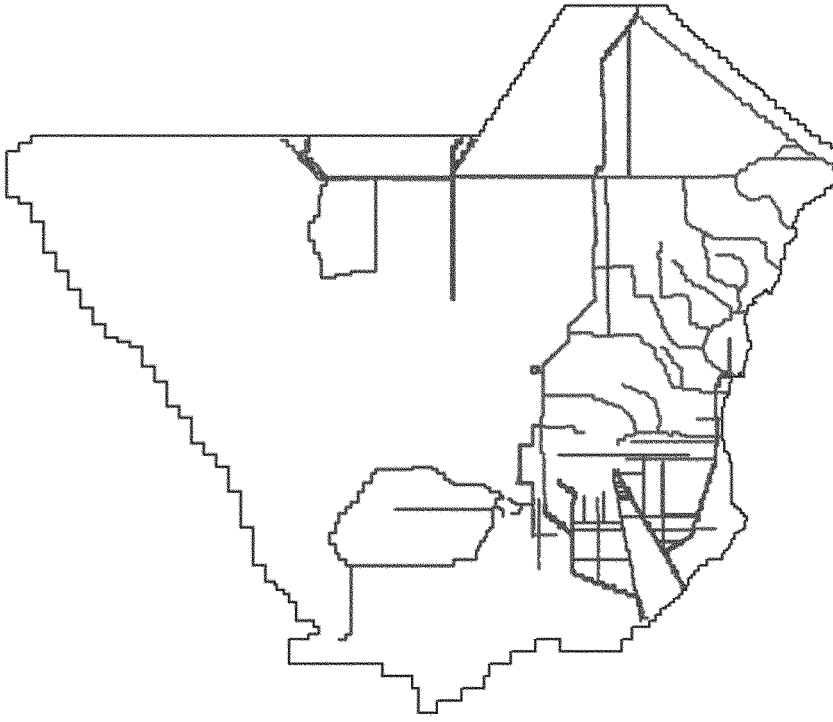


Figure 13. Pre-CERP Baseline MODBRANCH Configuration.

1.1.2.2 Alternative Configurations

Six final alternatives were selected for in-depth analysis under PIR1. These were designated as Alternatives 1C, 1D, 2Dshort, 2Dlong, 3D, and 6D. Each was simulated for the wet, dry and average years (1995, 1989, and 1978, respectively). A short description of the test alternatives is given here for informational purposes

Formulation and evaluation of the alternatives requires that the base is the FwoCERP configuration. However, savings clause analyses require using the ECB configuration. In both cases, the only changes to the base configuration, rules or boundary conditions are due to the specific modifications required for each alternative.

Alternatives 1C, 1D, 2D (short and long), and 3D will include a new pump station (S-200) to be constructed downstream of S-176. When triggered by increased stages between S-176 and S-177, the pump station will route water to a 510-acre (exterior dimension) (~560-acres in MODBRANCH model) above-ground impoundment Frog

Pond Detention Area, (FPDA) which will be constructed within the southern portion of the South Florida Water Management District (SFWMD)-owned Frog Pond Lands. The MODBRANCH configuration of the FPDA is shown in figure 14.

For alternatives 1C, and 1D, the pump station will include three 150 CFS pumps, at total of 450 CFS. For alternatives 2D (short and long) and 3D, the pump station will include three 75 CFS pumps, a total of 225 CFS.

For all the aforementioned alternatives, the pumps will be modeled to pump sequentially at elevations at or above 3.8, 3.9, and 4.0 (all ref NGVD). For all the aforementioned alternatives, pumping will be discontinued if the water elevation within the southernmost header canal exceeds two and a half feet above the local GSE (ground elevation 5.2 NGVD). Pumping at S-200 will also cease if the water depth at a point (figure 15) within the CSSS area C/U2 exceeds a depth of ten centimeters during the critical portion of the CSSS nesting season (February 1st thru July 15th). The model ground elevation at that point is 5.6' NGVD; the "off" trigger is then 5.93' NGVD.

The western portion of the FPDA will consist of a header canal with cascading water levels maintained by a series of internal weirs. As modeled, two 80' long east-west weirs are at 1/3 points along the length of the header canal. The weir elevations will be 0.5' above adjacent existing grades (ground el. 5.71 NGVD and 5.23 NGVD, respectively). Just upstream of the header weirs, and just upstream of the southern levee of the southern detention area cell, 80' long header overflow weirs will be modeled at elevations 1.2' above adjacent existing grades (ground el. 5.71 NGVD, 5.23 NGVD, and 4.8 NGVD, respectively). The conveyance from pump station S-200 to the header cell will be modeled as a fully lined channel. This minimizes the leakage between the channel and the aquifer; it is not possible in the model to have an "above ground" channel.

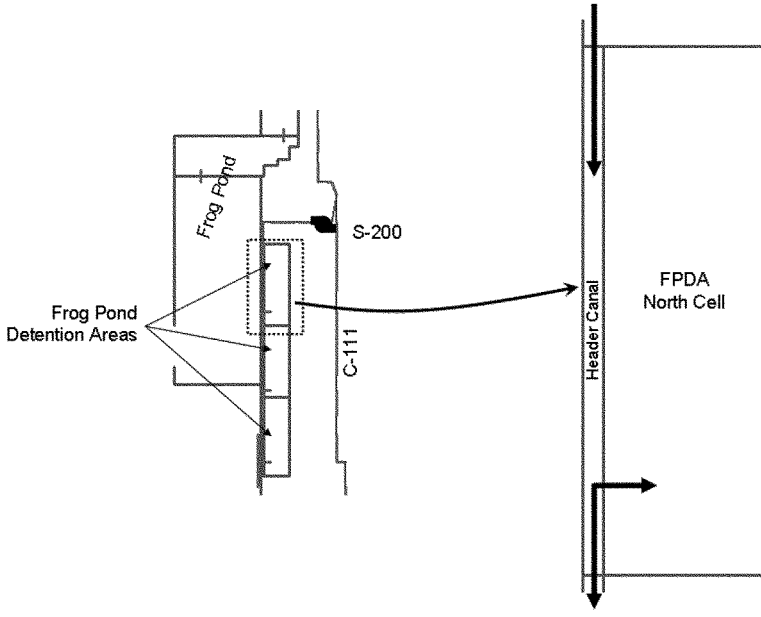


Figure 14. Detail of Frog Pond Detention Area.

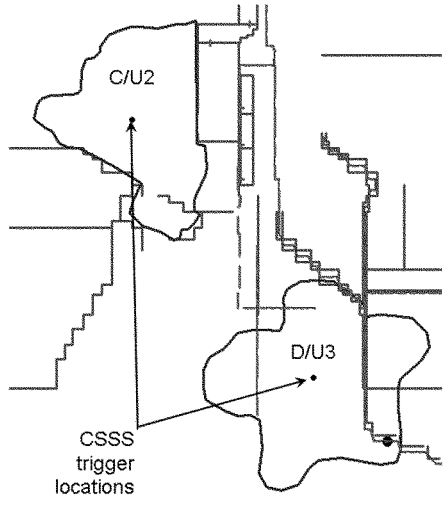


Figure 15. Location of Cape Sable Seaside Sparrow trigger locations.

Note that all the "D" alternatives have three features in common, shown in figure 16. These features are S-198, a plug in L31E near S-20a, and operational changes to S-20.

The S-198 structure will be constructed in the C-111 Canal just upstream of the C-110 Canal. The operable "S-197 like" structure is intended reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction. From a modeling perspective, the structure will be modeled exactly the same as S-197. A permanent plug will be installed within the L-31E just upstream of S-20A. From a modeling perspective, the plug will be a structure that is always closed and never passes any water.

S-20 normal operation is divided into wet and dry periods. During the dry period (15 October to 15 April) a maximum flow of 450 CFS is passed when the headwater is greater than 1.4' NGVD and up to 750 CFS when it is greater than 1.9' NGVD. During the wet period (15 April to October 14) a maximum flow of 450 CFS is passed when the headwater is greater than 2.4' NGVD and up to 750 CFS when it is greater than 2.9' NGVD. For all "D" alternatives, the open and close triggers were raised 0.5'.

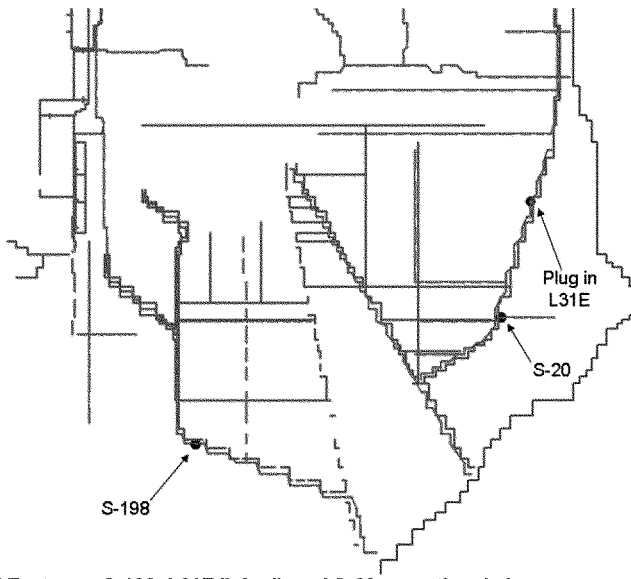


Figure 16. "D" Features: S-198, L31E "plug", and S-20 operational changes.

Alternatives 2Dshort and 2Dlong differ in the extent of the Aerojet canal that is utilized. Figure 17 shows the difference between the alternatives.

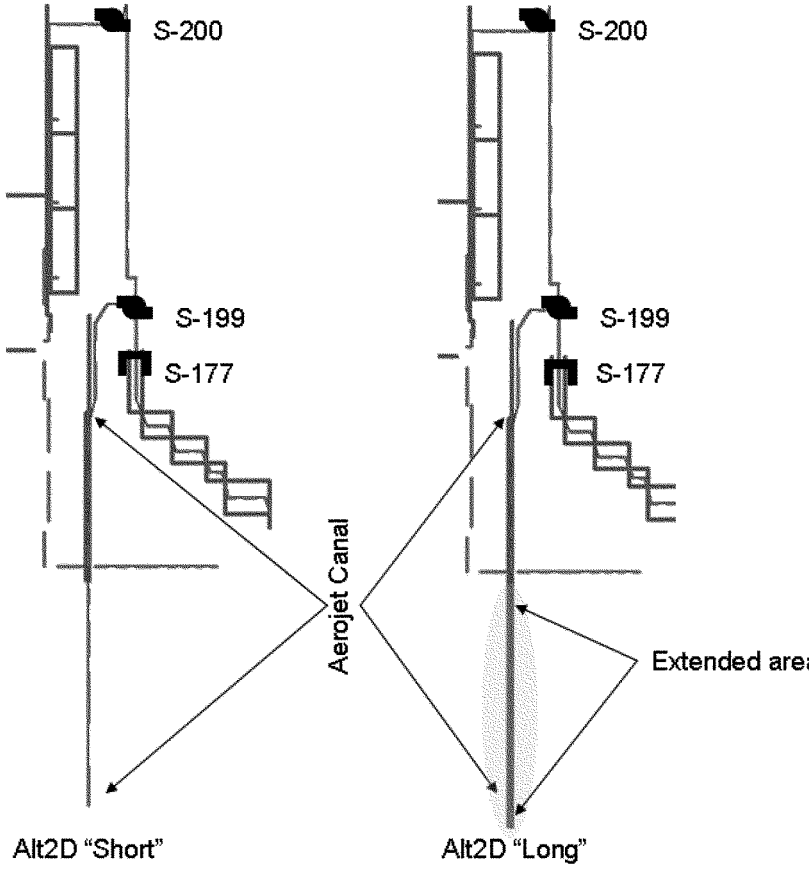


Figure 17. Configuration Difference between Alternative 2D "Short" and 2D "Long"

The Aerojet Road Canal begins approximately one mile south of Ingraham Highway (SR 9336). Although the canal spans a distance of approximately 4.8 miles, the canal is effectively plugged at six areas described as existing plugs 1-6 on SFWMD's Figure 4-6 dated 11/19/08. Plugs 1-6 will be modeled as earthen plugs (with crest elevations matching adjacent existing grades). Since the ground elevations vary elevations used to determine operations will be interpolated from a linear fit to the local elevations (figure 18).

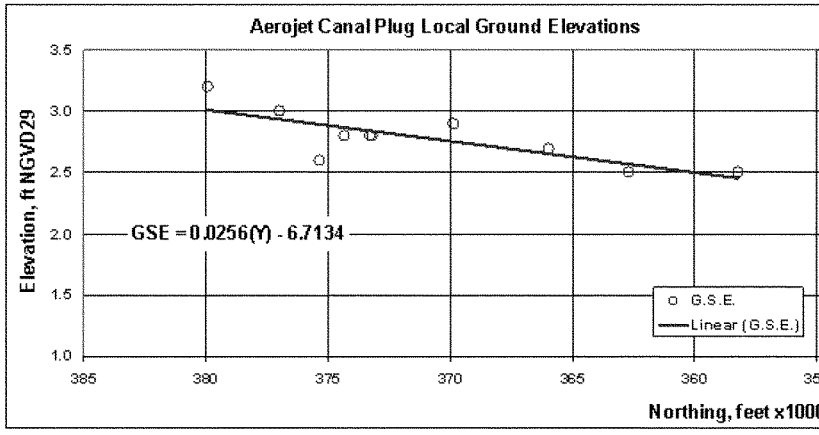


Figure 18. Linear fit to ground elevations along Aerojet Canal.

Figure 19 shows the locations of both the existing and proposed plugs for the alternatives 2D short, 2D long and 3D.

In alternative 2D short, three new plugs will be inserted; one ("proposed 3") is within the main Aerojet canal and two ("proposed 2" and "proposed 4") are in the east-west borrow canal). The proposed 3, and existing 6, 5, & 4, will be modeled as weirs with crest elevations 1' below adjacent existing grades (ground elevations are 2.8, 2.87, 2.84, and 2.82, respectively). The proposed plug 2 will be closed always due to the fact that the berm will be crossing this canal; proposed plug 4 will be set at local ground elevation, 3.2' NGVD. From a modeling perspective, water in either of the Alternative 2D's will not overtop the berm that surrounds the Aerojet canal.

In alternative 2D long new plugs will be constructed at the locations described as Proposed 1 & 3 (on the same figure), and the new plugs, and existing 6, 5, 4, 3, and 2 will all be modeled as weirs with crest elevations 1' below adjacent existing grades (ground elevations 2.5, 2.8, 2.87, 2.84, 2.82, 2.8, and 2.73 ft NGVD, respectively). Both alternatives 2D short and 2D long will also receive the plugs in the east-west borrow canal described as proposed 2 & 4. Proposed plug 2 is closed always due to the berm passing over it. Proposed plug 4 will be modeled with crest elevations matching adjacent existing grades.

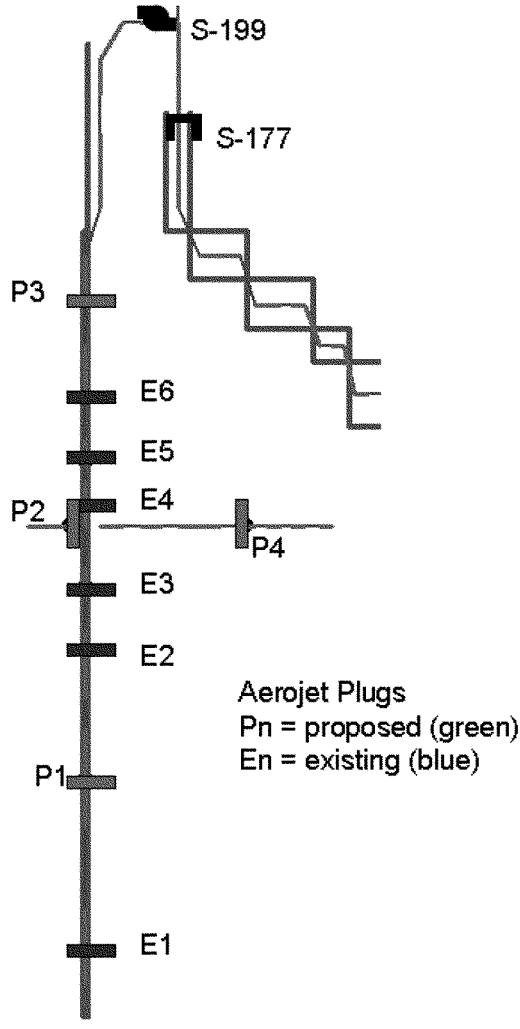


Figure 19. Location of Existing and Proposed Plugs, MODBRANCH Configuration.

Alternative 3D is similar to Alternative 2D "short" except water is not put into the Aerojet canal, but is put into a reservoir (designated as the "Aerojet Reservoir") (figure 20). In alternative 3D, existing plugs 6, 5, & 4 (figure 19) will be removed and 75 CFS pump station will be installed to collect seepage from the adjacent detention area to the west. The pump station will feature three 25 CFS pump stations which incrementally turn on at Aerojet canal elevations above 2.5, 2.6 and 2.7 ft NGVD.

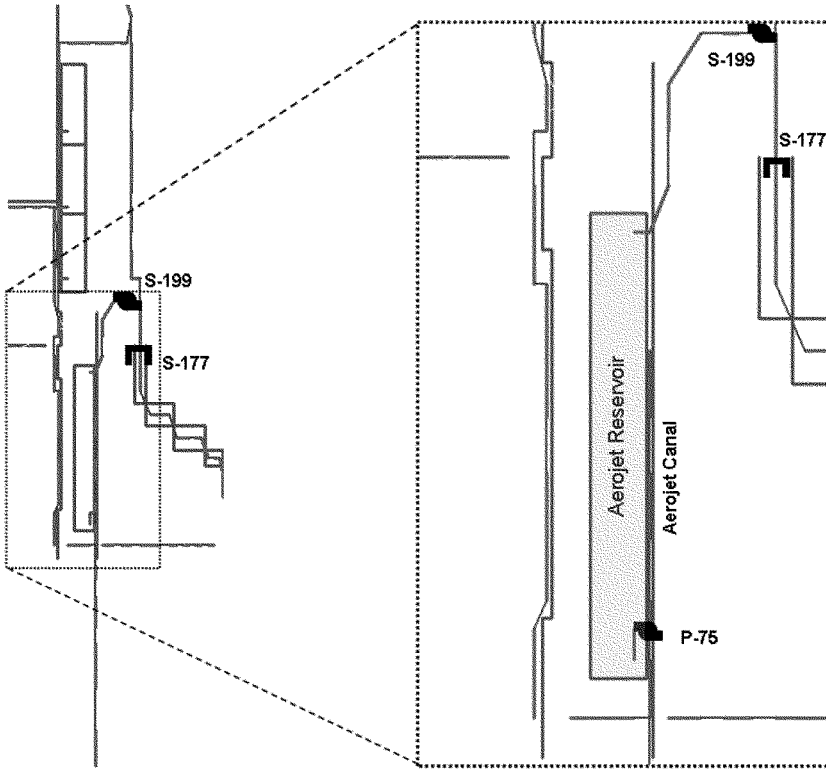


Figure 20. Alternative 3D configuration.

Alternative 6D includes the "D" options (S-20, S198, and the plug near S-20A) and an approximately 10 mile long, fully penetrating barrier. This barrier runs from the top of

the Frog pond area south to the approximate latitude of S-18C (figure 21). It is just west of the Aerojet Canal.

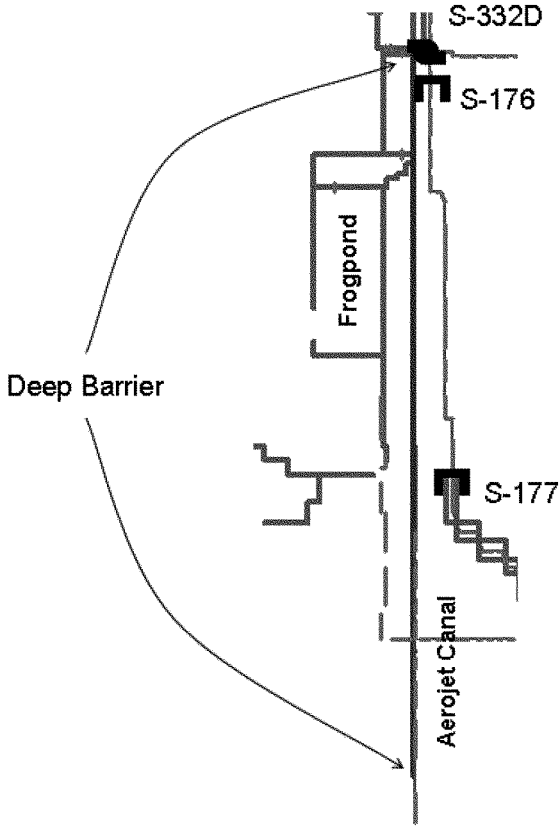


Figure 21. Alternative 6D configuration. Barrier location is in blue.

1.1.3.1 Performance Measures (PMs)

The MODBRANCH model outputs stage and flow for both 3D groundwater/ surface water and the 1D canal flow. Stage (ground water and canal) and flow (canal) values can be compared directly to field measurements to validate the model. These are representative of directly measured data and could be considered a "first-order PMs."

However, analysts in different disciplines require values that are derived functions of stage and/or flow and can not always be directly measured. These values vary from flow rates/volumes across transects, hydroperiods, and various "habitat units" which generally are "pure numbers" and are useful in relative comparisons between alternatives. A PM such as hydroperiod, which is dependant on a first order value (stage) and a constant (land elevation) can be considered more accurate than a PM computing salinity outside of the model domain by the use of regression equations. Although both PMs may be useful, the hydroperiod could be viewed as a 2nd order PM while the estimated salinity values would necessarily be higher order. In general, the more manipulation required to produce the performance measure, the less useful it will be.

A number of post-processing utilities have been created to convert the MODBRANCH output into "performance measures." These data sets were provided to the end users to evaluate the alternatives. The data were provided as Excel spreadsheets, text files of "comma-separated-values" (*.csv), short video files of stage and stage differences, and posted on interactive GIS web site.

A short discussion on the types of data provided follows; more detail on the analysis can be found by contacting the end users.

Spreadsheet File: MB_2006_C111SC_CSSS_drywet_data_2D.xls

This is a spreadsheet (figure 22) with data applicable to the Cape Sable Seaside Sparrow habitat. For each cell in the MODBRANCH model, the location, the row & column, the cell ground elevation, the size and the unit ID (U1, U2, U3, U4, and U5) are given (figure 23). The data presented here can be manipulated by the end users (USFWS) either in Excel or via a GIS package.

For each simulation the following information is presented:

Yearly Hydroperiod;
Maximum continuous dry period (1 March to 15 July);
Total number of dry days (1 March to 15 July); and,
Maximum continuous period that the depth > 20 cm (15 March to 30 June).

C111 Spreader Canal PM E.C. 3.3 Cape Sable Seaside Sparrow Nesting Condition
Longest dry period & number of dry days (1 March to 15 July)
Yearly Hydroperiod and Maximum Period depth > 20cm (15 March to 30 June)

							NSM_1978				NSM_1989			
X	Y	Row	Column	Ground Elevation (ft)	Area (acres)	CSSS Habitats (Units 1-5)	Hydroperiod	Max Dry Period (days)	Total Number of Dry Days	Max Period (days) Depth > 20cm	Hydroperiod	Max Dry Period (days)	Total Number of Dry Days	Max Period (days) Depth > 20cm
585500	529131.6	33	1	0.7	207.5	na	0	136	136	0	0	136	136	0
585500	527113.8	34	1	0.9	255.7	na	0	136	136	0	0	136	136	0
585500	524725.1	35	1	0.7	292.6	na	0	136	136	0	0	136	136	0
585500	522225.1	36	1	0.8	281.3	na	0	136	136	0	0	136	136	0
585500	520663.4	37	1	1.2	77.2	na	0	136	136	0	0	136	136	0
585500	520041.6	38	1	1.2	65.5	na	0	136	136	0	0	136	136	0
585500	519376.2	39	1	1.2	87.2	na	0	136	136	0	0	136	136	0
585500	518569.3	40	1	1.1	98	na	0	136	136	0	0	136	136	0

Figure 22. Example of post-processed MODBRANCH data in an Excel spreadsheet.

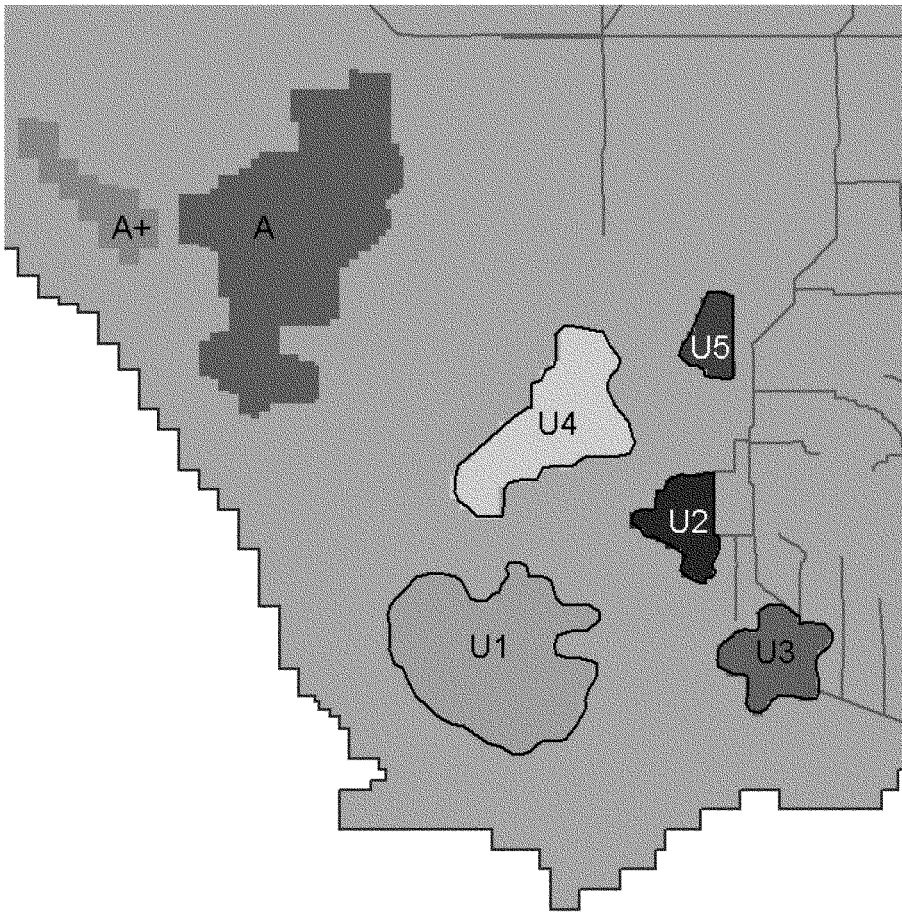


Figure 23. Cape Sable Seaside Sparrow (CSSS) Critical Habitat.

Spreadsheet File: MB_2006_C111SC_CSSS_binned_areas_2D.xls

This file contains similar data as **MB_2006_C111SC_CSSS_drywet_data_2D.xls**, but is not on a cell-by-cell basis. Instead it is binned according to number of days and acreage. The file contains: direct post-processed data from the simulations and a summary of the results as requested by the USFWS.

Spreadsheet File: MB_2006_C111SC_CSSS_score_E.C.3.3_FwoCERP.xls

This file (and the one called **MB_2006_C111SC_CSSS_score_E.C.3.3_EXTRA.xls**) contains performance score based on longest dry period 1 March to 15 July. A score is assigned based on the original CSSS habitat indicator areas (B, C, and D) (figure 24). This is related to the CSSS nesting condition. The basic score and number of acres with that score are given. Area weighted scores and summary (figure 25) are also given. In the files with *FwoCERP* in the name, only files necessary for alternative evaluation are included. The files with *EXTRA* in the name include the results for other simulations.

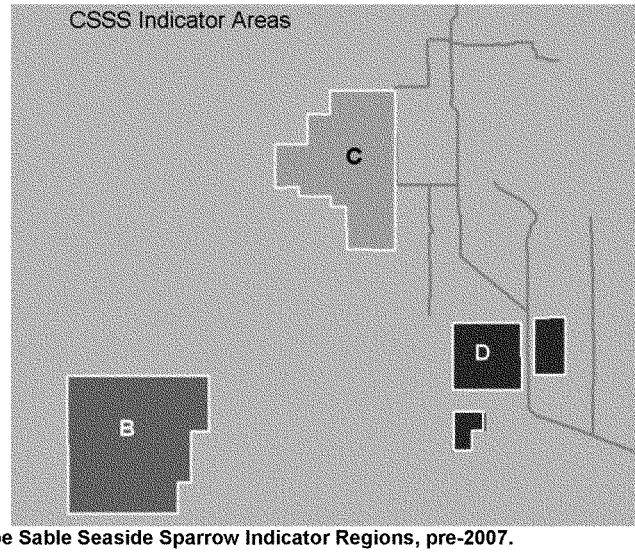


Figure 24. Cape Sable Seaside Sparrow Indicator Regions, pre-2007.

Simulation	CSSS Nesting Area Weighted Scores for Area B acres =			
	Average Year	Dry Year	Wet Year	3-year Composite Score
NSM	0.48	1.00	0.14	0.52
FwoCERP	0.69	1.00	0.47	0.71
FwoCERP_1C	0.69	1.00	0.47	0.71
FwoCERP_1D	0.69	1.00	0.47	0.71
FwoCERP_2DL	0.68	1.00	0.46	0.71
FwoCERP_2DS	0.69	1.00	0.46	0.71
FwoCERP_3D	0.68	1.00	0.46	0.71
FwoCERP_6D	0.68	1.00	0.47	0.71

Scale	
0.1 to 0.5	Degraded to Declining
>0.5 to 0.7	Sustainable
>0.7 to 1.0	Target

Figure 25. Example of the CSSS "score".

Spreadsheet File: MB_2006_C111SC_WadingBirds_E.C._3.2.xls

This file contains wading bird performance measures by "indicator region" based on recession rate, reversals, and prey productivity. The indicator regions are shown in figure 26. There are two "summary" tables. The first ('summary') gives the score as calculated and each indicator region weighed the same, regardless of the size. The second is an area weighted summary. Although the spreadsheet has a summary that ranks the alternatives, this is not the official ranking of the USFWS.

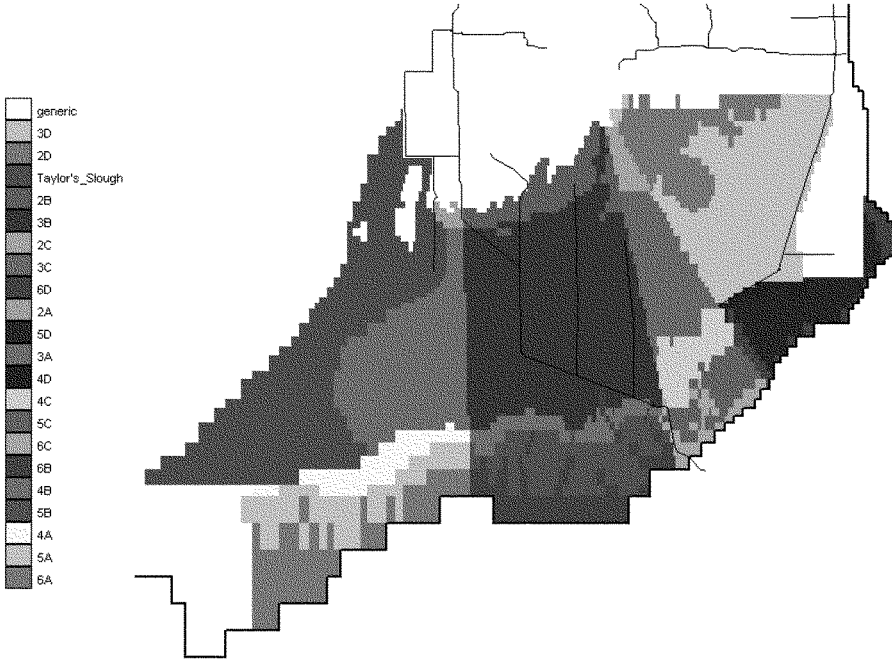


Figure 26. Wading Bird Indicator Regions.

Spreadsheet File: Wading_Bird_Habitat_units.xls

This file contains wading bird habitat units computed as instructed by the USFWS. The data by alternative and by week are presented. These values are normalized by dividing by the total area in each indicator region. Scores for each indicator region (figure 26) are computed and shown (figure 27). The area-weighted scores were devised by the Corps of Engineers and are for informational purposes only.

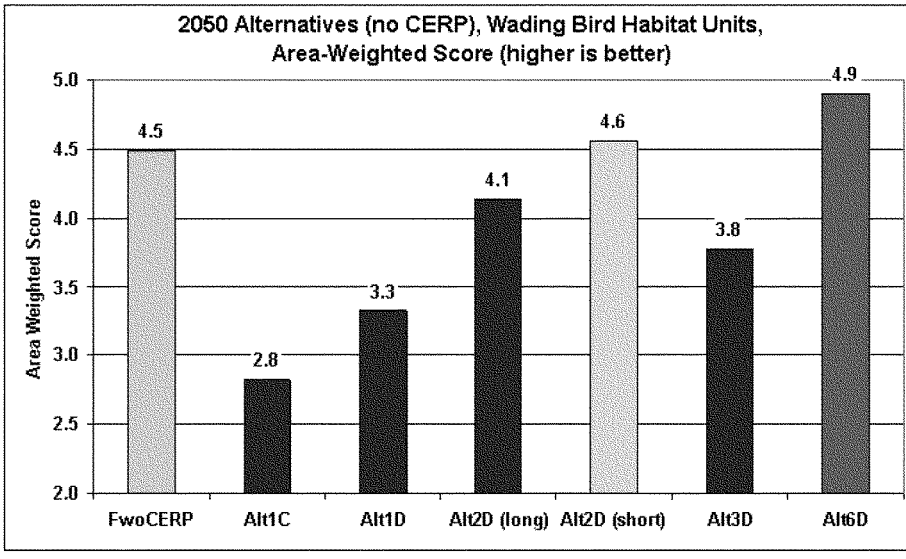


Figure 27. Wading Bird Habitat Units (area-weighted).

Spreadsheet File:
MB_2006_C111SC_MarlPrairie_VegMosaic_E.C._2.1_FwoCERP.xls

This has the Marl Prairie performance measures for the *FwoCERP* base and alternatives. This is comprised of the fraction of indicator region area within specified hydroperiod ranges. There is also a similar file (**MB_2006_C111SC_MarlPrairie_VegMosaic_E.C._2.1_EXTRA.xls**) with other simulations.

Spreadsheet File: MB_2006_C111SC_HP_areas_general_PM_FwoCERP.xls

This file contains tabular data showing area (acres) within Indicator Regions with hydroperiods in specified ranges. It also contains the percentage of the indicator region area within the hydroperiod bin. An analysis that computes the correlation between the alternatives and the NSM simulation is also presented.

Spreadsheet File: MB_2006_C111SC_Annual_Inundation_E.C._1.1_FwoCERP.xls

This file contains tabular data with yearly values of the maximum, 25%, 50%, 75%, and minimum ponding depths in each indicator region. Also presented are a summary of the data, the maximum, 25%, 50%, 75%, and minimum ponding depths in each indicator region for each day of the simulated year and the daily average ponding depth in each indicator region.

Spreadsheet File: MB_2006_C111SC_IR_HiLo_Area_E.C._1.3.xls

Shows the number of days in each year in which the water is either below or above the low or high water stage criteria. Data are delineated based on indicator regions. The data show the number of days in each year in which the water is either below or above the low or high water stage criteria, respectively. The stage criteria are based on the MB_2006 "pre-drainage" or NSM simulations. The criteria represent the 95% low or high stages in each cell.

Spreadsheet File: MB_2006_C111SC_IR_PMs_E.C._1.3.xls

This contains data related to high and low water events for <u>each cell</u> in the indicator regions. The values for the various alternatives are relative to the NSM 95% high and low for each of the three years simulated. For each alternative the number of days out of 365 the stage is either below the low or above the high of NSM. The number of times the water rises above or goes below the high and low NSM levels is also included.

Additional Files

There are a number of files that are found in "zipped" folders.

CSSS_area_stage_exceed.zip contains 6 spreadsheets. Each contains an analysis of CSSS habitat area average stage and frequency of exceedance. A typical file name is *CSSS_HabitatUnit_AveStage_and_FreqExceed_1978_FwoCERP.xls.* This particular file will have data for all the alternatives based on the future without CERP. An example of the results found here is shown in figure 28.

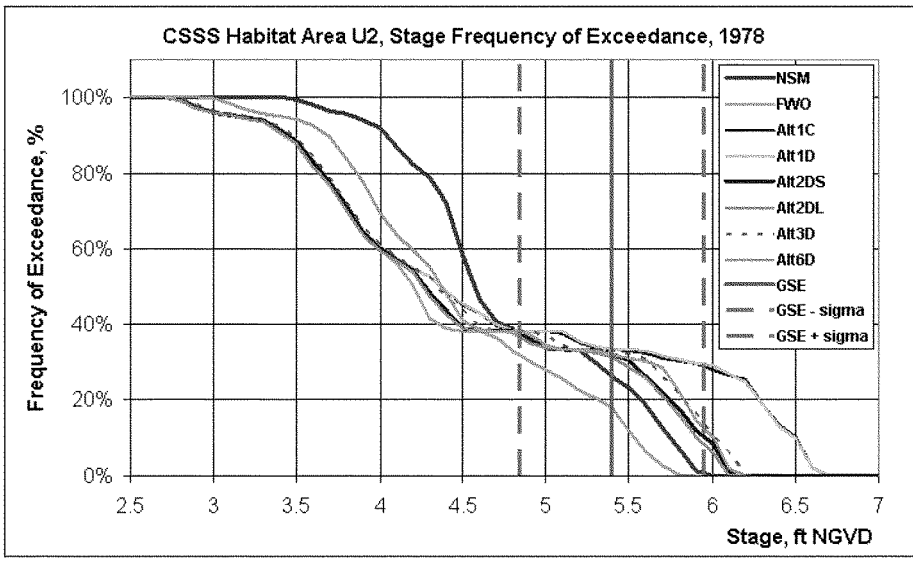


Figure 28. Frequency of Exceedance curve, CSSS area U2, 1978 (FwoCERP base)

FWS_csv.zip contains a separate data file (comma separated variable format) for each simulation. The data include Wading Bird Recession Rate and Foraging Depth Suitability Indices (Jan-Apr & Nov-Dec) by week. These values are given for each cell in the indicator regions. These files can easily be imported to GIS programs or Excel.

Flows_PM_1.5_FwoCERP.zip and **Flows_PM_1.5_ECB.zip** are zipped folders of *.csv files. These files can be imported directly into Excel spreadsheets. The data are flows across various transects. Figures 29 – 35 show the flow transects found in these files. Many transects were specified in earlier phases of the study and are generally not used. However, they are provided here to maintain continuity.

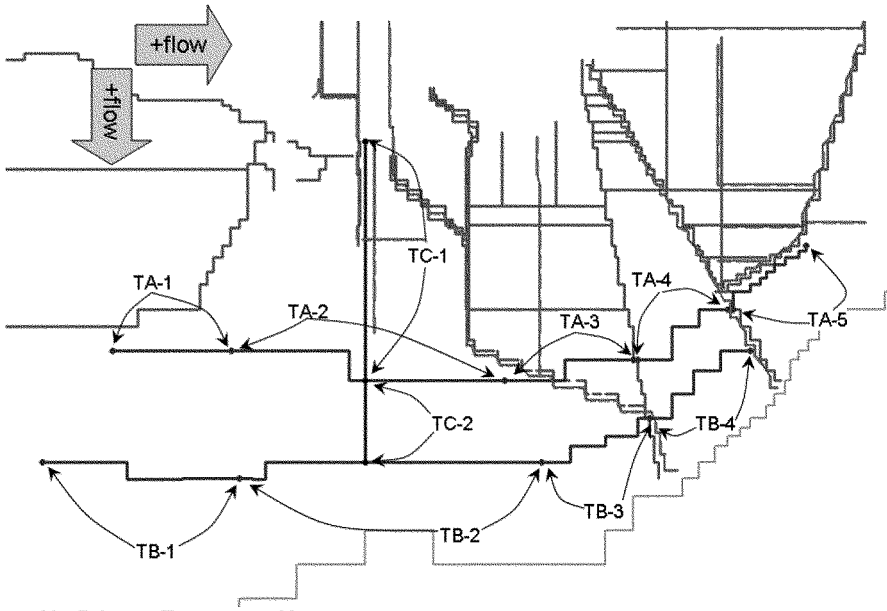


Figure 29. Primary Transects of interest.

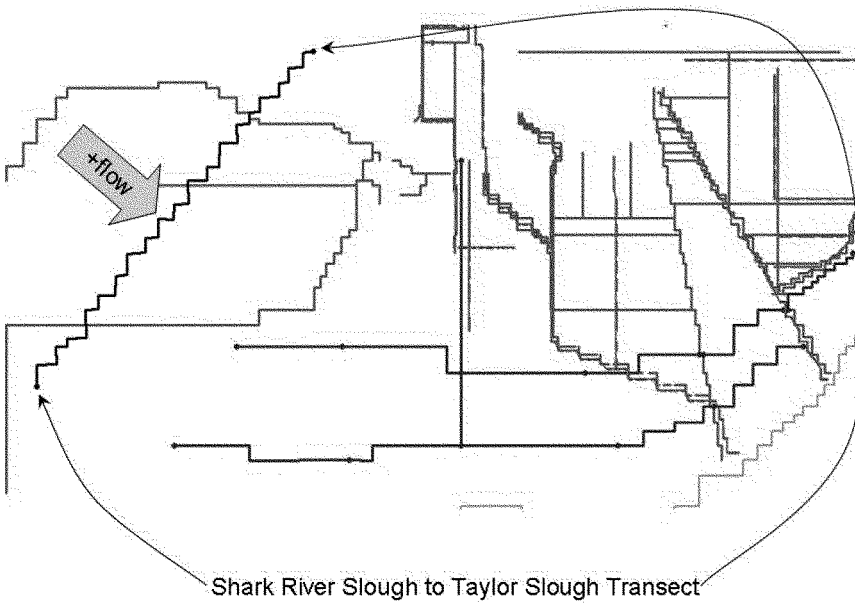


Figure 30. Transect between Shark River and Taylor Slough.

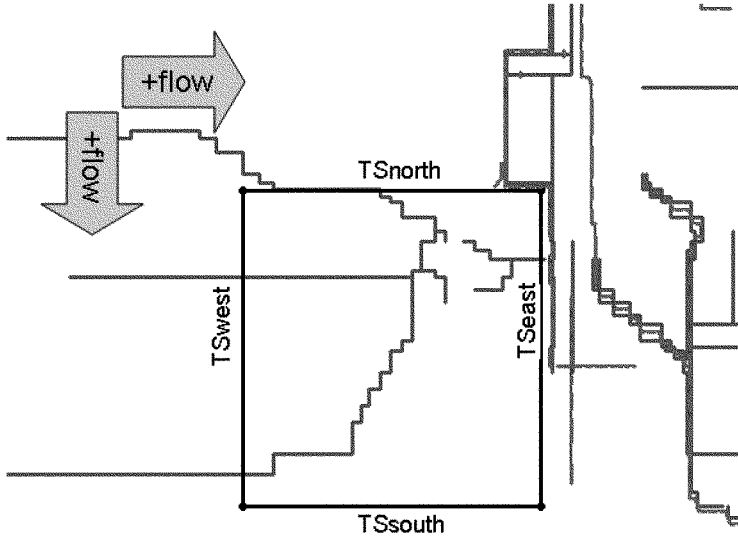


Figure 31. Headwater of Taylor Slough Transects.

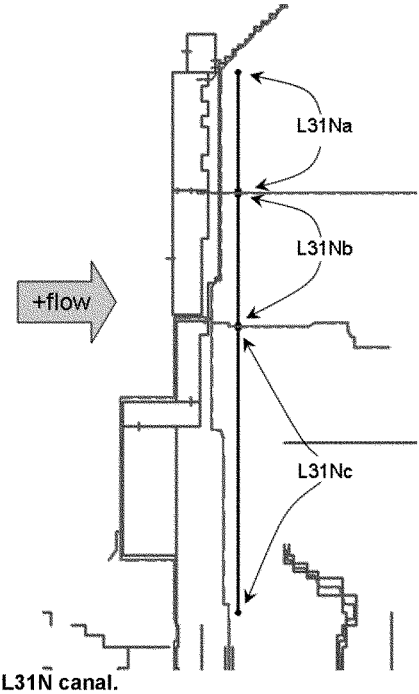


Figure 32. Transects East of L31N canal.

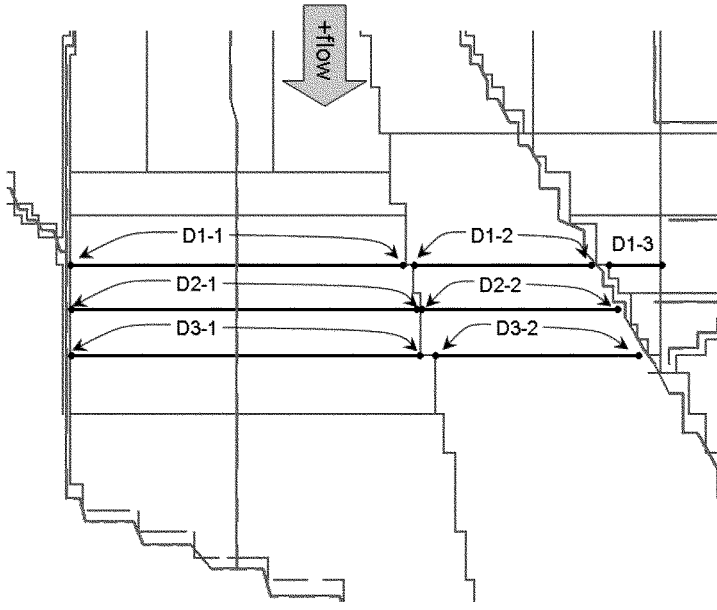


Figure 33. Transects in vicinity of the spreader canal.

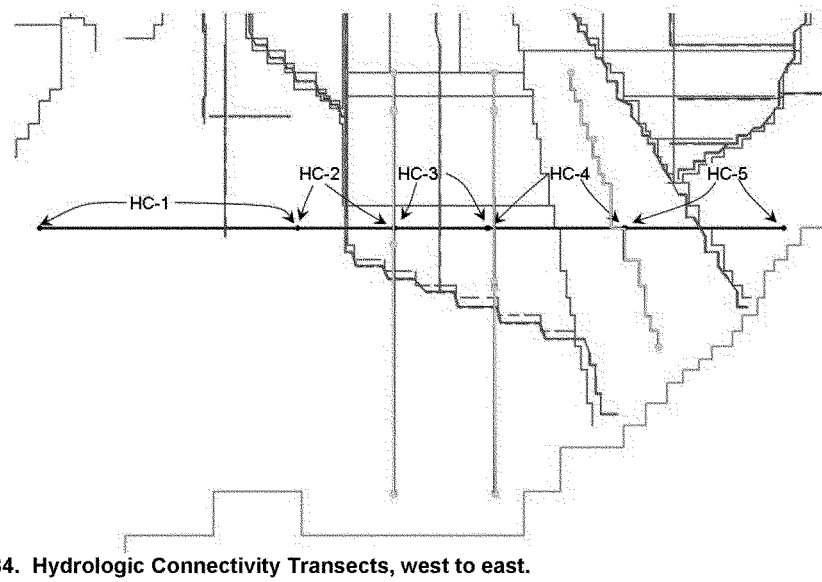


Figure 34. Hydrologic Connectivity Transects, west to east.

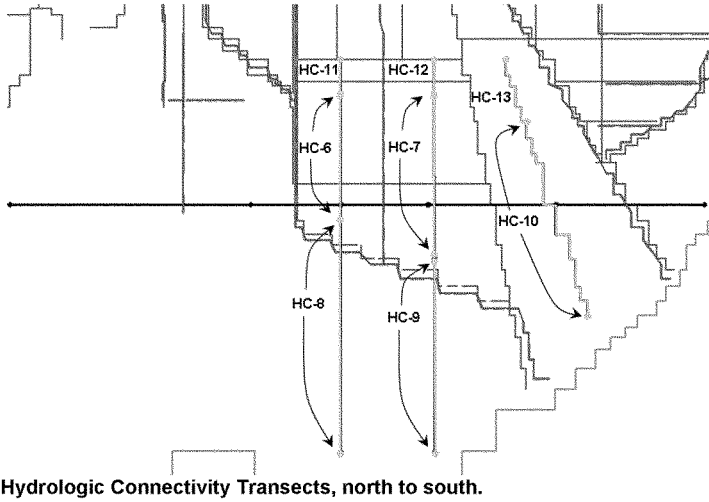


Figure 35. Hydrologic Connectivity Transects, north to south.

Flood Impacts

Various PMs were developed for the flood impacts. Normal hydroperiods used for ecological impacts are based on the number of days in a year that the stage is above the ground. However, for flood impact analysis, hydroperiods are computed as the number of days within a specified season that the water depth exceeds a specified value. The data are divided into two seasons (wet and dry) and eleven depth values are used (+/-2.0, +/-1.5, +/-1.0, +/-0.5, +/-0.25, 0.0 ft).

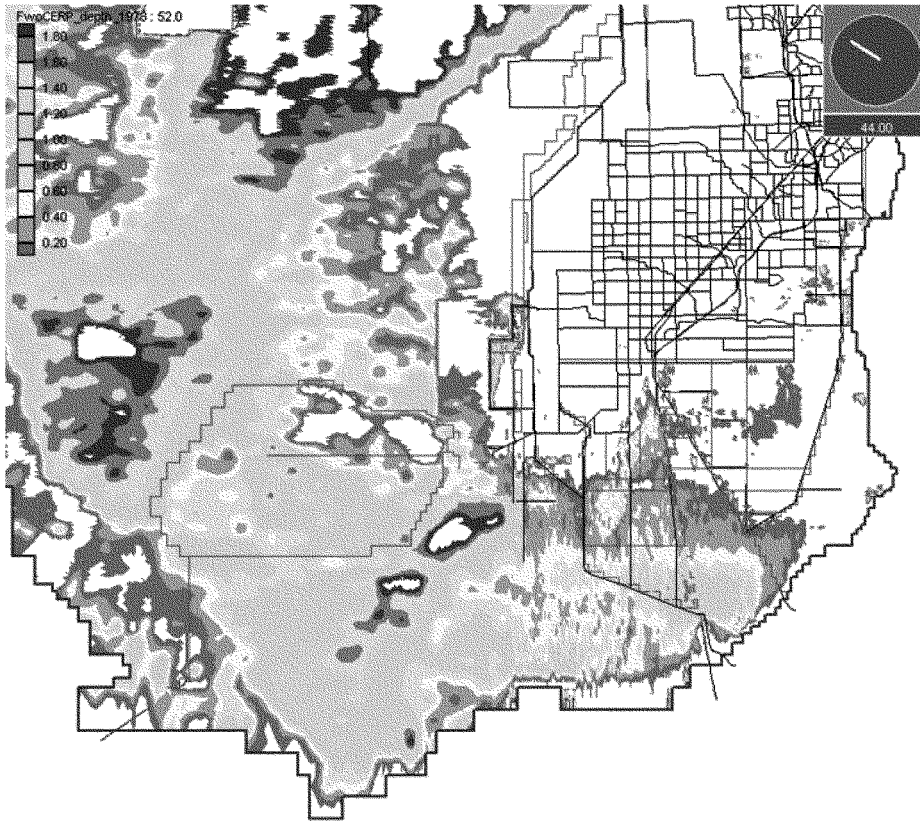
A second flood impact PM is the longest single duration water is above a stage that is specified between 0 and 24" below the ground, in increments of 2". This PM is useful in determination of impacts on various crops.

Both types of data were provided for each cell to allow further post-processing using GIS packages.

1.1.3.2 Discussion of Results

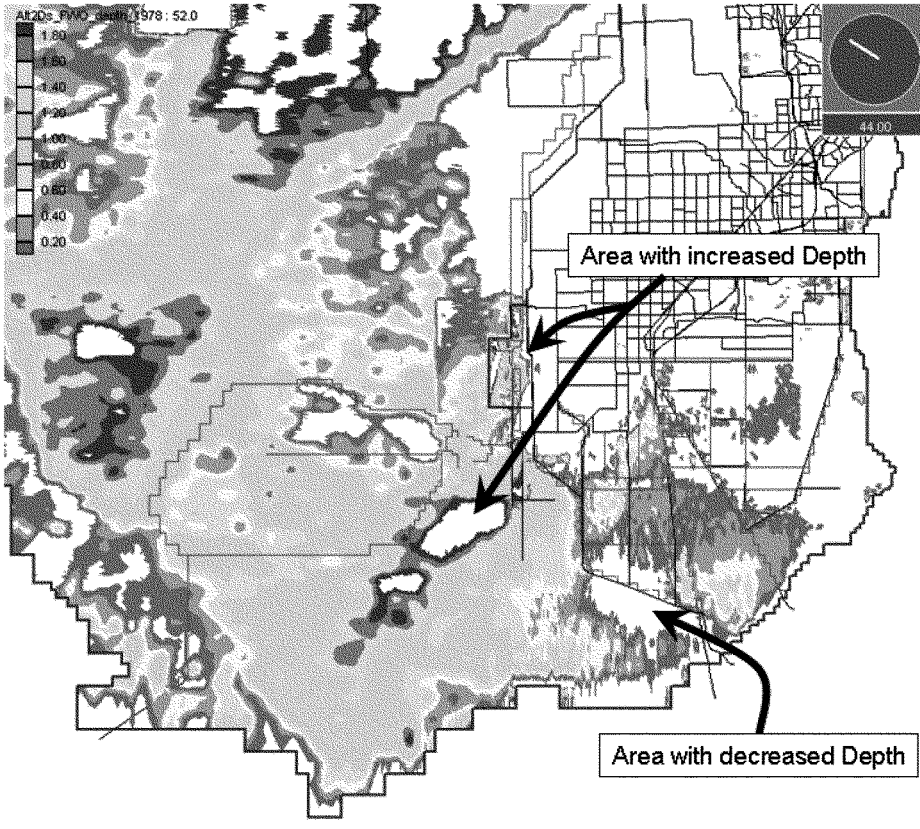
The MODBRANCH model performed adequately for this study. Stages and flows predicted for the various bases and alternatives are as expected. New features and structures operations caused impacts as expected. As an example, Figures 36 and 37 show the depth for the FwoCERP base and FwoCERP Alt2D "short". The addition of the Frogpond detention areas and the Aerojet Canal clearly show increased stages in the headwaters of Taylor's Slough.

An in-depth discussion of the extensive analysis is beyond the scope of this report. Those who are interested are referred to the "C-111 Spreader Canal Western PIR and EIS" sections on biological impacts, economics, and savings clause.



BASE Depth (FWO CERP bc) 1978

Figure 36. MODBRANCH Depth, Future without CERP, 1978 (average year).



Alt2Dshort Depth (FWO CERP bc) 1978

Figure 37. MODBRANCH Depth, Alt2D "short" + Future without CERP, 1978 (average year).

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Appendix A: Structure, Canal, and other features of the C-111SC Bases and Alternatives

Within the MODBRANCH model, there are several different types of control structures. Pumps operate as pumps; they move the amount of water specified by the rules. Spillways and culverts operate a bit differently. The amount of water passed is dependant on the stages and the structure "coefficients."

Model Description of Gated Spillways

The BRANCH portion of the model represents spillways as either free or submerged weirs, or as a submerged orifice. The following equation is used to represent flow through a gated spillway when the gate is out of the water, for both free and submerged weirs:

$$Q = C_w L d_1 \sqrt{2g(d_1 - d_2)}$$

where,

Q is the spillway discharge,
d_1 is the upstream stage measured relative to the weir sill,
d_2 is the downstream stage measured relative to the weir sill,
L is the length of the weir,
g is the gravitational constant, and
C_w is the weir coefficient.

Typically, the value of C_w is close to 1. Typical weir coefficients for various types of gated spillway can be found in Brater and King, 1976.

When the gate is in the water, the structure subroutine uses the following submerged orifice equation:

$$Q = C(h_g)\sqrt{d_1 - d_2}$$

where,

$$C(h_g) = C_g L h_g \sqrt{2g}$$

is a function of the gate opening, hg, and Cg is the submerged orifice coefficient for the gate. A value of Cg is not a necessary input for the computations performed.

Model Description of Gated Culverts

For gated culverts the following equation is used:

$$Z_1 - Z_2 = C_c\left(\frac{v^2}{2g}\right) + \left(\frac{Q}{C_g A_g \sqrt{2g}}\right)^2$$

where,

C_g is the resistance coefficient of the gate, and
A_g is the orifice area exposed by the gate.

Or, upon simplification:

$$Z_1 - Z_2 = Q^2 C_{cg}$$

where,

C_{cg} is the combined resistance coefficient for the gate and culvert.

Note: It is not necessary to input a value for C_{cg}. The coefficient to be included in the branch input file is C_c.

In general, when a spillway or a culvert has met the "open" criteria, the differences in stage are sufficient to pass the maximum allowed under that rule. In order to maintain numerical stability, the rules are input such that the maximum allowed flow increases based on trigger stages. This is due to the fact that the BRANCH time step is 1 hour and most structures in the real world begin releasing water in smaller time steps.

Structure, Canals and Detention Area Descriptions

The discussions below describe the variations in structures, canals and detention areas under the different modeling configurations. They include the major changes but do not include all structures and canals within the model domain.

Structure 174

Structure 174 (S-174) is a reinforced concrete, gated spillway, with discharge controlled by a cable operated, vertical lift gate. The structure is located on the L-31W borrow canal near its junction with Canal 111, about 5 miles west of Homestead.

The structure was designed to pass 500 CFS, which is 40 percent of the standard project flood [SPF]. Although the structure was essentially replaced by S-332D, and would not normally have been modeled within the Existing Conditions Baseline (ECB), it was included in order to assist S-332D in meeting the requirements set forth in the Taylor Slough Rainfall Formula (TSRF).

As modeled, within the SFWMM2x2 ECB run (which provides boundary conditions), and within all ECB with and without alternative runs, S-174 was allowed to fully open, and to pass up to 165 CFS depending on the headwater at S-175 and the TSRF.

Under the Future conditions, S-174, and the L31W canal, is removed and therefore there are no operations.

Structure 176

Structure 176 (S-176) is a reinforced concrete, gated spillway, with discharge controlled by a vertical lift gate. The current non-regulatory release operations have an open elevation of 5.0' NGVD, and a close elevation of 4.75' NGVD. The structure was designed to pass 630 CFS, which is 40 percent of the standard project flood [SPF].

The structure was modeled as a gated spillway structure which fully opens, and can pass up to 630 CFS when headwater is above 5.0' NGVD, passes up to 1100 CFS (SPF) when headwater is above 5.5' NGVD, and is closed at all elevations below 5.0' NGVD.

Water Supply: The structure will allow up to 630 CFS when the headwater at S-177 is below 3.0' NGVD

S-176 operations were modeled exactly the same for Existing Conditions, Future without project, and all project alternatives.

Structure 177

Structure 177 (S-177) is a reinforced concrete, gated spillway, with discharge controlled by a vertical lift gate. The current non-regulatory release operations have an open elevation of 4.2' NGVD, and a close elevation of 3.6' NGVD. The structure was designed to pass 1400 CFS, which is 40 percent of the standard project flood [SPF].

The structure was modeled as a gated spillway structure which can pass up to 1400 CFS when headwater is greater than 4.2' NGVD; it passes up to 2900 CFS (SPF) when headwater is greater than 4.7' NGVD. At elevations below 4.2' NGVD, the structure was modeled as closed.

S-177 operations were modeled exactly the same for Existing Conditions, Future without project, and Alternative 6D.

Within the runs for Alternatives 1C, 1D, 2D (short and long), and 3D, the open trigger was raised 0.1' (to 4.3' NGVD) to accommodate proposed pumps upstream of S-177. Under these rules, when the headwater is greater than 4.3' NGVD the maximum allowed flow is 1400 CFS; when it is greater than 4.8' NGVD the maximum allowed flow is 2900 CFS.

Structure 178

Structure 178 (S-178) is a single-barreled, reinforced concrete box culvert. The current design operations have an open elevation of 4.6' NGVD. The structure was designed to pass 510 CFS, which is 40 percent of the standard project flood [SPF]. This structure is operated so as to maintain the optimum upstream water surface elevation of 4.5 feet, insofar as possible. Headwater elevations above 5.0 feet will overflow the top of the box structure uncontrolled.

The structure was modeled as a single-barreled, gated box culvert structure which can pass up to 510 CFS when the stage is greater than 4.5' NGVD and up to 1275 CFS (SPF) when the stage is greater than 5.0' NGVD and closed at all other elevations below 4.5' NGVD. S-178 operations were modeled exactly the same for Existing Conditions, Future without project, and all project alternatives.

Structure 18C

Structure 18C (S-18C) is a reinforced concrete, gated spillway, with discharge controlled by two vertical life gates. The current non-regulatory release operations have an open elevation of 2.6' NGVD, and a close elevation of 2.3' NGVD. The structure was designed to pass 2100 CFS, which is 40 percent of the standard project flood [SPF].

The structure was modeled as a gated spillway structure which allows incremental maximum flows of 500, 1500, 2100, and 3200 CFS at headwater stages of 2.6', 2.8', 3.0' and 3.2' NGVD. S-18C operations were modeled exactly the same for Existing Conditions, Future without project, and all project alternatives.

Structure 197

Structure 197 (S-197) is a thirteen-barreled corrugated metal pipe culvert. The structure currently triggers off S-177 headwater elevations and S-18C headwater elevations. The structure was designed to pass 2400 CFS, which is 40 percent of the standard project flood [SPF].

The structure was modeled as a thirteen-barreled gated pipe culvert structure which can pass up to 2400 CFS. The culverts are opened based on headwater stages at either S-177 or S-18c. When S-177 is greater than 4.1' or S-18c is greater than 2.8', open 3 culverts (maximum flow 555 CFS). When S-177 is greater than 4.2' or S-18c is greater than 3.1', open 7 culverts (maximum flow 1300 CFS). When S-177 is greater than 4.3' or S-18c is greater than 3.3', open 13 culverts (maximum flow 2400 CFS).

The culverts are closed when headwater at S-176 has declined below 5.2' NGVD and headwater at S-177 has declined below 4.2' NGVD.

S-197 operations were modeled exactly the same for Existing Conditions, Future without project, and all project alternatives.

Structure 332

Pump Station 332 (S-332) is no longer operated; therefore, it is not operated in the model.

Structure 332I

Pump Station 332I (S-332I) is no longer operated, therefore not included in the model.

Structure 322B

Pump Station 332B (S-332B) is located approximately 10 miles upstream of S-177 on the L-31N Canal. The primary purpose for the pump station is to pump water from the canal upstream of S-176 into the S-332B North detention area, and S-332B West detention area. The pump station contains four diesel driven pumps with 125 cfs capacity each and one electric motor pump with 75 cfs capacity. Under current operation guidance (Interim Operating Plan [IOP]), no more than two of the 125 cfs diesel pumps can pump into the S-332B North detention area, and no more than two of the 125 cfs diesel pumps (and the single 75 cfs electric pump) can pump into the S-332B West detention area.

The structure was modeled as two pump stations (S332Bn and S332Bw); S332Bn pumps into the North detention area with a maximum of 250 CFS (two 125 CFS pumps). S332Bw pumps into the West detention area with a maximum of 325 CFS (two 125 CFS pumps + one 75 CFS pump). The S332Bn pump station does not turn on until the West detention pond is "close to overflow"; i.e. the stage is greater than 8.3' NGVD. If the West detention pond is full, then S332Bn turns 1 pump on when the headwater is greater than 5.0' NGVD and 2 pumps when it is greater than 5.5' NGVD.

If the West detention pond is not full, then S332Bw will be used. It turns on 2 pumps (250 CFS) when the headwater is greater than 5.0' NGVD. It turns on the additional 75 CFS electric pump if the headwater is greater than 5.5' NGVD. S332Bw is turned off if the West detention pond stage exceeds 8.2' NGVD.

S-332B operations were modeled exactly the same for Existing Conditions, Future without project, and all project alternatives.

Structure 332C

Pump Station 332C (S-332C) is located approximately 8.3 miles upstream of S-177 on the L-31N Canal. The primary purpose for the pump station is to pump water from the canal upstream of S-176 into the S-332C detention area. The pump station contains four diesel driven pumps with 125 cfs capacity each and one electric motor pump with 75 cfs capacity for a total capacity of 575 cfs.

Under existing conditions the structure was modeled as pumps which operate as follows; when the headwater is greater than 5.0' NGVD, pump 150 CFS; at 5.2' NGVD, pump 325 CFS; and at 5.5' NGVD pumps 575 CFS.

Under the future (2050) conditions, the structure pumps up to 325 CFS. When the headwater stage is greater than 5.0' NGVD it pumps 150 CFS; when the stage is greater than 5.5' NGVD, it pumps at 325 CFS.

Structure 332D

Pump Station 332D (S-332D) is located at the junction of the L-31N and the L-31W Borrow Canal. The primary purpose for the pump station is to pump water from the canal upstream of S-176 into the S-332D detention area. The pump station contains four diesel driven pumps with 125 cfs capacity each and one electric motor pump with 75 cfs capacity. Under current operation guidance (IOP), maximum pumping of 500 cfs may occur from July 16 to November 30; 325 cfs from December 1 to January 31; and 165 cfs from February 1 to July 15.

Under existing conditions, the structure was modeled as pumps which operate as follows; turn the pumps on when the headwater is greater than 4.85' NGVD. The maximum pumping rate will vary based on the time of the year. From 16 July to 30 November, pump at 500 CFS; from 1 December to 31 January pump at 325 CFS; and from 1 February to 15 July pump at 165 CFS.

Under the future conditions, S332D begins pumping 0.2' lower than under ECB or existing conditions (both of which are operated under IOP). It then uses incremental increases from 75 CFS to 500 CFS. The pumping rates of 75, 125, 250, 375 and 500 CFS correspond to headwater stages of 4.65, 4.70, 4.75, 4.80, and 4.85, respectively. However, during 1 December to 31 January, the maximum pumping rate is limited to 324 CFS; from 1 February to 15 July it is limited to 165 CFS.

Structure 20

Structure 20 (S-20) is a reinforced concrete, gated spillway with discharge controlled by a vertical lift gate. The current high range operations have an open elevation of 2.4' NGVD, and a close elevation of 1.8' NGVD, while the current low

range operations have an open elevation of 1.4' NGVD, and a close elevation of 1.0' NGVD, . This structure was designed to pass the design flood 450 CFS, which is 40 percent of the SPF.

The structure was modeled as a gated spillway structure which can pass up to 750 CFS (SPF). The normal operation is divided into wet and dry periods. During the dry period (15 October to 15 April) a maximum flow of 450 CFS is passed when the headwater is greater than 1.4' NGVD and up to 750 CFS when it is greater than 1.9' NGVD. During the wet period (15 April to October 14) a maximum flow of 450 CFS is passed when the headwater is greater than 2.4' NGVD and up to 750 CFS when it is greater than 2.9' NGVD.

S-20 operations were modeled exactly the same for Existing Conditions, Future without project, and project alternatives 1C. For all D series alternatives (i.e. Alt 1D, 2D, 3D, and 6D), the open and close triggers were raised 0.5'.

Under the "D" operations the operations are set to incrementally open the "gates" by gradually increasing the maximum allowed flow rate. The stages and rates are:

Trigger Stages for S-20 under "D" alternatives	
S20 Headwater Stage, ft NGVD	Maximum Flow Rate, CFS
2.4	150
2.5	250
2.6	450
2.7	525
2.8	575
2.9	625
3.0	750

Structure 20A

Structure 20A (S-20A) is no longer operated, therefore it is not included in the model.

L-31 West Canal

Portions of L-31 W Canal have recently been filled under the C-111 South Dade Federal Project; additional filling will take place under subsequent phases of the C-111 South Dade Federal Project..

Under the ECB and the IORLO2 simulations, L-31W is still in the model, as is S-174. S-332D pumps into the Frogpond "flow way", but S-174 passes water to the L-31W canal as required by the Taylor Slough Rainfall Formula.

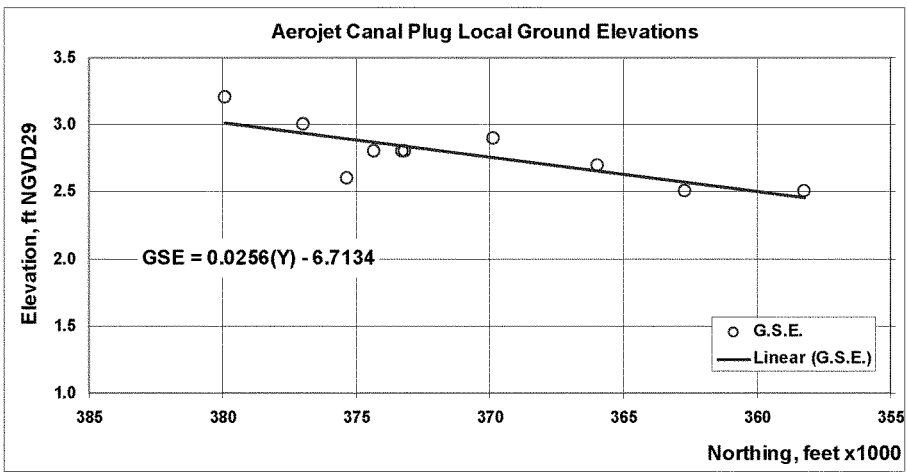
Under all Future Condition scenarios, L-31W canal is backfilled (removed) to approximately S-175. From that point to the southern end, it has "plugs" inserted.

Canal 110

Canal 110 (C-110) is located to the east of C-111E. Although not currently connected to the C-111 Canal, because it crosses topographical contours, and because of the highly transmissive aquifer, it tends to over drain the adjacent wetlands. Originally intended to be plugged under the C-111 Federal project, its plugging has been deferred to the C-111 Spreader Canal Project. As such, the canal will be modeled in its existing configuration within the existing, and will be modeled under all "future" conditions, with the addition of nine "plugs".

Aerojet Road Canal

The Aerojet Road Canal begins approximately one mile south of Ingraham Highway (SR 9336). Although the canal spans a distance of approximately 4.8 miles, the canal is effectively plugged at six areas described as existing plugs 1-6 on SFWMD's Figure 4-6 dated 11/19/08. Plugs 1-6 will be modeled as earthen plugs (with crest elevations matching adjacent existing grades),. Ground elevations used to determine operations will be interpolated from a linear fit to the local elevations (see figure below).



In alternative 2D short, three new plugs will be inserted; one ("proposed 3") is within the main Aerojet canal and two ("proposed 2" and "proposed 4") are in the east-west borrow canal). The proposed 3, and existing 6, 5, & 4, will be modeled

as weirs with crest elevations 1' below adjacent existing grades (ground elevations are 2.8, 2.87, 2.84, and 2.82, respectively). The proposed plug 2 will be closed always due to the fact that the berm will be crossing this canal; proposed plug 4 will be set at local ground elevation, 3.2' NGVD. From a modeling perspective, Alternative 2D short will include high enough perimeter grading to ensure that water does not overtop the perimeter of the active portion of this feature which ends just upstream of the existing east west borrow canal.

In alternative 2D long new plugs will be constructed at the locations described as Proposed 1 & 3 (on the same figure), and the new plugs, and existing 6, 5, 4, 3, and 2 will all be modeled as weirs with crest elevations 1' below adjacent existing grades (ground elevations 2.5, 2.8, 2.87, 2.84, 2.82, 2.8, and 2.73 ft NGVD, respectively). Both alternatives 2D short and 2D long will also receive the plugs in the east-west borrow canal described as proposed 2 & 4. Proposed plug 2 is closed always due to the berm passing over it. Proposed plug 4 will be modeled with crest elevations matching adjacent existing grades. From a modeling perspective, Alternative 2D long will include high enough perimeter grading to ensure that water does not overtop the perimeter of the active portion of this feature which ends just upstream of the separate canal segment which is approximately the latitude of S-18C.

In alternative 3D, existing plugs 6, 5, & 4 will be removed and 75 CFS pump station will be installed to collect seepage from the adjacent detention area to the west. The pump station will feature three 25 CFS pump stations which pump at elevations above 2.5, 2.6 and 2.7 ft NGVD.

S-332 B North and S-332 West Detention Areas

Under existing conditions the S-332B North detention area covers approximately 240 acres and can receive flow from two of the four 125 cfs diesel pumps located within the temporary S-332B pump station. The S-332B West detention area currently covers approximately 862 acres and can receive flow from two of the four 125 cfs diesel pumps and the 75 cfs electrical pump located within the temporary S-332B pump station. Within the existing conditions run, S-332B North and S-332B West will be modeled in their current configuration.

Within the future without, and all project alternative runs, the detention areas will be modeled as intended to be built out per the 1994 GRR.

S-332 C Detention Area

S-332 C Detention Area is intended to extend the created hydraulic ridge created by S-332B. The S-332C detention area currently covers approximately about 850 acres and can receive flow from four 125 cfs diesel pumps and a single 75 cfs electric pump located within the temporary S-332C pump station. Within the

existing conditions run, S-332 C will be modeled in their current configuration. Within the future without, and all project alternative runs, the detention areas will be modeled as intended to be built out per the 1994 GRR.

S-332 D Detention Area

The S-332D detention areas in the "Existing" conditions are different from the "Future" conditions.

In the "Existing" conditions, the S-332D pump puts water into the north end of the Frog pond flow ways. There is no "high head cell" in the existing conditions. Water is discharged into a cell and flows southward. There is a "broad crested weir" between the upper and lower cells, with a crest elevation of 7.0 ft NGVD. There is another weir between the lower cell and the flow way with a crest elevation of 6.5 ft NGVD.

In the "Future" (including IORLO2) conditions, S-332 D Detention Area routes discharges from the S-332D pump station west to a high head cell, and then through two detention areas (south then west) and finally through a flow way area (south) before discharging into Taylor Slough near S-332. The S-332D Header Cell covers approximately 26 acres in the MODBRANCH model, has an average bottom elevation of approximately 4.95 feet NGVD and a 1,840-foot long discharge weir with a crest elevation of 8.2 8.1 feet NGVD. The weir discharges into the first detention area (Cell 4) which covers approximately 440 acres, an average bottom elevation of approximately 5.3 feet NGVD, and an earthen berm acting as a broad crested weir (~2100 ft wide) with a top elevation of approximately 6.5 feet NGVD. This detention area discharges to a second detention area (Cell 5) which covers approximately 413 acres, has an average bottom elevation of 5.1 feet NGVD, and a weir crest elevation of approximately 5.8 feet NGVD. The 1,900-foot long weir is constructed of concrete and discharges into the scraped portion of the flow way which covers an area of approximately 1,300 acres. In the "Future" condition there is an approximately 2,000 foot-long levee gap located in the southwest corner of the flow way near S-332 which directs flow towards Taylor Slough. This gap is not in the IORLO2 or the existing conditions because L31W is still in the configurations.

Cape Sable Seaside Sparrow (CSSS) override pumping conditions will be included within all scenarios

S-200 Pump Station & Frog Pond Detention Area (Alternatives 1C, 1D, 2D (Short and long), and 3D only)

Alternatives 1C, 1D, 2D (Short and long), and 3D will include a new pump station (S-200) to be constructed downstream of S-176. When triggered by increased stages between S-176 and S-177, the pump station will route water to a 510-acre (exterior dimension) (~560-acres in MODBRANCH model) above-ground

impoundment Frog Pond Detention Area, (FPDA) which will be constructed within the southern portion of the South Florida Water Management District (SFWMD)-owned Frog Pond Lands.

For alternatives 1C, and 1D, the pump station will include three 150 CFS pumps, at total of 450 CFS. For alternatives 2D (short and long) and 3D, the pump station will include three 75 CFS pumps, a total of 225 CFS. For all the aforementioned alternatives, the pumps will be modeled to pump sequentially at elevations at or above 3.8, 3.9, and 4.0 (all ref NGVD). For all the aforementioned alternatives, pumping will be discontinued if the water elevation within the southernmost header canal exceeds two and a half feet above the local GSE (ground elevation 5.2 NGVD). Pumping at S-200 will also cease if the water depth at a point (X=782570ft, Y=397220ft) within the CSSS area C/U2 exceeds a depth of ten centimeters during the critical portion of the CSSS nesting season (February 1st thru July 15th). The model ground elevation at that point is 5.6' NGVD; the "off" trigger is then 5.93' NGVD.

The western portion of the FPDA will consist of a header canal with cascading water levels maintained by a series of internal weirs. As modeled, two 80' long east-west weirs will be modeled at 1/3 points along the length of the header canal. The weir elevations will be 0.5' above adjacent existing grades (ground el. 5.71 NGVD and 5.23 NGVD, respectively). Just upstream of the header weirs, and just upstream of the southern levee of the southern detention area cell, 80' long header overflow weirs will be modeled at elevations 1.2' above adjacent existing grades (ground el. 5.71 NGVD, 5.23 NGVD, and 4.8 NGVD, respectively). The conveyance from pump station S-200 to the header cell will be modeled as a fully lined channel. This minimizes the leakage between the channel and the aquifer; it is not possible in the model to have an "above ground" channel.

S-199 Pump Station (Alternatives 2D (Short and long), and 3D only)

Alternatives 2D (Short and long), and 3D will include a second new pump station modeled immediately upstream of S-177, downstream of Ingraham Highway (SR 9336). When triggered by increased stages between S-176 and S-177, the pump station will route water to either the Aerojet Road Canal (Alternatives 2D short and long) or the Aerojet Road Detention Area (Alternative 3D).

For alternatives 2D (short and long) and 3D, the pump station will include three 75 CFS pumps, and the pumps will be modeled to pump sequentially at elevations at or above 3.8, 3.9, and 4.0 (all ref NGVD). For alternatives 2D (short and long) pumping will be discontinued if the water elevation within the Aerojet Road Canal at the mid-point (Y=374930 ft) exceeds two and a half feet above the local GSE (ground elevation 2.7' NGVD). For alternative 3D pumping will be discontinued if the water elevation near the southern end of the Aerojet Detention area (X=798340ft, Y=374930ft) reaches two and a half feet above the local GSE

(ground elevation 2.5 NGVD). For all the aforementioned alternatives described in this section, pumping at S-199 will also cease if the water depth at a point (X=806300ft, Y=374930ft) within the CSSS area D/U3 exceeds a depth of ten centimeters during the critical portion of the CSSS nesting season (February 1st thru July 15th). Please see the section on Aerojet Road for modifications required to accommodate S-199 pumping.

Aerojet Detention Area (Alternative 3D only)

Alternative 3D will include a ~288-acre above ground reservoir to be constructed between the L-31W and Aerojet Road Canals. In Alternative 3D, this detention area will receive water from S-199 described above. In alternative 3D, existing plugs 6, 5, & 4 will be removed and 75 CFS pump station will be installed to collect seepage from the adjacent detention area to the west. The pump station will feature three 25 CFS pump stations which pump at elevations above 2.5, 2.6 and 2.7 ft NGVD.

S-198 Structure (All alternatives except 1C)

The S-198 Structure will be constructed in the C-111 Canal just upstream of the C-110 Canal. The operable "S-197 like" structure is intended reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction. From a modeling perspective, the structure will be modeled exactly the same as S-197.

Plug in L-31E Near S-20A (All alternatives except 1C)

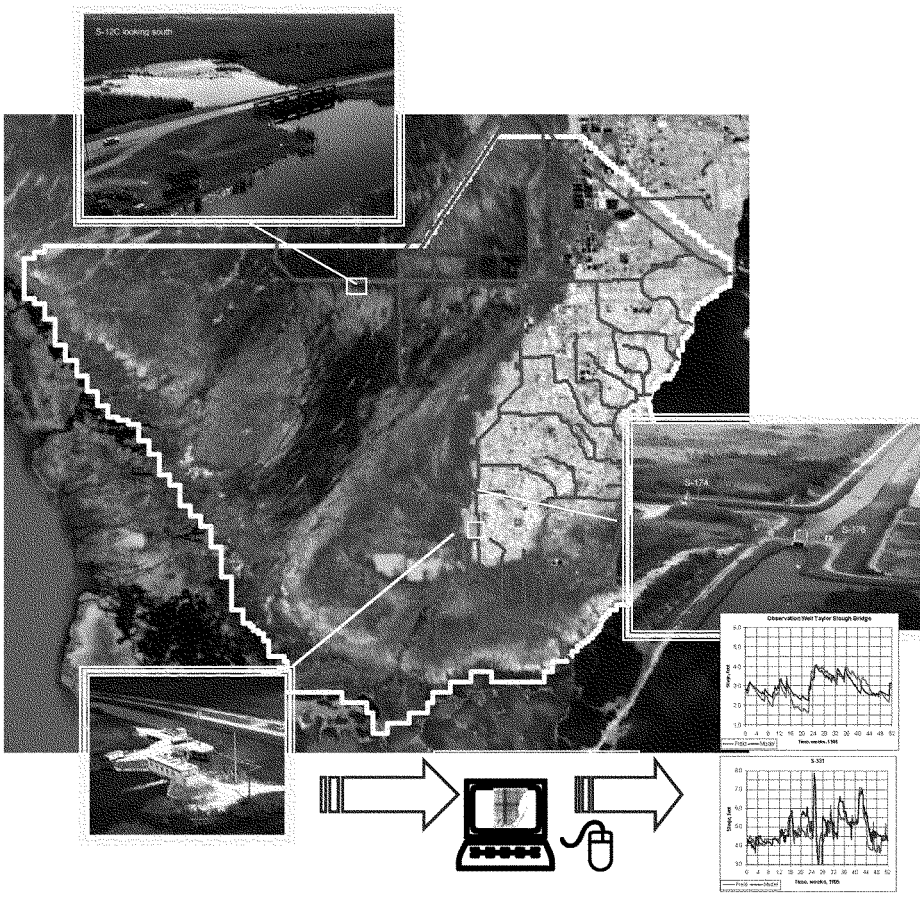
A Permanent Plug will be installed within the L-31E just upstream of S-20A. From a modeling perspective, the plug will be a structure that is always closed and never passes any water.

Physical Seepage Barrier (Alternative 6D)

Alternative 6D (Alt6D) is comprised of the base runs (either Future or Existing conditions) with the "D" options (S-20, S198, and the plug near S-20A) and an approximately 10 mile long, fully penetrating barrier. This barrier is runs from the top of the Frog pond area south to the approximate latitude of S-18C. It is just west of the Aerojet Canal.

A.17 CALIBRATION AND VERIFICATION OF THE MODBRANCH (MB_2006) NUMERICAL MODEL OF SOUTH FLORIDA

Calibration and Verification of the MODBRANCH (MB_2006) Numerical Model of South Florida



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Preface

The work reported herein was performed at the Jacksonville District, U.S. Army Corps of Engineers, as part of the Comprehensive Everglades Restoration Program (CERP). This report presents the results of the calibration and verification of the MODBRANCH numerical model of the South Florida area.

The work was conducted from 2005 to 2007 under the direction of the following personnel Russ Weeks, Chief of the Hydrologic Modeling Section; Sean Smith, Chief of the Water Resources Engineering Branch; and Steve Duba, Chief of the Engineering Division.

COL Robert Carpenter and COL Paul Grosskruger were Commanders of the Jacksonville District during the period of development.

"Computer models can't prove anything, Ted. A prediction can't ever be proof - it hasn't happened yet. And computer models have failed to accurately predict the last ten or fifteen years. But if you want to believe in them anyway, there is no arguing with faith."

Kenner to Ted Bradley
"State of Fear" by Michael Crichton, 2004

INTRODUCTION

The U.S. Army Corps of Engineers (Jacksonville District) previously used the MODBRANCH model in studies of South Dade County[1], and the CSOP study[2]. The domain of the South Dade model included the area south of a line approximately 3 miles north of the L-29 and C-4 canals extending to Florida Bay. The western and eastern boundaries of that model were a line approximately 4 miles west of the L-67 extension and Biscayne Bay, respectively. The domain of the model used in the CSOP study (the "PDM model") was bounded by the Biscayne Bay to the east; Florida Bay to the south; and, the Gulf of Mexico to the west. The northern boundary is roughly 2 miles north and parallel to the following canals: C-6, L-30, and L-29.

Several ongoing projects required the use of a MODBRANCH model: the C-111 Spreader Canal (C-111SC) and the ENP Seepage Management (ENPSM) project. The latter project requires the simulation of a ground water flow barrier from S-335 to G-211, along the western sides of the lower L-30 and the L31N canals. The model boundary of the PDM model is too close to this project area for the model to be useful. In order to "kill two birds with one stone", it was decided to extend the PDM model boundary further into WCA-3B so that the new model (MB_2006) would be suitable for both projects, thus saving the time and costs of building two separate, but similar models.

The new model was developed as a tool to determine impacts of canals, structures, and water use on the system. The MODBRANCH model is a hybrid model created from two USGS models. The first model is MODFLOW, which simulates the ground water hydrodynamics. The second model is BRANCH, which simulates the canal hydrodynamics. The MODFLOW and BRANCH models were "coupled" into MODBRANCH by Swain and Wexler[3] in 1993. Swain, Howie, and Dixon[4] first employed it in south Florida in 1995. Further modifications were added by CESAJ to more accurately model the area of South Florida.

Two years were selected for the calibration and verification process. These years represented dry and wet periods and were 1989 and 1995, respectively.

MODEL DOMAIN AND DESCRIPTION

Figure 1 shows the model domain superimposed on a "false color" LANDSAT photograph of the area. The model domain includes Water Conservation Area 3B (WCA3B), the Pennsuco wetland area and parts of both Miami-Dade and Monroe counties. The figure illustrates the surficial complexity of the area. Land elevations vary from the high Atlantic Ridge (>10 ft. NGVD29) to the low Everglades. Land use varies from urban to suburban to agricultural to wilderness.

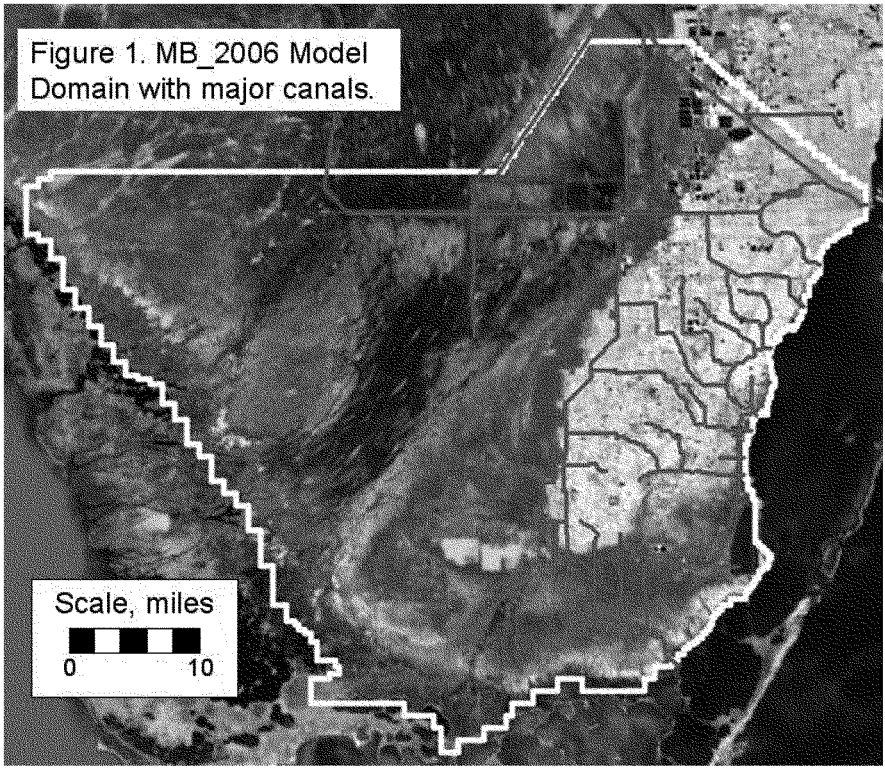


Figure 1. MB_2006 Model Domain with major canals.

GROUND WATER AND OVERLAND FLOW

Ground water and overland flow are simulated by the MODFLOW part of MODBRANCH. MODFLOW is a pseudo-three-dimensional, finite difference, ground water model[5]. This model requires defining a model "grid" of specified numbers of rows, columns, and layers. The width of each row or column is determined by required resolution in specific areas. The resolution was predominantly determined by the need to accurately locate canals and sub-surface features.. The model grid is shown in figure 2 with major canals superimposed in red. The model is bounded by the Biscayne Bay to the east; Florida Bay to the south; and, the Gulf of Mexico to the west. The northern boundary is roughly 2 miles north and parallel to the following canals: C-6, L-30, and L-29. This model also includes that part of WCA-3B up to L-67c (but not including L-67c). The model grid is made up of 239 rows, 259 columns, and 5 layers. The grid resolution varies horizontally from a minimum of 207 feet to a maximum of 5000 feet. Levees are defined by using the *horizontal flow barrier* package of MODFLOW.

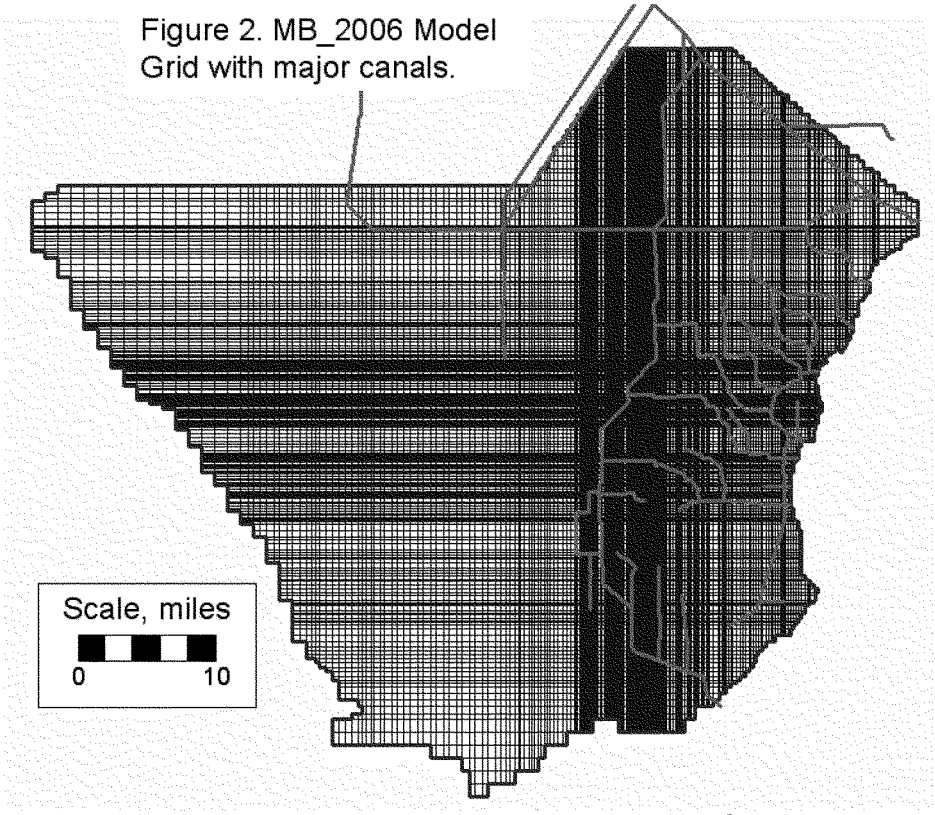


Figure 2. MB_2006 Model Grid with major canals.

The primary aquifers in the study area are the Biscayne and the Gray Limestone aquifers. The Biscayne aquifer is the dominant feature in the eastern part of the model while the Gray Limestone aquifer is the dominant feature of the west. Other hydrogeologic layers include the Gray Limestone confining unit and the surficial sediments (peat, muck, caprock, fine sand, marl, and marsh sediments).

THE BISCAYNE AQUIFER

The Biscayne Aquifer, of Pleistocene age, is the main potable aquifer in South Florida. It covers an area of approximately 4,000 square miles including all of Dade County[6]. The Biscayne Aquifer consists of beds of highly permeable (K~3,000 to 45,000 feet per day) limestone and sandy-limestone of marine origin. The bottom of the Biscayne Aquifer is characterized by an abrupt change in sediment type where clays and marls of the Tamiami Formation or Hawthorn Formation are present. The Biscayne Aquifer is mostly an unconfined aquifer, although segments may exhibit semi-confined conditions initially. In general, the Biscayne Aquifer is well connected to surface water features including the various drainage canals that are located in the study area.

THE GRAY LIMESTONE AQUIFER

The Gray Limestone aquifer is a less permeable formation than the Biscayne aquifer, although not insignificant. The hydraulic conductivity ranges from 200 to 7,000 feet per day. The characteristics of this aquifer are the dominant hydrogeological feature in the western part of the model domain. It is comprised mainly of the Ochopee Limestone of the Tamiami Formation. There are some areas where the formation is comprised of a permeable part of an unnamed formation that is mainly quartz sand. In some regions there is a fairly good confining unit overlaying the Gray Limestone Aquifer. Within the model domain, this confining unit (known as the "gray limestone confining unit") is mainly in the Miami-Dade County area.

MODEL STRATIGRAPHY

The stratigraphic sequence of aquifers varies throughout the model and is not uniform. There are "lenses" and "pinch-out" zones that are not known, but are obviously present. In order to build MODFLOW input files that described the layering certain assumptions had to be made. The domain was divided into five regions (see figure 3). Each region was assigned a specific sequence of layers, as shown in Table 1.

Note that the first layer is designated as "overland flow." The MODFLOW equations are modified in this layer to simulate overland flow instead of ground water flow. The use of the Kadlec equation is discussed in a separate section. Layer two is specified as "surficial sediments."

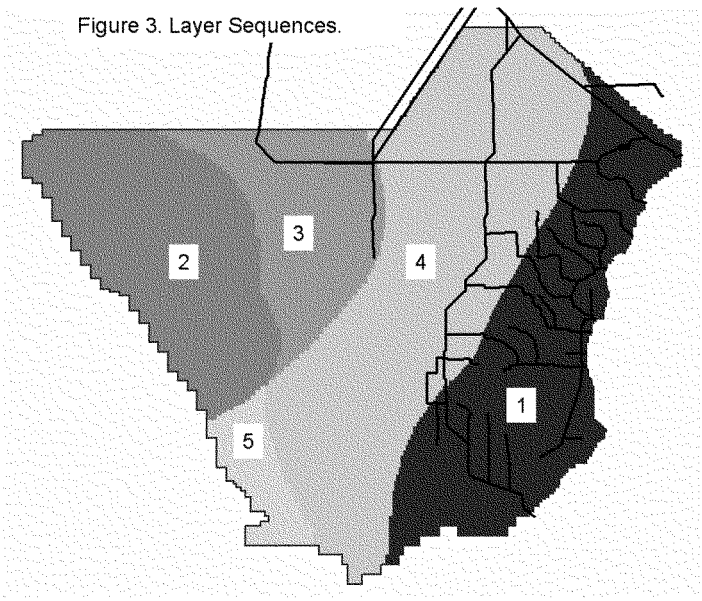


Figure 3. Layer Sequences.

Table 1. Layers by Sequence					
Sequence #	***Direction of increasing depth →***				
	Layer 1	**Layer 2**	**Layer 3**	**Layer 4**	**Layer 5**
1	Overland Flow	Surficial Sediments	Biscayne Aquifer		Lower Clastics of Tamiami
2			Gray Limestone		
3			Gray Limestone Confining Unit	Gray Limestone	
4			Biscayne Aquifer	Gray Limestone Confining Unit	Gray Limestone
5			Biscayne Aquifer		Gray Limestone

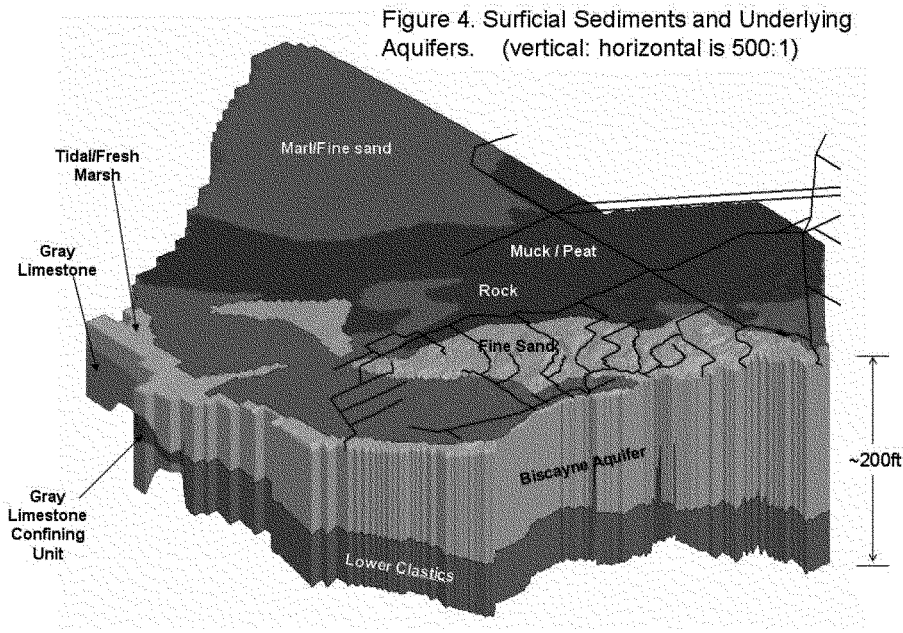


Figure 4. Surficial Sediments and Underlying Aquifers. (vertical: horizontal is 500:1)

Layers 2-5, which include the surficial sediments and the underlying aquifers, are shown in figure 4. The corresponding hydraulic conductivity of each sediment type is also listed in table 3. The thicknesses of each surficial sediment type are not generally available over the entire region. However, the thickness can be

inferred by taking the difference between the land surface elevation and the top of the surficial aquifer. This procedure was used for all the surficial sediment types with the exception of peat. When peat was present, a thickness based on figure 5 was used.

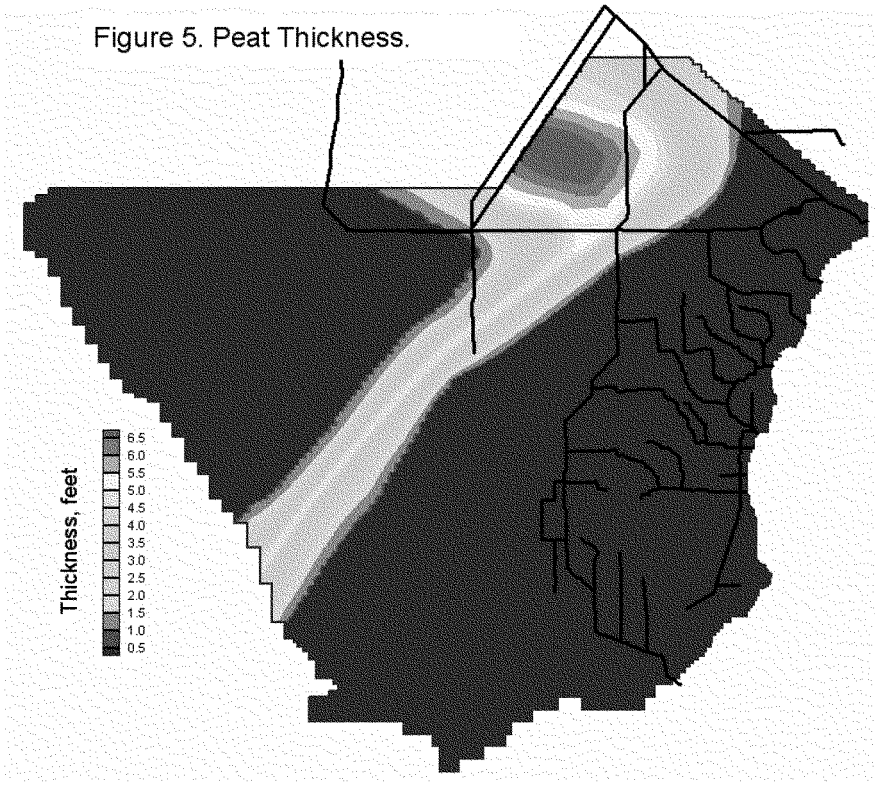


Figure 5. Peat Thickness.

The elevation of each subsequent layer was determined primarily by using the information found in the Fish and Stewart[2] (eastern part) and Reese and Cunningham[3] (western part).

TOPOGRAPHY

The topography used in this model (figure 6) was produced from a variety of sources which include LIDAR ("Light Detection and Ranging") data collected for the C-111, the CSOP, the WPA projects and USGS Helicopter data. The data collected were processed and the USACE Jacksonville GIS staff created a 100 foot topographic model of south Florida. This data set was sampled to a 200 foot model prior to being used to create the MB_2006 topographic data. Major roads, canals and levees were digitally removed from the data sets. Using the 200 foot

model, a median value for each MB_2006 cell was calculated and assigned to the cell. Figure 7 shows the domain of each data source. Figure 8 shows the standard deviation of the 200 ft values within each MB_2006 cell. Note that even with roads, canals and levees removed there are cells with very significant variation of topography.

Figure 6. MB_2006 Topography.

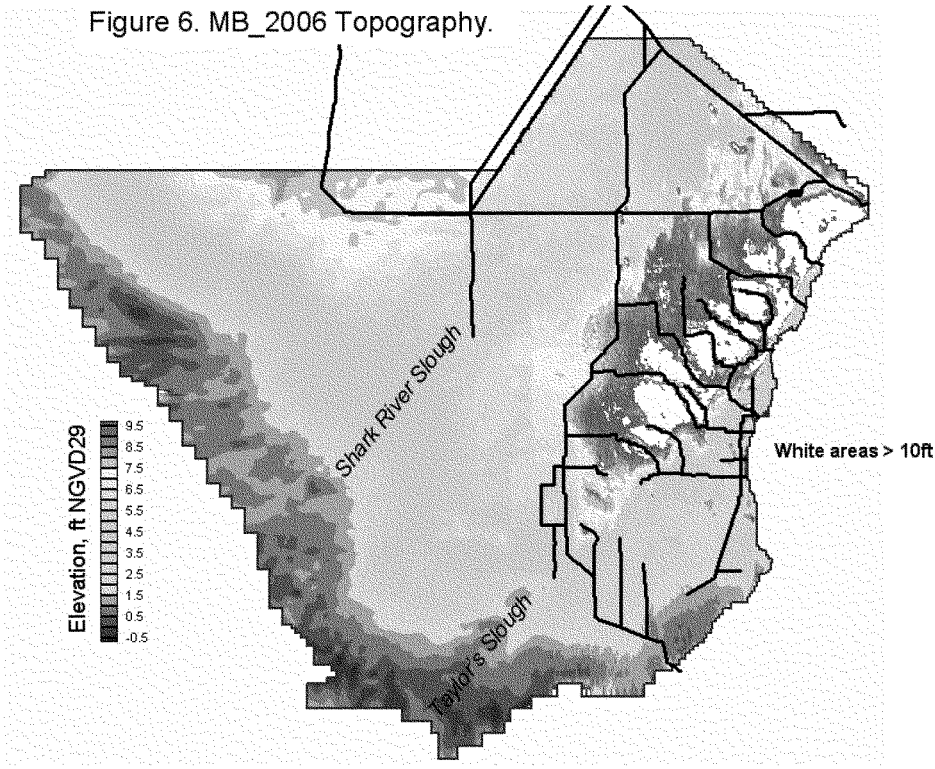


Figure 7. MB_2006 Topography Source.

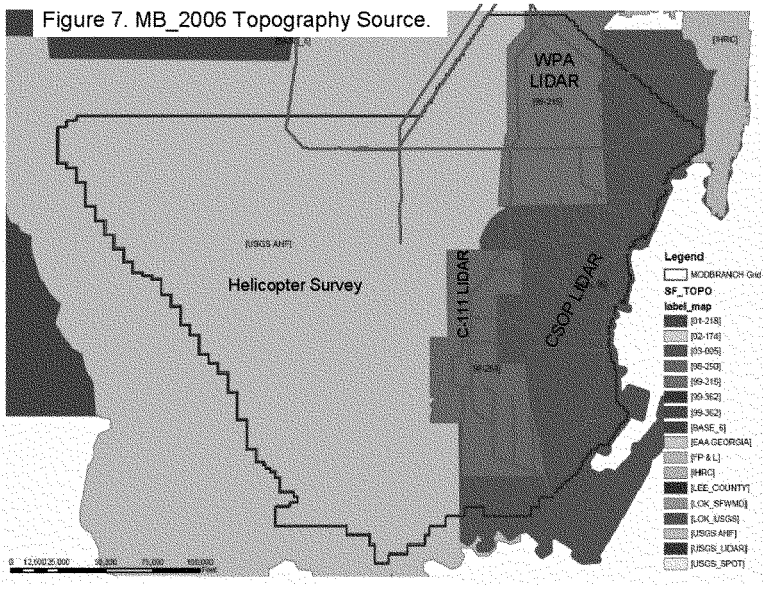
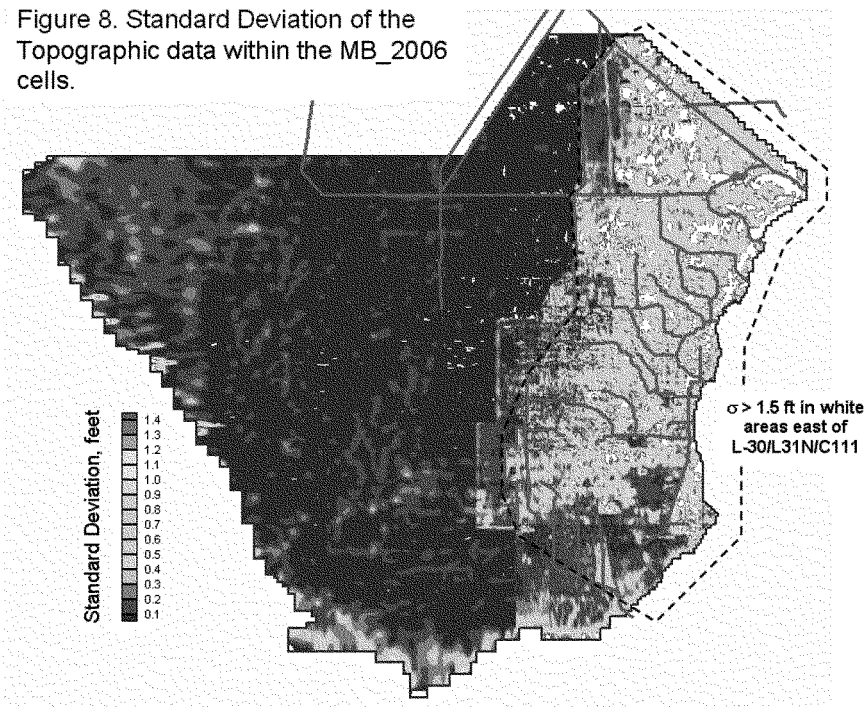


Figure 8. Standard Deviation of the Topographic data within the MB_2006 cells.



STORAGE COEFFICIENTS

The model requires the definition of the storage properties of the various aquifer materials. These are referred to as the primary (sf1) and secondary (sf2) storage coefficients. Table 2 lists the values used for the MB_2006 model simulations.

Table 2. Storage Coefficients of Geologic Materials

Material	Primary Storage Coefficient (sf1)	Secondary Storage Coefficient (sf2, specific yield)
Overland Flow	1.00	n/a
Muck/Peat	0.10	0.44
Fine Sand	0.20	0.23
Tidal/Fresh Marsh	0.10	0.08
Marl/Fine Sand	0.10	0.23
Rock/Caprock/ Oolite	0.10	0.14
Biscayne	0.20	0.12
Gray Limestone Confining Unit	0.05	0.01
Gray Limestone	0.10	0.12
Lower Clastics of Tamiami Formation	0.01	0.01

HYDRAULIC CONDUCTIVITY

The hydraulic conductivity of each cell varied based on the material. For certain materials, such as the surficial sediments and the gray limestone confining unit, the hydraulic conductivity was assigned a constant value. The gray limestone and the Biscayne aquifers were given values that varied according to location. These values were derived using information from Fish and Stewart (1991) and Reese and Cunningham (2000). Table 3 gives the values, or range of values, used for hydraulic conductivity in the MB_2006 model.

Table 3. Hydraulic Conductivities of Geologic Materials

Material	Hydraulic Conductivity, feet per day	Source
Muck/Peat	1	Mark Wilsnack
Fine Sand	10	Domenico & Schwartz
Tidal/Fresh Marsh	1	
Marl/Fine Sand	1	
Rock/Caprock/ Oolite	1	Fish & Stewart
Biscayne	3,000 to 45,000	
Gray Limestone Confining Unit	10	
Gray Limestone	300 to 7,000	Reese & Cunningham
Lower Clastics of Tamiami Formation	1	Fish & Stewart

OVERLAND FLOW

One of the issues of concern of the previous MODBRANCH models (South Dade, PDM) is that overland flow equations were approximated through the use of extremely high conductivity values for the uppermost layer and by specifying the upper layer's bottom elevation as the land surface elevation. This concern has been addressed by implementing the Kadlec's "Rate Law" equation[7,8] for overland flow for the top layer. This is the method employed by the South Florida Water Management District (SFWMD) in its MODFLOW Wetland package. Appendix B discusses the Kadlec equation and the application to MODFLOW. The general form of the equation is

$$v = K_f * d^{\beta} * S_f^{\alpha}$$

where,
v is velocity,
K_f is the flow conductance,
d is the depth,
β is the depth exponent,
S_f is the friction slope, and
α is the slope exponent.

As applied by the SFWMD's wetland package, the value of α=1 and β =3. The MODBRANCH code was modified so that a value of K_f was input for the top layer instead of hydraulic conductivity.

The flow conductance (K_f) of the area will depend on vegetation and land use. Water flow through a dense stand of vegetation will be impeded much more than water flowing over a parking lot or a manicured lawn. Actual values of conductance are not available from field measurements in the area. However, values can be assigned using land use and the values used by the SFWMD in its Lower East Coast Sub-Regional (LECsR) MODFLOW model as a guide. Table 4 lists suggested values of the Kadlec "coefficient" with and associated land use types. Note that due to assignment of β =3, the Kadlec coefficients have units of $1/ft^2$-day which results in v having units of ft/day.

Table 4. Suggested Kadlec Coefficient Values and Land Use Types.

http://www.sfwmd.gov/org/pld/hsm/modflow/wtl_input_kdl.htm

Each land use or vegetation type category in the map has a value for the Kadlec coefficient, the suggested values did not come from field data as they were obtained during the calibration process. The suggested values ranges from 400,000 to 2,000,000, as seen in the following table.

Description	Suggested Kadlec coefficient		Description	Suggested Kadlec coefficient
Lakes	2,000,000		Borrow land	400,000
Reservoirs	2,000,000		Rock Quarries	992,000
Streams and waterways	2,000,000		Freshwater Marshes	992,000
Embayment opening	2,000,000		Freshwater Marshes - Sawgrass	992,000
Bay Swamps	2,000,000		Melaleuca	992,000
Mangrove Swamps	2,000,000		Row Crops	992,000
Channels	2,000,000		Wet Prairies - with Pine	710,000
Wet prairies	1,760,000		Spoil Areas	992,000
Tidal Flats	1,760,000		Roads and Highways	992,000
Mixed Wetland Hardwoods	1,760,000		Improved Pastures	992,000
Mixed Wetland Hardwoods - Willows	1,760,000		Wetland Forested Mixed	1,259,000
Mixed Wetland Hardwoods- Mixed Shrubs	1,760,000		Cypress-with Wet Prairies	1,514,000
Cypress	1,510,000		Light Industrial	710,000

Figure 9 shows the 2000 land use types found within the model domain. There are 31 second level landuse types within the model domain. Of particular interest is the fact that "vegetated non-forested wetlands" (primarily sawgrass), covers the majority of the model domain (>56%). The Kadlec values used in the model are shown in table 5, sorted according to most prevalent land use to least.

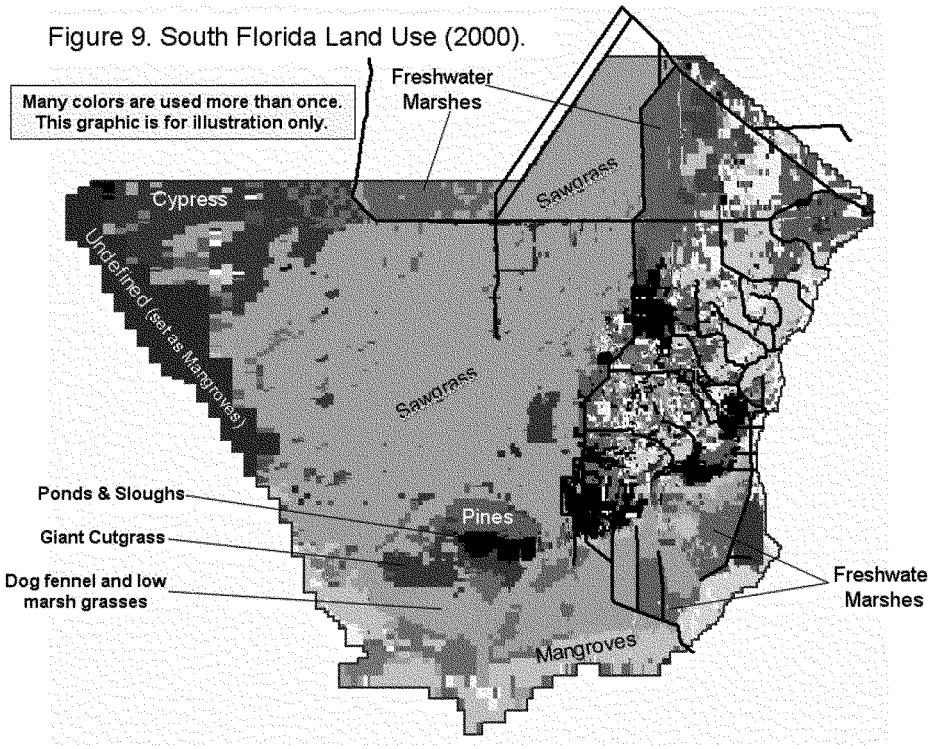


Figure 9. South Florida Land Use (2000).

Table 5. Kadlec Coefficient based on 2000 Landuse and applied to MB_2006 grid.

Landuse Code	Landuse type	Number of MB_2006 cells	Area, acres	% of total area	Kadlec Coefficient, 1/ft^2-sec			
					Average	Median	Minimum	Maximum
640	Vegetated non-forested wetlands	23,155	723,177	56.5%	991,963	992,000	991,642	993,186
610	Wetland Hardwood Forest	4,292	188,049	14.7%	1,759,995	1,760,000	1,758,900	1,772,700
130	Single Family units (>6/acre)	2,901	64,445	5.0%	710,043	710,000	709,808	712,100
210	Crop & Pasture Land	5,491	52,907	4.1%	992,011	992,000	991,581	992,619
620	Cypress	425	45,166	3.5%	1,513,974	1,514,000	1,513,650	1,514,150
120	Single Family units (2-5/acre)	1,712	30,837	2.4%	710,033	710,000	710,000	710,936
650	Non-vegetated tidal flats	474	18,391	1.4%	1,759,983	1,760,000	1,759,240	1,760,240
140	Commercial & Services	645	15,748	1.2%	710,056	710,000	710,000	711,988
110	Low density residential	1,433	15,444	1.2%	710,058	710,018	709,877	710,802
220	Tree Crops	1,800	14,552	1.1%	899,989	900,000	899,795	900,561
240	Nurseries & Vineyards	1,275	13,550	1.1%	900,008	900,000	899,769	900,698
420	Upland Hardwood Forests	489	11,313	0.9%	992,016	992,000	991,617	993,034
810	Transportation Facilities	405	9,872	0.8%	991,961	992,000	991,600	992,578
160	Rock Quarries	283	9,812	0.8%	992,025	992,000	991,624	992,739
320	Shrubs & Brush	499	9,502	0.7%	900,024	900,000	899,818	900,848
830	Utilities	410	9,039	0.7%	992,068	992,000	991,699	992,634
410	Upland Coniferous Forests	157	7,206	0.6%	900,024	900,000	899,919	900,229
150	Industrial	195	6,923	0.5%	710,040	710,000	710,000	710,634
170	Institutional	356	6,156	0.5%	999,954	999,988	999,605	1,000,520
180	Recreational	263	5,696	0.4%	999,978	999,998	999,537	1,000,620
190	Open Land	375	5,656	0.4%	999,960	999,984	999,644	1,000,850
530	Reservoirs	225	5,227	0.4%	1,999,698	1,999,800	1,998,680	2,000,000
310	Herbaceous Dry Prairie	117	2,635	0.2%	900,108	900,007	899,877	901,651
540	Embayments	57	2,214	0.2%	1,999,933	1,999,980	1,999,290	2,000,000
260	Rural Open Land	208	1,876	0.1%	900,013	900,006	899,815	900,329
510	Streams & Waterways	54	1,412	0.1%	1,999,627	1,999,850	1,998,020	2,000,000
740	Disturbed Land	88	1,360	0.1%	400,320	400,284	400,000	401,164
630	Wetland Forested Mix	45	612	0.05%	1,258,977	1,259,000	1,258,770	1,259,270
430	Upland Hardwood Forests	37	469	0.04%	991,955	991,988	991,759	992,000
250	Specialty Farms	21	326	0.03%	900,004	900,000	899,922	900,079
330	Mixed Rangeland	22	269	0.02%	900,030	900,000	899,871	900,369

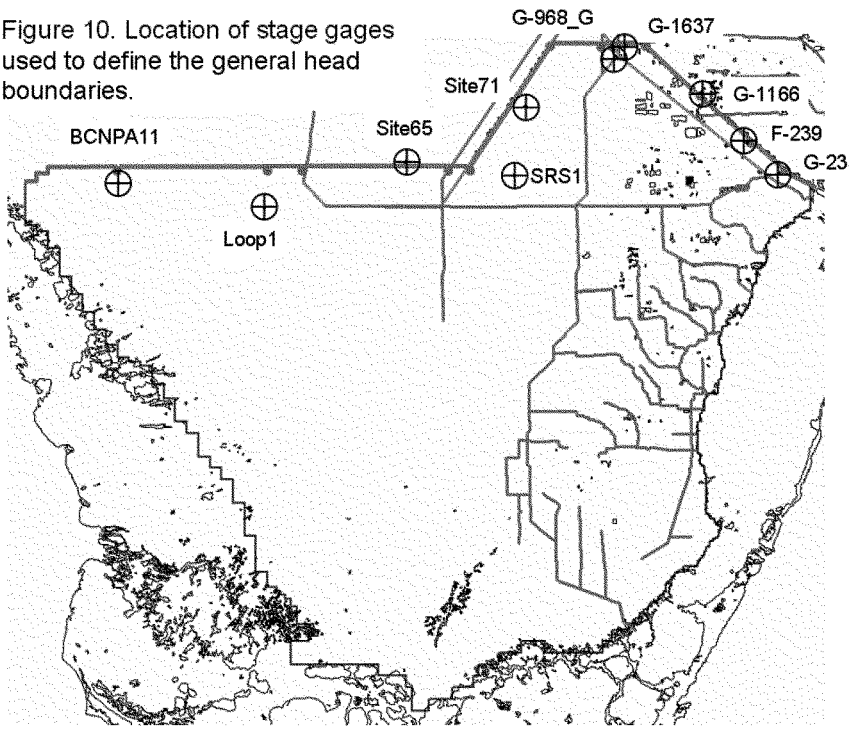
MODEL BOUNDARY CONDITIONS

The ground water portion of the model (MODFLOW) requires a number of input data sets as boundary conditions. These include the general head boundaries, the recharge (rainfall), evapo-transpiration, and production well withdrawal rates. Each of these is dependent on the specific time period simulated. For calibration and verification simulation the data used to create these boundary conditions was derived from field data when possible.

GENERAL HEAD BOUNDARIES

The general head boundaries were generated using field data from ground water gages and a constant stage of 0.25 feet at the coastal boundaries. The locations of the gages and stations are shown in figure 10. Generally, stages were interpolated between the locations. Some locations used the nearest daily stage as a constant (L-28 to L-67A and the top row of the grid).

Figure 10. Location of stage gages used to define the general head boundaries.



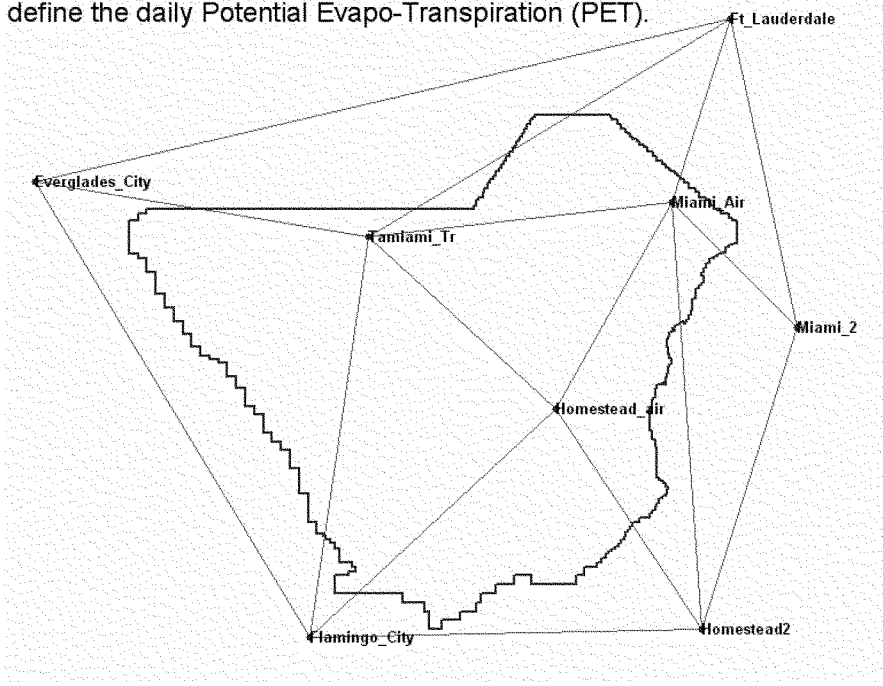
The general head boundary for the coastal areas was modified in order to include the density effects of salinity. A description of the adjustment procedure is found in Appendix A.

The general head boundary values along the northern edge of the model domain (indicated by the green and magenta lines in figure 10) are more complicated. The exact value at each cell is computed using a combination of field data and knowledge of both horizontal (levees and canals) barriers.

METEOROLOGY

The meteorological boundaries consist of rainfall (recharge) and evapo-transpiration (ET). The region lacks a complete rainfall record (both spatially and temporally) for the calibration and verification time periods. Rainfall was defined based on the values used by the South Florida Water Management 2x2 model (SFWMM2x2).

Figure 11. Triangulated Irregular Network (TIN) used to define the daily Potential Evapo-Transpiration (PET).



ET is computed by MODBRANCH using the MODFLOW evapo-transpiration package. This package requires that the user input the maximum potential evapo-transpiration (PET) and parameters that control the effective ET.
The maximum potential ET was defined on a daily basis by using the same data the SFWMD uses for the SFWMM2x2. Figure 11 shows a triangulated irregular network (TIN) with the vertices located at points with daily PET values. The MODBRANCH cells within each triangle were assigned daily PET values based on the equation of a plane through the three vertices. Figure 12 lists the monthly

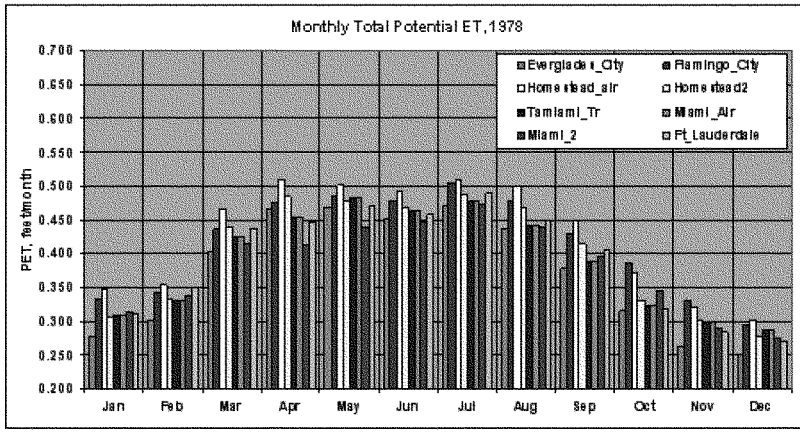
total PET values at each of the nine locations for the average (1978), dry (1989) and wet (1995) years.

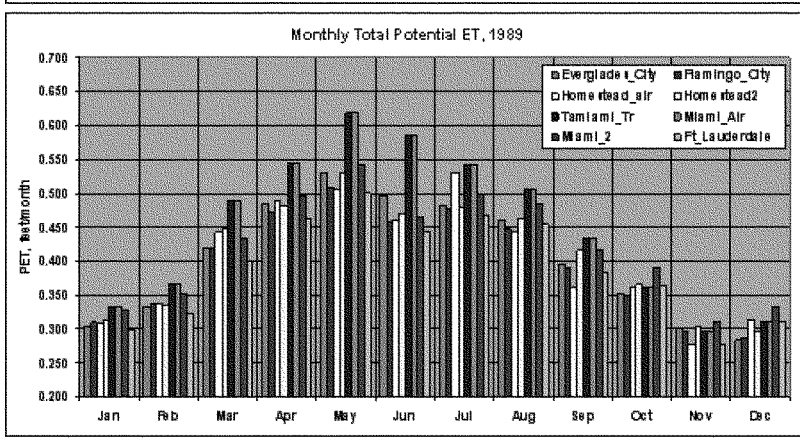
In order to compute ET the model requires several depth values. The first value is the depth below ground at which maximum ET can occur and is known as the "maximum ET depth". The second value is the "ET extinction depth" below which no ET can occur. The ET is computed using a simple equation:

$$ET(z) = PET * f(z).$$

The function f(z) ranges from 1 (at elevations greater than ground elevation – maximum ET depth) to 0 (at elevations less than ground elevation – ET extinction depth).

Good approximations for the maximum ET depth and the ET extinction depth are the "shallow root zone" and the "deep root zones," respectively. The values used in the MB_2006 model are modified from values used in the SFWMM2x2 and are shown in Table 6. The land use types used are those shown in figure 9.





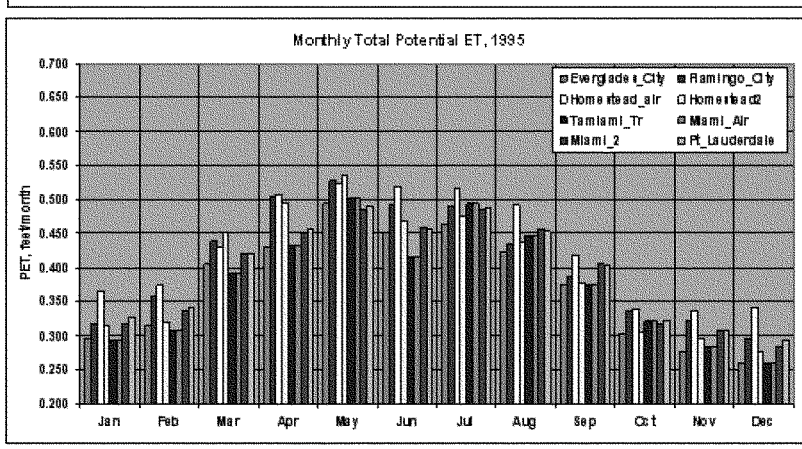


Figure 12. Monthly Total Potential Evapo-Transpiration (PET).

Table 6. Landuse codes and associated root zone depths.		
Landuse Codes	Depth, feet	
	Shallow Root Zone (depth of maximum ET)	Deep Root Zone (ET extinction depth)
111-156	1.0	2.0
160-163	20.0	30.0
165	1.0	2.0
166	3.0	8.0
170-192	1.0	2.0
211-212	1.5	3.0
213	1.5	4.0
214-216	1.5	3.0
221-241	2.0	3.0
242-330	1.0	2.0
411-420	4.5	8.0
422-424	1.5	8.0
427-437	4.5	8.0
511-512	2.0	8.0
520-543	3.0	10.0
611-612	0.0	10.0
617-619	2.0	8.0
621-624	0.0	4.5
625-630	0.0	8.0
641-642	0.0	4.5
643-644	0.0	5.0
650-651	0.0	2.0
740-835	1.0	2.0

PRODUCTION WELLS

All significant sources and sinks must be input as a boundary condition. Municipal water production wells in the area are shown in figure 13. The daily rate at which each individual well in each well field was pumped was not available. The only data available were the monthly total volumes for each permitted well field (see Table 7). A computational cell may only have a single "well" assigned to it. Therefore, the actual pumping rate assigned to each MODBRANCH "well" depended on the number of wells located within a cell. The rates of each well were dependent on the number of wells covered by the permit and the total pumped volume. Only the wells in the north (permit # 13-00037-W) had information available indicating the distribution of pumping rates between the wells.

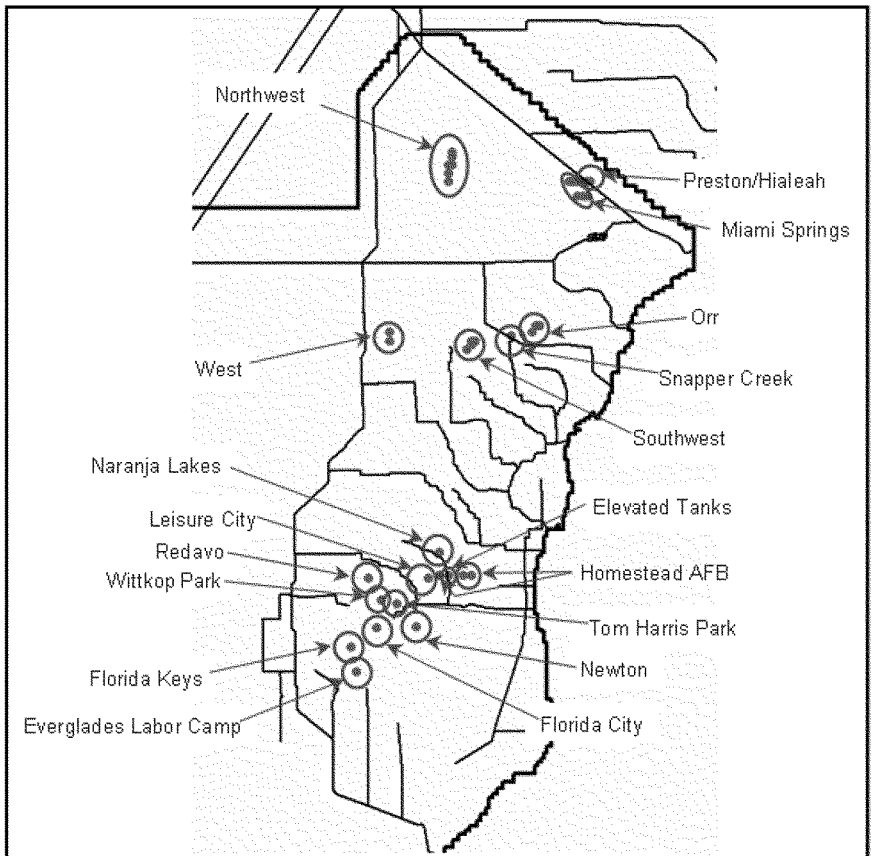


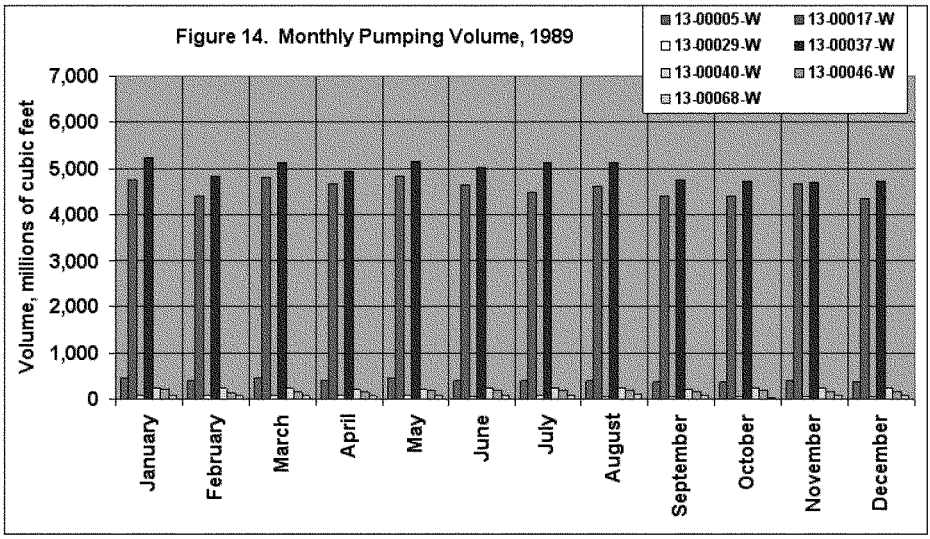
Figure 13. Production Well Locations.

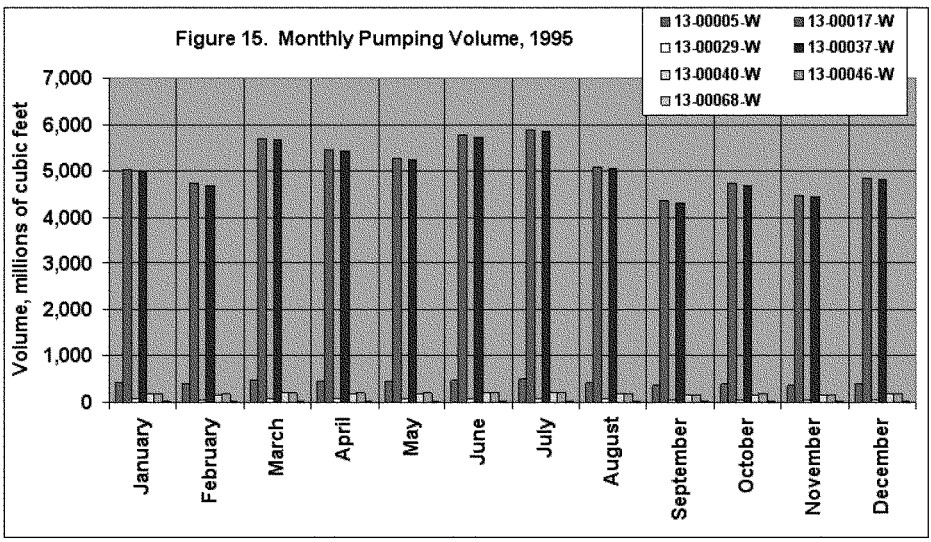
Table 7. Volumes Pumped, millions of cubic feet

1988							
Permit #	**13-00005-W**	**13-00017-W**	**13-00029-W**	**13-00037-W**	**13-00040-W**	**13-00046-W**	**13-00068-W**
Yearly Total	*4819.7*	*55758.0*	*803.2*	*59171.1*	*2542.3*	*2641.6*	*0.0*
January	413.0	4576.0	78.3	4866.0	205.3	206.3	0.0
February	393.1	4427.0	62.9	4535.6	191.7	193.7	0.0
March	434.1	4888.0	67.0	5043.0	211.3	214.6	0.0
April	436.2	4968.0	67.2	5310.1	235.6	219.8	0.0
May	392.8	4699.0	65.7	5000.7	213.6	208.1	0.0
June	359.3	4416.0	64.5	4730.0	204.9	204.6	0.0
July	389.6	4595.0	62.1	4871.3	211.9	210.5	0.0
August	391.8	4641.0	70.0	4883.9	217.8	217.1	0.0
September	367.0	4456.0	64.8	4881.1	204.7	215.6	0.0
October	404.4	4676.0	66.9	5105.6	216.7	220.8	0.0
November	409.0	4552.0	66.9	4918.0	207.3	210.3	0.0
December	429.5	4864.0	66.9	5025.8	221.5	220.1	0.0
1989							
Permit #	**13-00005-W**	**13-00017-W**	**13-00029-W**	**13-00037-W**	**13-00040-W**	**13-00046-W**	**13-00068-W**
Yearly Total	*4936.0*	*55056.0*	*759.5*	*59480.9*	*2772.8*	*2102.0*	*990.2*
January	455.6	4752.5	77.5	5232.9	238.2	221.4	87.1
February	413.2	4401.0	72.8	4836.7	227.3	142.6	80.5
March	445.9	4821.5	74.4	5130.6	245.8	157.8	91.6
April	410.1	4666.0	72.0	4936.5	219.0	165.9	85.4
May	446.6	4824.5	74.4	5151.5	224.6	183.1	82.6
June	412.6	4655.0	66.0	5009.8	227.2	183.0	82.0
July	408.5	4491.5	68.2	5142.3	229.6	181.8	91.8
August	413.5	4619.0	49.6	5121.5	232.5	182.3	117.1
September	383.0	4397.0	51.0	4751.2	226.9	170.6	84.9
October	383.5	4402.5	49.6	4742.1	237.4	174.4	26.6
November	388.8	4664.0	51.0	4705.7	231.1	168.5	78.2
December	374.6	4361.5	53.0	4720.1	233.1	170.6	82.5
1994							
Permit #	**13-00005-W**	**13-00017-W**	**13-00029-W**	**13-00037-W**	**13-00040-W**	**13-00046-W**	**13-00068-W**
Yearly Total	*5130.1*	*60927.5*	*701.6*	*61895.7*	*2907.6*	*2090.9*	*504.2*
January	420.7	4996.1	57.5	5075.4	238.4	171.5	41.3
February	395.0	4691.4	54.0	4766.0	223.9	161.0	38.8
March	477.1	5666.3	65.2	5756.3	270.4	194.5	46.9
April	456.6	5422.5	62.4	5508.7	258.8	186.1	44.9
May	441.2	5239.8	60.3	5323.0	250.1	179.8	43.4
June	482.2	5727.2	65.9	5818.2	273.3	196.5	47.4
July	492.5	5849.0	67.4	5942.0	279.1	200.7	48.4
August	425.8	5057.0	58.2	5137.3	241.3	173.5	41.8
September	364.2	4325.9	49.8	4394.6	206.4	148.5	35.8
October	395.0	4691.4	54.0	4766.0	223.9	161.0	38.8
November	374.5	4447.7	51.2	4518.4	212.3	152.6	36.8
December	405.3	4813.3	55.4	4889.8	229.7	165.2	39.8
1995							
Permit #	**13-00005-W**	**13-00017-W**	**13-00029-W**	**13-00037-W**	**13-00040-W**	**13-00046-W**	**13-00068-W**
Yearly Total	*5136.9*	*61375.5*	*838.0*	*60875.5*	*2209.8*	*2354.1*	*377.8*
January	421.2	5032.8	68.7	4991.8	181.2	193.0	31.0
February	395.5	4725.9	64.5	4687.4	170.2	181.3	29.1
March	477.7	5707.9	77.9	5661.4	205.5	218.9	35.1
April	457.2	5462.4	74.6	5417.9	196.7	209.5	33.6
May	441.8	5278.3	72.1	5235.3	190.0	202.5	32.5
June	482.9	5769.3	78.8	5722.3	207.7	221.3	35.5
July	493.1	5892.0	80.4	5844.0	212.1	226.0	36.3
August	426.4	5094.2	69.6	5052.7	183.4	195.4	31.4
September	364.7	4357.7	59.5	4322.2	156.9	167.1	26.8
October	395.5	4725.9	64.5	4687.4	170.2	181.3	29.1
November	375.0	4480.4	61.2	4443.9	161.3	171.8	27.6
December	405.8	4848.7	66.2	4809.2	174.6	186.0	29.8

Permit #	**Well fields included in permit**
13-00005-W	Florida Keys Aqueduct Authority
13-00017-W	West, Orr, Snapper Creek, and Southwest
13-00029-W	Florida City
13-00037-W	Northwest, Preston/Hialeah, and Miami Springs
13-00040-W	Everglades Labor Camp, Naranja Lakes, Leisure City, Redavo, Newton, and Elevated Tanks
13-00046-W	City of Homestead: Wittkop Park and Tom Harris Park
13-00068-W	Homestead Air Force Base

Figures 14 and 15 show the monthly total volumes pumped from the wells covered under each permit. Note that the majority of pumping is done in the well fields covered by permits 13-00017-W and 13-00037-W, both in the northern part of the model domain.





CANAL GEOMETRY AND LEAKAGE

Canal stage and flow rates are simulated by the BRANCH part of MODBRANCH. Canals are represented by a series of one-dimensional "branches" each of which are defined by a number of "cross-sections" or "segments" of defined length, depth, and area. Structures can be defined as pumps, culverts, or spillways. The canal network is comprised of 798 branches (~3000 cross-sections) and 52 structures of various types. The network represents over 360 miles of canals as illustrated in Figure 16. The model domain covers approximately 2,000 square miles.

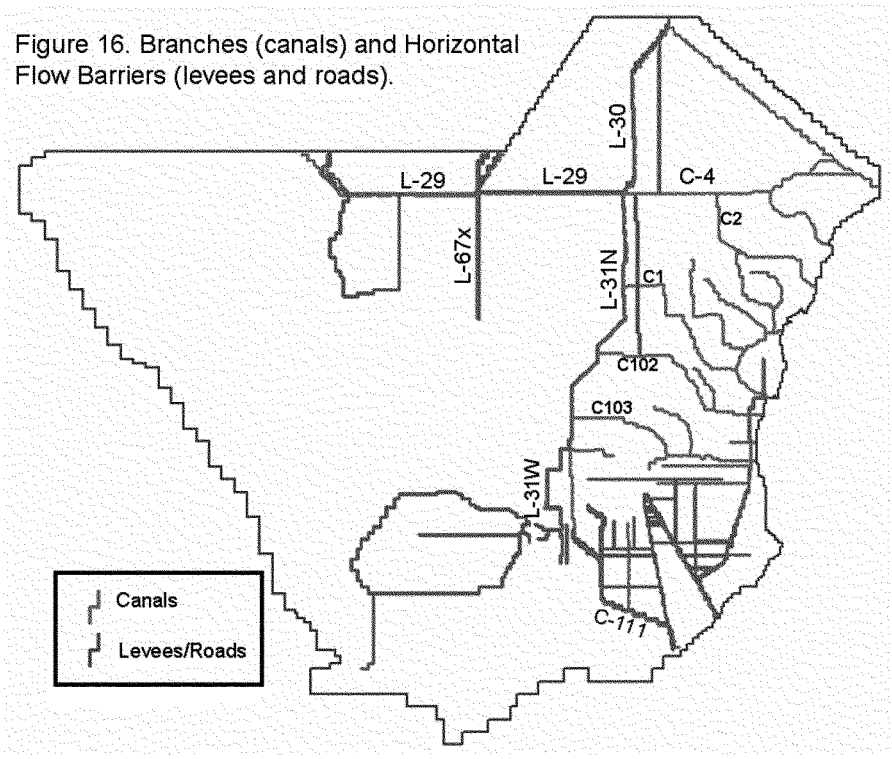


Figure 16. Branches (canals) and Horizontal Flow Barriers (levees and roads).

Each branch segment is assigned to a specific MODFLOW cell corresponding approximately to that segment's geographic location. Canal location accuracy is therefore limited to the local grid resolution. Each canal segment is assigned to the 3rd layer. It is important to note that the model does not simulate flow between the canals and the top (overland flow) layer directly. Water which moves overland (i.e., within the 1st layer) must first move down through the 2nd and 3rd layers and then into the canals. Conversely, water moving out of the canals into the 1st layer must first pass through the 2nd and 3rd layers. There is no direct hydraulic link between any canal segment and overland flow.

Movement between the 3rd layer and the canal segment is controlled by a "leakage coefficient," which is an input variable via the BRANCH portion of the code. An analysis of field data for a number of canal reaches was done in order to determine the range of values for the leakage coefficients. This analysis is found in Appendix C. Based on the analysis, the MB_2006 model used only two values of leakage coefficient: 0.00024/second and 0.00048/second. The lower value was applied only to C-4, L-30, and C-6 (Miami Canal). The value of 0.00048/second agrees with the value found by Genereux, et al[9].

The cross-sectional area of each canal was based on the "as built" specifications of the canals, if that information was available. If the information was not available, then the next approximation was the planned cross-sections. If that information was not available, then approximations were made using other means (aerial photography, personal communications, etc.) The last method was used mainly for non-project canals (Military canal, Card Sound Road canal, etc.).

There are fifty-one structures in the calibration branch network and fifty-two structures in the verification branch network (G-211 did not exist in 1989). These include pumps, gated culverts and gated spillways. The specific structures and types are listed in Table 8.

Table 8. Structures included in the MB_2006 Branch Network for Calibration and Verification Simulations

Pumps	Gated Culverts	Gated Spillways
S-331	***CulC4***	*G-114*
S-332	***CulML***	***G-93***
S-332D	***G-119***	S-118
	G-211	S-119
	S-120	S-123
	S-121	S-148
	S-122	S-165
	S-14	S-166
	S-149	S-167
	S-173	*S-174**
	S-175	S-176
	S-178	S-177
	S-194	S-179
	S-195	S-18C
	S-196	S-20
	S-197	S-20F
	S-25	S-20G
	S-25A	S-21
	S-336	S-21A
	S-338	S-22
	S-343A	S-25b
	S-343B	S-26
	S-346	***S-333***
	S-347	***S-334***
		S-335

Manually operated structues in **Bold Italics.**
Remotely operated structures in *Red, Bold Italics*
Uncontrolled in *Blue, Bold Italics*
Automatically operated structures are in plain font
**S-174 is both automatic and manually controlled.*

CANAL BOUNDARY CONDITIONS

The canals must have boundary conditions defined wherever a branch junction is not connected to another branch. There were two types of canal boundary

conditions used in the calibration and verification of the models. The first is a flow boundary. The flow boundaries were used when a canal had a terminal end within the model domain; in these cases the flow was specified as 0. Flow boundaries were also used to define the inflows of the S12 (A, B, C, D) structures.

There are sixteen canal junctions that require stage boundaries. Nine of the stage boundaries are tidal boundaries. These data are harmonic daily average stages. Six stage boundaries were obtained from field data at the nearest gauging stations. The last stage boundary is a constant and represents the stage in the Turkey Point cooling ponds. The stage boundary locations are shown in figure 17.

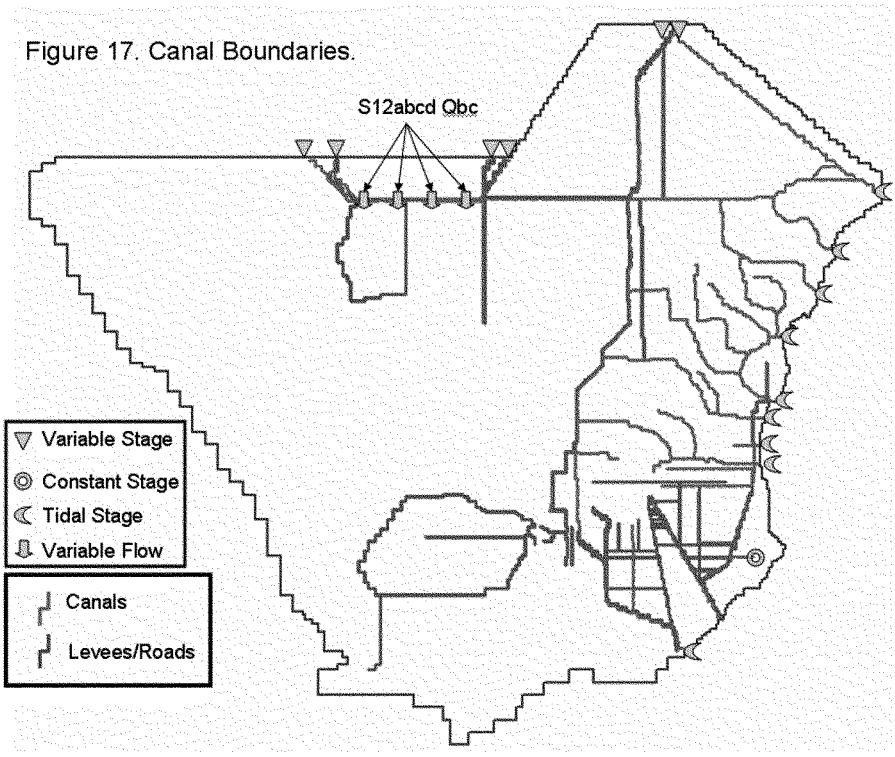


Figure 17. Canal Boundaries.

HORIZONTAL FLOW BARRIERS

Levees, and some roads, are designated as "horizontal flow barriers" in the model. The flow barriers were generally placed only in layers 1 and 2. The effectiveness of the horizontal flow barrier is determined by the hydraulic

characteristic (HYDCHR) assigned to the barrier. The majority of the barriers were assigned values of HYDCHR equal to –9.999. This value serves as a "flag" to the code and indicates that there is essentially no flow allowed through that segment of the barrier. The only exceptions to this were the barriers for L-28 and L-29. These barriers had HYDCHR values of 10 in order to increase the amount of seepage through the levees.

Most defined roads were included in both layers 1 and 2. However, a few roads were included as horizontal flow barriers only in layer 1. These include State Highway 27 (within the ENP) and Krome Avenue.

MODEL TIME STEPS

The computational time step used in both the BRANCH and MODFLOW portions of the model is 1 hour. Using the same time step increases model stability, although computation time is increased. The simulation time is 396 days, which covers an entire year and has an additional 31 days of "spin-up." The total number of time steps is 9504.

MODFLOW SOLVER

The solver used for the MODFLOW portion of the model is the Preconditioned Conjugate-Gradient Package 2 (PCG2). The modified, incomplete Cholesky method of preconditioning was used. The PCG2 package also requires that the user define two different iterations, an outer (Picard) iteration and an inner iteration.

The number of outer iterations required to reach a solution varies depending on whether a problem is linear or non-linear. In general a MODFLOW model is non-linear if the aquifers are unconfined or if certain packages are used. These packages include the River package, the Stream Package, the Evapo-transpiration package, and the Drain package. In the case of this study, the aquifers are unconfined and the Evapo-transpiration package is also used. Although neither the River nor Stream package is used, coupling the BRANCH model with the MODFLOW model can also be expected to introduce non-linearity.

The practical problem with non-linear simulations is that they require much more time than linear simulations. A linear problem generally requires 1 outer iteration and less than 50 inner iterations. A non-linear problem may require 100 outer iterations and 3-10 inner iterations.

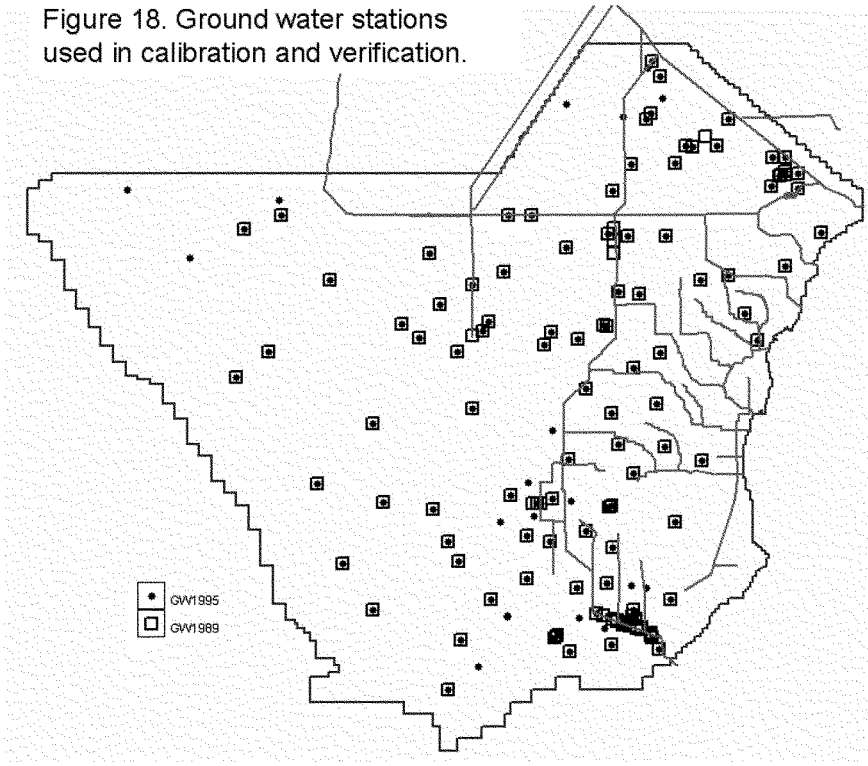
Test simulations were previously run with a variety of outer iterations and 4 inner iterations. Results of these tests are discussed in Appendix E. The final conclusion is that it is appropriate and justified to use 5 outer iterations and 4 inner iterations for this study.

The convergence criteria were set at 0.050 ft (head change) and 30,000 cf/d (residual change). The relaxation parameter is 0.98.

CALIBRATION AND VERIFICATION

The MB_2006 MODBRANCH model was *calibrated* to 1989 data. The model was *verified* to 1995 data. The locations of the data stations are shown in figure 18.

Figure 18. Ground water stations used in calibration and verification.



The canal inputs are based on fairly well known data (cross-section, leakage coefficient, Manning's n, maximum structure flow rates, etc.). As such, it was not justifiable that these values should be used as a "knob" in order to calibrate/verify the model.

Model simulations were generally performed for both years without using general structure operational rules. Structures were operated based on field data records, if available. This insured that the canal levels were representative of

actual field conditions and put the burden of calibration and verification on having correct hydrogeological and meteorological parameters. This is justifiable due to the fact that the latter parameters have a wide range of valid values that can be adjusted during the calibration and verification process. The canal parameters have a narrower range of valid values.

Time series plots of each station with both field data and model results can be found in appendix D.

CALIBRATION AND VERIFICATION STATISTICS

Many different statistics have been created and used to "prove" a model's worthiness.

Ten statistical measurements were used in order to determine the "goodness" of the model results versus field data. These are: Pearson's correlation coefficient[10] (r), average absolute difference, average difference, root mean squared error (RMSE), systematic root mean squared error ($RMSE_S$), unsystematic root mean squared error ($RMSE_U$), the ratio $RMSE_S$ / RMSE, the index of agreement (d), and the least square fit (slope and intercept)[11] of the field data versus model data. In order to insure that each measurement is understood a short description of each is included here.

Pearson's Correlation Coefficient, r

This is also known as the linear correlation coefficient and is defined as:

$$r = \frac{\sum_i (x_i - \underline{x})(y_i - \underline{y})}{\sqrt{\sum_i (x_i - \underline{x})^2}\sqrt{\sum_i (y_i - \underline{y})^2}}$$

where

x_i = individual field data points,
$\underline{x}$ = the average of the individual field data points,
y_i = individual model data points, and
$\underline{y}$ = the average of the individual model data points.

The correlation coefficient has a range between –1 and +1. When the value approaches +1, then the model and field are near "positive correlation." Complete positive correlation occurs when the model data versus the field data lie on a perfect straight line with positive slope. When the value approaches –1, the model and field data have "negative correlation." As r approaches a zero value, the data are uncorrelated. A good model should have r values approaching +1.

Average Absolute Difference

The average absolute difference is also known as the *mean absolute error*. The value indicates the amount of deviation between the model and field data. It is the average of the absolute difference between the model and field data:

$$\Delta_{abs} = \sum_{i}^{N} |m_i - f_i| \Big/ N$$

where

m_i = individual model data value,
f_i = individual field data value, and
N = number of model and field data pairs.

Average Difference, or "Bias"

The average difference is simply the average of the differences between model and field data. This is also known as the *mean bias error*. Its main value is that it will give an indication whether the model is over-predicting (> 0) or under-predicting (< 0).

$$\Delta = \sum_{i}^{N} (m_i - f_i) \Big/ N$$

Root Mean Square Error (RMSE)

The *root mean square error* is computed as:

$$RMSE = \sqrt{\sum_{i}^{N} (m_i - f_i)^2 \Big/ N}$$

The utility of the RMSE is limited, as are the previous error indicators, in that it contains errors associated with both the imperfections of the model and the inaccuracy of the field data. A better measure of model performance is the *Systematic Root Mean Square Error*. Since the RMSE is commonly used, it is included for comparison with other models.

Systematic Root Mean Square Error ($RMSE_S$)

The $RMSE_S$ is a measure of error that is associated with the model parameters. As such, it is a better indication of how the model is performing than the RMSE alone. The more accurate that a model is, the closer that $RMSE_S$ is to zero. The $RMSE_S$ is defined:

$$RMSE_S = \sqrt{\sum_i^N (\hat{m}_i - f_i)^2 \Big/ N}$$

where

$\hat{m}_i$ = the *expected value* of the model results derived from a linear least squares fit of the model and field data, evaluated at f_i.

Unsystematic Root Mean Square Error ($RMSE_U$)

The $RMSE_U$ is an indication of the amount of error that will always exist and which probably can not be removed from the system. As $RMSE_S$ approaches zero, $RMSE_U$ approaches RMSE. The $RMSE_U$ is defined:

$$RMSE_U = \sqrt{\sum_i^N (m_i - \hat{m}_i)^2 \Big/ N}$$

where the variables are defined above.

$RMSE_S$ / RMSE

The ratio of $RMSE_S$ to RMSE indicates the proportion of the error that arises from systematic error. Ideally, this should be small.

Index of Agreement (d)

The index of agreement is a measurement of average relative error. It ranges between 0 and 1, with 1 being considered "good." The index of agreement, d, is defined as:

$$d = 1 - \sum_i^N (m_i - f_i)^2 \Big/ \left(|m_i'| - |f_i'|\right)^2$$

where

$$m_i' = m_i - \underline{f}$$

$$f_i' = f_i - \underline{f}$$

Slope and Intercept

The final statistics used are the slope and intercept of a linear least squares fit between the field data and the model results. For a "perfect" fit, the slope would be 1 and the intercept would be 0.

Percent of time model is within 1 foot of field data

The SFWMD uses the percentage of the simulated period that the model is within +/- 1 foot of field data as an estimate of the "goodness" of the model. This is used in its discussion of calibration and verification of the LECsR model.

Statistical Analysis

Table 9 shows the MB_2006 results for both the calibration (1989) and verification (1995) periods. This table lists the Pearson's r (correlation coefficient), the average absolute error, the bias, the RMSE, and the systematic RMSE for all the groundwater stages used within the MB_2006 domain. Table 10 is a global summary of the results and includes other statistics. The two most commonly used statistics, Pearson's r and RMSE, indicate average values of ~0.79 and ~0.6 ft, respectively. It should be noted that the Systematic RMSE (that error associated with the model data) is about 0.1 ft less than the normal RMSE. Figures 19 and 20 show the RMSE of the stage plotted with color relative to the magnitude of the RMSE (red is "bad" and blue is "good"). The location of production wells is superimposed on each figure.

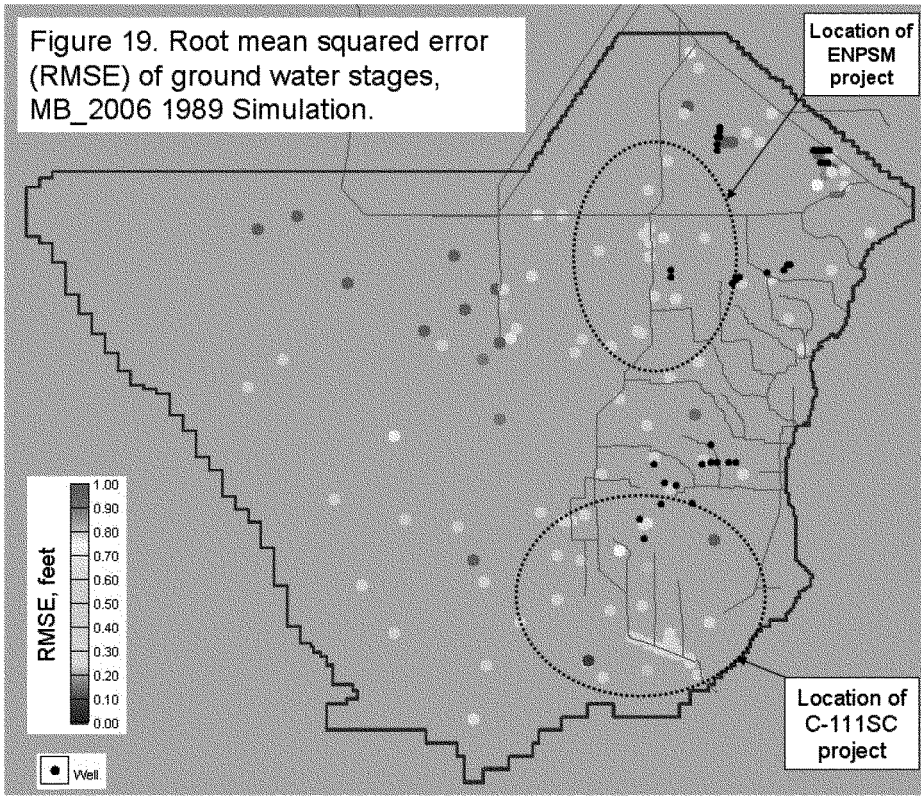


Figure 19. Root mean squared error (RMSE) of ground water stages, MB_2006 1989 Simulation.

For both simulation periods, some of the largest RMSE values are in the vicinity of the production wells that pump the largest values. As discussed above, the information on the pumping rates did not designate which wells pumped specific

volumes; only the volumes for each permit were provided. This could be a significant source of errors for locations near the production wells.

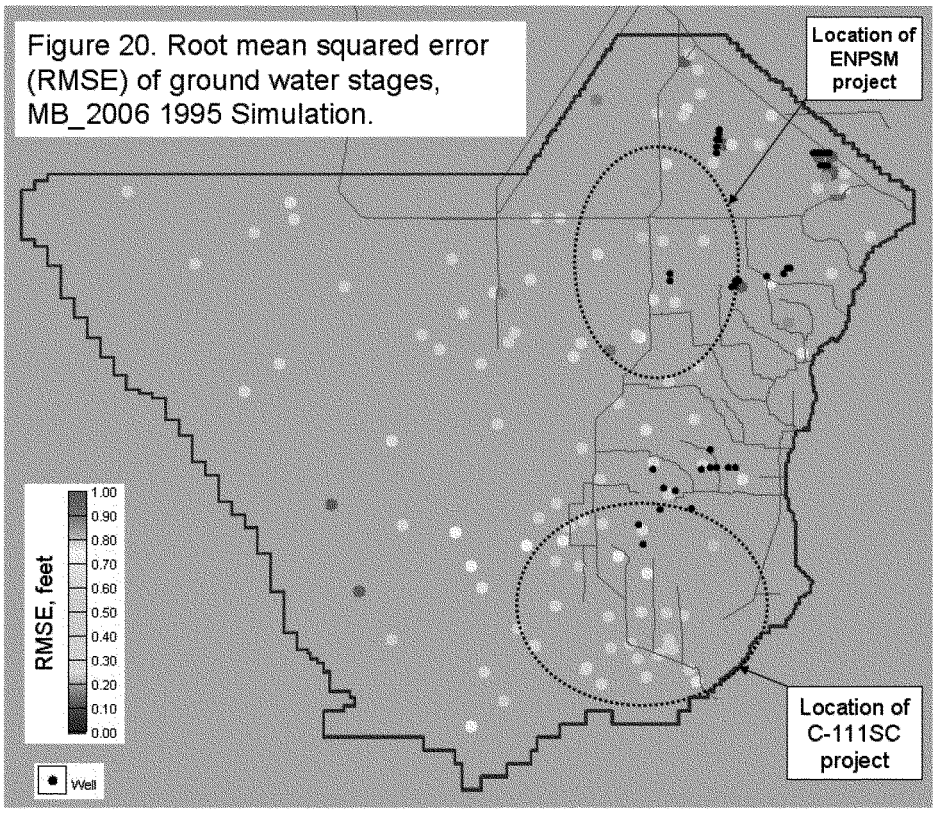


Figure 20. Root mean squared error (RMSE) of ground water stages, MB_2006 1995 Simulation.

The 1989 RMSE shows larger values in the north western part of the model domain than the 1995 RMSE. This may be indicative of dry year errors in boundary conditions, meteorological errors, or errors in geologic input. If the latter two reason are the source of the error, this indicates that the model is doing a fairly good job with the overland flow equations, which would dominate in the wet (1995) year.

The geologic parameters in the western part of the model are defined by the gray limestone and the gray limestone confining unit (figure 3 and table 1) and are based on the work of Reese and Cunningham[12]. Their work is fairly recent (2000) and represents fairly up to date data. If these data are inaccurate, it would require significant field work to correct.

The third possible cause is meteorological: rain and/or evapo-transpiration. This region is more isolated than the rest of the model domain and has the fewest rain gages for the creation of accurate rainfall boundary conditions.

Do the values shown in tables 9 and 10 indicate that the MB_2006 model is sufficiently calibrated and verified? There are many ways to answer that question. However, in order to be consistent, one of the best ways is to compare with other hydrologic models in the region. The south Florida area is blessed to have a plethora of modeling work and two of the most scrutinized models are from the SFWMD. The first is the venerable South Florida Water Management Model (SFWMM), also referred to as the "2x2"; the second is the SFWMD Lower East Coast sub-Regional (LECsR) MODFLOW model. These models have been reviewed by numerous individuals and agencies and have been found to be useful tools to understand the hydrology of the area. Therefore, it behooves us to compare the MB_2006 results with these models.

Table 11 shows the SFWMM2x2 summary values of correlation coefficient, RMSE, and Bias for 79 locations which are within the domain of the MB_2006 model. These are from the SFWMM v5.4 calibration and verification report (April 2004, http://www.sfwmd.gov/org/pld/hsm/models/sfwmm/index.html). The calibration period is a 12 year period covering 1984-1995; the verification periods are from 1981-1993 and 1996-2000, a total of 18 years. The correlation coefficient for calibration and verification is 0.87, the RMSE is ~0.4 ft, and the absolute average bias <0.1 ft. These values correspond fairly well with the MB_2006 values of 0.79, 0.6 ft, and <0.1 ft, respectively. There can be many reasons for the discrepancy, including the choice of gages and the periods and length of the simulations. Note that two gages that are included in the MB_2006 statistics (G-3355 and G-3356) are not included in the SFWMM2x2 analysis. These two locations are potentially bad data stations; the inclusion of these locations could reduce the estimated accuracy of the MB_2006 model.

The SFWMD LECsR model has much finer resolution than the SFWMM2x2 and is a MODFLOW based model. Since the MODBRANCH model is also MODFLOW based and has fine resolution, the LECsR model results should be comparable to the MB_2006 results. Table 12 reports the bias, the mean absolute error, and the RMSE for the calibration and verification periods, as reported by the SFWMD[13]. Note that the upper part of the table reports all 195 locations used in the LECsR model calibration and verification. The lower part reports the values only for the 85 locations that are within the MB_2006 domain. The calibration period is 1986-1999, approximately 14 years. The verification period is 1999-2000, a period of 2 years.

The 85 locations within the MB_2006 domain indicate better values of mean absolute error and RMSE than the values for all 195 locations. The bias for the 195 locations is slightly less than that of the 85 locations, although the difference is really insignificant. The absolute value of the bias for both the MB_2006 and LECsR are both on the order of ~0.1 ft, the mean absolute errors are both ~0.5 ft

and the RMSE values are in the range of 0.5 to 0.7 ft. Based on these statistics, the MB_2006 model compares well with the LECsR model.

Another measure of "goodness" used by the SFWMD is the percent of simulation time that model results are within a specified range of field data. The SFWMD uses this in its discussion of calibration and verification of the LECsR model. The standard of the SFWMD is to determine how often the model stages are within +/-1 foot of the field data. Tables 13 and 14 show this "statistic" for the MB_2006 and LECsR models, respectively. At the end of each table is a summary with the number of locations with percentages greater than 90%, 80% and 70%, and the global average percentage. The same results are shown graphically in figures 21 and 22, with the red dots indicative of poor agreement and the blue dots indicative of good agreement.

Figure 21. Percent of Time MB_2006 stage is within 1 foot of ground water stages, 1989 Simulation.

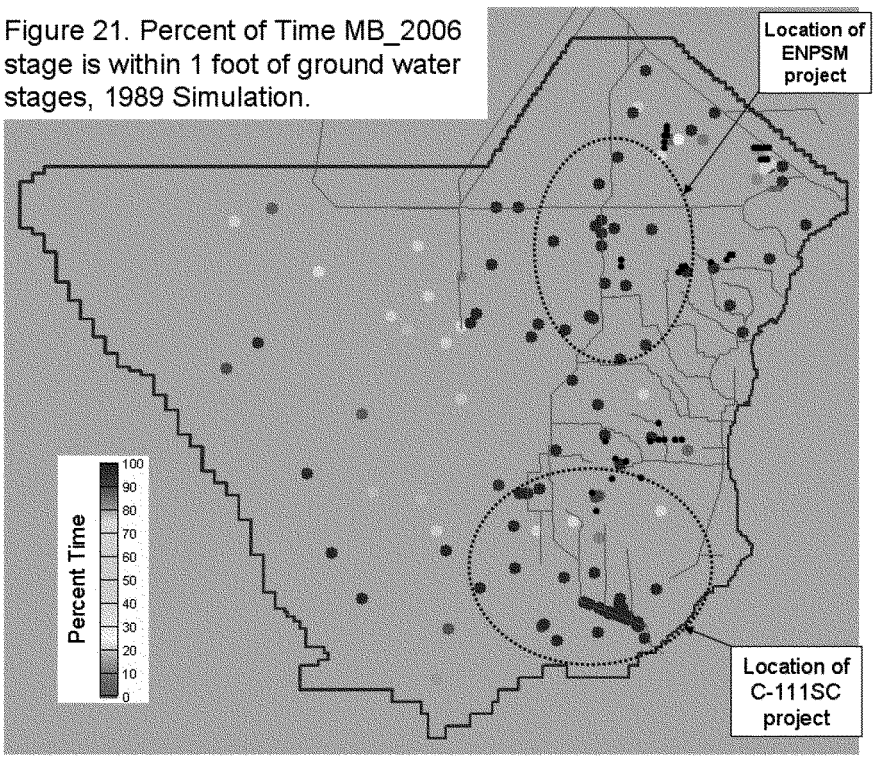
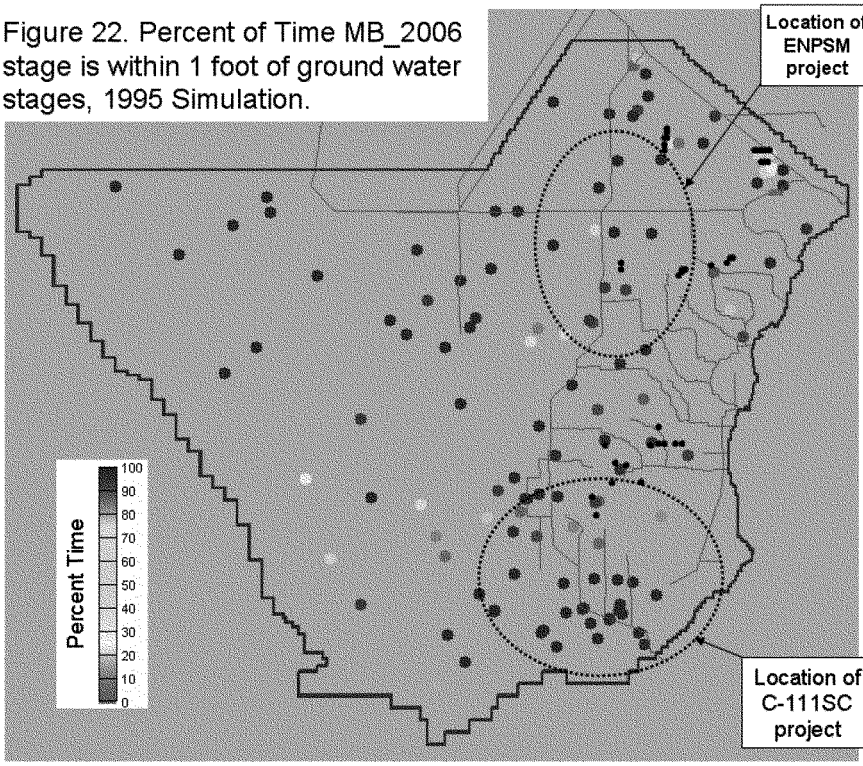


Figure 22. Percent of Time MB_2006 stage is within 1 foot of ground water stages, 1995 Simulation.



The MB_2006 shows the average percent of time the model is within 1 ft of the field measurements to be 87% (1989) and 90% (1995). The LECsR model reports values of ~87% for both its calibration and verification periods.

Based on the general agreement between the three models discussed above, it is evident that the MB_2006 model is calibrated and verified at least to the level of the SFWMD LECsR and SFWMM2x2 models.

Table 9. MB_2006 Statistics for Calibration (1989) and Verification (1995) Stations.

Station	1989					1995				
	Pearson's r	Average Absolute Difference, feet	Bias (model - field), feet	RMS Error, feet	Systematic RMSE, feet	Pearson's r	Average Absolute Difference, feet	Bias (model - field), feet	RMS Error, feet	Systematic RMSE, feet
2287497						0.76	0.32	0.23	0.38	0.29
2289096						0.92	1.34	1.34	1.35	1.35
3-34						0.96	0.41	-0.41	0.49	0.45
3-71						0.99	0.15	-0.15	0.17	0.15
3B-SE_B	0.77	0.28	0.16	0.38	0.23	0.96	0.15	-0.04	0.20	0.05
ANGELS	0.87	0.31	0.20	0.40	0.25	0.93	0.85	-0.85	0.91	0.86
BCNPA10						0.82	0.34	0.31	0.38	0.31
BCNPA11						0.95	0.34	-0.34	0.35	0.34
BCNPA9						0.88	0.64	0.64	0.66	0.65
EVER8						0.69	0.42	-0.15	0.49	0.15
F-179	0.83	0.18	-0.09	0.28	0.21	0.87	0.43	-0.41	0.54	0.50
F-319	0.87	0.26	0.02	0.33	0.13	0.70	0.25	0.00	0.36	0.10
F-358	0.84	0.37	-0.30	0.45	0.30	0.76	0.46	-0.18	0.59	0.18
Fpond	0.85	0.28	0.12	0.35	0.18	0.87	0.28	-0.03	0.39	0.05
G-1183	0.79	0.73	-0.73	0.78	0.73	0.52	0.54	-0.10	0.66	0.13
G-1362	0.90	0.56	0.56	0.60	0.56	0.72	0.46	-0.08	0.52	0.20
G-1363	0.89	0.53	0.52	0.58	0.53	0.76	0.52	0.20	0.66	0.20
G-1368A	0.69	0.59	-0.15	0.79	0.63	0.57	1.99	1.85	3.13	3.11
G-1486	0.86	0.30	0.04	0.35	0.11	0.72	0.46	0.18	0.58	0.21
G-1487	0.83	0.31	-0.27	0.38	0.33	0.83	0.56	-0.52	0.63	0.57
G-1488	0.84	0.30	-0.13	0.37	0.25	0.95	0.20	-0.16	0.26	0.22
G-1502	0.88	0.44	0.04	0.50	0.06	0.89	0.60	-0.55	0.78	0.67
G-3	0.71	2.09	-2.09	2.22	2.10	0.77	1.10	1.09	1.26	1.12
G-3073	0.93	0.19	-0.02	0.26	0.08	0.51	0.58	-0.47	0.71	0.59
G-3253	0.80	3.89	3.88	4.07	4.04	0.83	0.83	-0.33	1.04	0.94
G-3259A	0.92	1.48	1.46	1.62	1.59	0.85	0.60	-0.58	0.78	0.67
G-3264A	0.88	0.43	0.21	0.58	0.26	0.98	0.36	0.26	0.39	0.36
G-3273	0.86	0.44	0.18	0.53	0.19	0.90	0.49	-0.37	0.62	0.50
G-3328	0.84	0.26	-0.13	0.32	0.15	0.69	0.21	-0.06	0.28	0.20
G-3329	0.83	0.64	-0.53	0.75	0.56	0.65	0.38	0.12	0.47	0.14
G-3354	0.88	0.25	-0.21	0.30	0.21	0.73	0.36	0.09	0.44	0.13
G-3355	0.45	0.64	-0.56	0.81	0.70	0.55	0.57	-0.44	0.71	0.45
G-3356	0.72	0.95	-0.95	1.00	0.97	0.53	0.65	-0.57	0.80	0.60
G-3439	0.69	0.31	-0.06	0.43	0.18	0.92	0.28	-0.06	0.35	0.06
G-3465	0.84	0.77	-0.73	0.89	0.74	0.84	0.75	0.72	0.85	0.76
G-3466	0.80	0.55	-0.42	0.64	0.42	0.85	1.24	1.26	1.36	1.33
G-3467	0.89	0.24	-0.15	0.31	0.15	0.89	0.35	0.26	0.40	0.35
G-551	0.88	0.36	-0.18	0.45	0.18	0.78	1.56	1.43	1.68	1.55
G-553	0.90	0.40	-0.34	0.50	0.36	0.73	0.66	-0.92	0.86	0.57
G-594	0.78	1.16	-1.16	1.24	1.20	0.89	0.58	-0.44	0.66	0.59
G-596	0.85	0.34	0.24	0.40	0.36	0.89	0.65	-0.64	0.73	0.66
G-596_B	0.87	0.31	0.23	0.38	0.34	0.87	0.52	-0.50	0.62	0.51
G-613	0.50	0.60	0.55	0.75	0.56	0.68	0.63	0.58	0.72	0.54
G-614	0.91	0.90	0.90	0.93	0.90	0.88	0.47	0.82	0.59	0.47
G-618_B	0.92	0.37	0.30	0.40	0.31	0.90	0.28	0.25	0.30	0.28
G-620_B	0.36	1.11	-0.93	1.35	1.08	0.77	0.39	0.32	0.47	0.46
G-757A	0.92	0.40	0.40	0.44	0.41	0.82	0.40	-0.27	0.54	0.38
G-789	0.82	0.39	0.33	0.45	0.37	0.78	0.34	0.06	0.47	0.19
G-855	0.86	0.22	0.12	0.27	0.14	0.75	0.46	-0.37	0.59	0.37
G-860	0.90	0.22	-0.10	0.27	0.11	0.35	0.50	-0.04	0.67	0.27
G-864	0.75	0.58	-0.56	0.69	0.56	0.65	0.61	-0.43	0.84	0.52
G-864A	0.74	0.55	-0.50	0.66	0.51	0.64	0.53	-0.26	0.78	0.39
G-968	0.90	0.53	0.46	0.68	0.65	0.93	0.72	-0.72	0.79	0.79
G-972	0.85	0.30	-0.24	0.40	0.33	0.82	0.39	0.37	0.42	0.38
G-973	0.93	0.22	0.03	0.27	0.11	0.74	0.58	0.58	0.64	0.56
G-975	0.77	0.39	-0.10	0.49	0.39	0.85	0.30	0.18	0.38	0.21
G-976	0.81	0.75	0.63	0.83	0.74	0.86	0.27	-0.13	0.37	0.13
HUMBLE	0.94	0.36	0.35	0.40	0.37	0.83	0.33	-0.13	0.40	0.13
KROME	0.82	0.23	-0.12	0.28	0.22	0.93	0.45	-0.45	0.53	0.48
L29	0.94	0.20	0.02	0.25	0.09	0.68	0.24	0.19	0.27	0.19
L31 EXT1	0.86	0.26	0.12	0.34	0.27					
L31 EXT2	0.73	0.26	0.34	0.35	0.32					
L31 EXT3	0.84	0.20	0.24	0.29	0.25					
L67E	0.66	0.63	0.61	0.81	0.78					
L67E S	0.65	1.17	1.17	1.30	1.26					
L67EX E_B	0.42	0.50	0.45	0.61	0.56	0.89	0.15	0.11	0.18	0.11
L67EX W	0.36	1.54	1.32	1.76	1.67	0.86	0.50	0.49	0.64	0.63
Loop1	0.47	2.69	-2.70	2.82	2.73	0.86	0.24	0.24	0.28	0.24
Loop2	0.64	2.17	-2.17	2.37	2.30	0.81	0.34	-0.33	0.38	0.34
NESRS1	0.39	0.52	-0.28	0.63	0.45	0.88	0.25	0.23	0.28	0.23
NESRS2	0.54	0.40	-0.32	0.49	0.26	0.83	0.23	0.15	0.27	0.16
NESRS3_B	0.66	0.24	0.01	0.32	0.15	0.87	0.71	-0.71	0.80	0.75
NESRS4_B	0.87	0.27	-0.08	0.35	0.27	0.89	0.37	0.37	0.39	0.37
NESRS5_B	0.31	0.60	-0.62	0.68	0.52	0.89	0.40	0.40	0.42	0.40

Table 9 (continued). MB_2006 Statistics for Calibration (1989) and Verification (1995) Stations.

Station	1989					1995				
	Pearson's r	Average Absolute Difference, feet	Bias (model - field), feet	RMS Error, feet	Systematic RMSE, feet	Pearson's r	Average Absolute Difference, feet	Bias (model - field), feet	RMS Error, feet	Systematic RMSE, feet
NP-112						0.83	0.60	-0.10	0.71	0.23
NP-127	0.87	0.27	0.10	0.35	0.16	0.85	0.22	0.13	0.30	0.14
NP-146						0.53	0.30	-0.18	0.39	0.26
NP-158	0.83	0.71	0.70	0.79	0.70	0.89	0.44	0.36	0.55	0.40
NP-201	-0.07	1.26	-1.27	1.57	1.39	0.86	0.47	0.21	0.55	0.54
NP-202	0.22	0.75	-0.65	1.00	0.76	0.84	0.45	0.43	0.58	0.57
NP-203	0.40	0.62	-0.51	0.79	0.57	0.81	0.50	0.50	0.58	0.57
NP-205	0.56	1.20	-0.57	1.38	1.27	0.55	0.35	-0.01	0.38	0.36
NP-206	0.80	0.65	-0.37	0.90	0.53	0.90	0.32	0.07	0.35	0.20
NP-311	0.92	0.44	0.02	0.55	0.43	0.86	0.46	-0.19	0.55	0.18
NP-31W	0.86	0.28	0.11	0.34	0.17	0.89	0.32	0.10	0.39	0.13
NP-C27	0.93	0.22	-0.30	0.25	0.22	0.74	0.48	0.22	0.55	0.25
NP-C50						0.76	0.50	0.26	0.57	0.31
NP-CHP	0.27	0.53	-0.64	0.66	0.63	0.59	0.65	-0.69	0.73	0.69
NP-CT3R	0.88	0.24	-0.02	0.29	0.12					
NP-CV1N	0.91	0.24	-0.07	0.28	0.15					
NP-CV1S	0.85	0.27	-0.09	0.31	0.12					
NP-CV2N	0.89	0.26	0.09	0.31	0.18					
NP-CV2S	0.85	0.29	0.00	0.35	0.24					
NP-CV3N	0.89	0.27	0.09	0.31	0.19					
NP-CV3S	0.86	0.29	0.10	0.33	0.18					
NP-CV4N	0.88	0.27	0.10	0.32	0.18					
NP-CV4S	0.86	0.29	0.10	0.33	0.17					
NP-CV5N	0.93	0.23	-0.07	0.27	0.16	0.76	0.43	0.23	0.49	0.21
NP-CV5S	0.85	0.32	0.05	0.35	0.26					
NP-CV6N	0.88	0.27	0.07	0.32	0.19					
NP-CV6S	0.85	0.28	0.10	0.32	0.17					
NP-CV7N	0.85	0.25	0.11	0.30	0.16					
NP-CV7S	0.84	0.26	0.14	0.30	0.14					
NP-CV8N	0.87	0.26	0.13	0.32	0.16					
NP-CV8S	0.85	0.29	0.13	0.34	0.16					
NP-CV9N	0.90	0.25	0.00	0.30	0.15	0.76	0.45	0.17	0.52	0.24
NP-CV9S	0.88	0.28	-0.03	0.33	0.15					
NP-DO1	0.97	0.27	-0.63	0.30	0.27	0.79	0.57	0.53	0.67	0.55
NP-EP1	0.92	0.21	-0.12	0.27	0.21	0.76	0.28	-0.06	0.37	0.13
NP-EP12R	0.81	0.48	-0.48	0.51	0.50	0.75	0.75	-0.75	0.77	0.75
NP-EP9R	0.81	0.32	-0.31	0.35	0.32	0.70	0.23	0.10	0.30	0.12
NP-EPS	0.87	0.19	-0.16	0.23	0.16	0.72	0.28	-0.06	0.34	0.12
NP-EV6						0.76	0.38	-0.10	0.46	0.20
NP-EV7						0.76	0.39	-0.31	0.46	0.27
NP-EV8						0.70	0.39	0.04	0.49	0.09
NP-N10						0.92	0.38	-0.25	0.46	0.25
NP-N14						0.55	0.62	-0.44	0.74	0.27
NP-NTS1	0.87	0.28	0.01	0.34	0.19	0.93	0.33	-0.28	0.42	0.28
NP-NTS3	0.90	0.28	0.10	0.36	0.21					
NP-OT3	0.54	0.44	-0.27	0.55	0.44	0.64	0.45	0.45	0.63	0.50
NP-P33	0.62	0.76	-0.78	0.90	0.79	0.83	0.54	0.54	0.59	0.58
NP-P34	0.84	0.42	0.29	0.48	0.39	0.86	0.23	0.25	0.29	0.20
NP-P35	0.36	0.49	-0.42	0.57	0.46	0.77	1.06	1.06	1.11	1.06
NP-P36	0.46	0.62	-0.34	0.76	0.57	0.85	0.63	0.62	0.66	0.65
NP-P37	0.89	0.35	0.23	0.55	0.52	0.71	0.26	0.10	0.30	0.16
NP-P38	0.85	0.25	-0.06	0.31	0.27	0.71	0.88	0.83	0.98	0.87
NP-P44	0.95	0.71	0.12	0.79	0.73	0.77	0.61	0.45	0.75	0.53
NP-P46	0.86	0.35	-0.04	0.40	0.38	0.72	0.37	0.25	0.47	0.25
NP-P62	0.84	0.58	0.29	0.79	0.72	0.96	0.61	0.53	0.63	0.61
NP-P67	0.91	0.22	-0.05	0.30	0.18	0.78	0.29	0.20	0.35	0.24
NP-P72	0.85	0.94	-0.92	1.10	0.96	0.78	0.62	0.47	0.73	0.54
NP-ROB						0.72	0.43	0.16	0.57	0.31
NP-TSB	0.94	0.47	0.35	0.55	0.47	0.87	0.36	0.00	0.47	0.03
NP-TSH						0.78	0.25	0.11	0.33	0.12
RUTZKE_G						0.91	0.30	-0.15	0.38	0.18
S-19	0.83	0.74	-0.68	0.87	0.70	0.84	1.06	1.09	1.16	1.09
S-196A	0.89	0.55	0.55	0.60	0.56	0.69	0.50	0.16	0.63	0.17
S-68	0.78	0.95	-0.94	1.07	0.94	0.82	1.45	1.40	1.67	1.62
SNAPPERN	0.86	0.28	0.72	0.31	0.28					
SWEVER1	0.84	0.23	-0.18	0.27	0.23	0.90	0.16	0.08	0.21	0.13
SWEVER2A	0.88	0.21	-0.06	0.27	0.20	0.71	0.36	0.05	0.45	0.09
SWEVER2B	0.86	0.24	-0.19	0.29	0.19	0.71	0.38	0.09	0.46	0.12
SWEVER3	0.65	0.30	0.03	0.36	0.09	0.80	0.25	0.32	0.31	0.10
SWEVER4	0.65	0.38	0.31	0.49	0.35	0.87	0.41	0.35	0.52	0.41
SWEVER5A	0.72	0.28	0.20	0.44	0.41	0.79	0.20	0.09	0.28	0.09
SWEVER5B	0.78	0.05	-0.31	0.07	0.02	0.67	0.25	0.03	0.35	0.23
TSHilton						0.78	0.22	0.02	0.30	0.02

Table 10. MODBRANCH MB_2006 Statistical Summary for Calibration (1989) and Verification (1995)

	Pearson's r	Average Absolute Difference, feet	Bias (model-field), feet	RMSE, feet	Systematic RMSE, feet	Unsystematic RMSE, feet	Sys RMSE/ RMSE	Index of Agreement	slope	Intercept	Average Number of Points
1989 (127 locations)											
All Data											
Average	0.78	0.52	-0.06	0.61	0.49	0.31	0.56	0.77	0.82	0.66	309
Median	0.85	0.35	-0.02	0.40	0.32	0.28	0.59	0.83	0.78	0.56	365
Standard Deviation	0.18	0.50	0.67	0.53	0.54	0.15	0.27	0.16	0.38	1.47	108
Minimum	-0.07	0.05	-2.70	0.07	0.02	0.06	0.01	0.26	-0.07	-2.90	38
Maximum	0.97	3.89	3.88	4.07	4.04	0.81	0.99	0.97	2.47	5.96	365
Best 90% (re: RMSE)											
Average	0.80	0.40	-0.05	0.48	0.36	0.29	0.53	0.79	0.86	0.50	305
Median	0.85	0.31	0.00	0.40	0.27	0.27	0.56	0.84	0.82	0.41	365
Standard Deviation	0.15	0.20	0.38	0.23	0.24	0.12	0.26	0.14	0.36	1.22	111
Minimum	0.22	0.05	-1.16	0.07	0.02	0.06	0.01	0.26	0.13	-2.44	38
Maximum	0.97	1.16	0.90	1.24	1.20	0.73	0.97	0.97	2.47	4.84	365
1995 (123 locations)											
Average	0.79	0.49	0.09	0.59	0.42	0.34	0.51	0.75	0.92	0.40	347
Median	0.81	0.43	0.09	0.52	0.31	0.34	0.49	0.77	0.89	0.32	365
Standard Deviation	0.12	0.29	0.49	0.36	0.39	0.16	0.33	0.13	0.37	2.11	33
Minimum	0.35	0.15	-0.92	0.17	0.02	0.06	0.00	0.35	0.09	-6.95	206
Maximum	0.99	1.99	1.85	3.13	3.11	0.69	0.99	0.98	1.90	6.96	365
Best 90% (re: RMSE)											
Average	0.79	0.42	0.02	0.50	0.33	0.33	0.47	0.77	0.95	0.32	348
Median	0.81	0.40	0.07	0.49	0.27	0.32	0.44	0.78	0.97	0.24	365
Standard Deviation	0.12	0.15	0.35	0.17	0.20	0.16	0.32	0.12	0.36	2.17	32
Minimum	0.35	0.15	-0.75	0.17	0.02	0.06	0.00	0.35	0.20	-6.95	206
Maximum	0.99	0.75	0.82	0.85	0.79	0.69	0.99	0.98	1.90	6.96	365

Table 11. SFWMM v5.4 Calibration (1984-1995) and Verification (1981-1993,1996-2000) Statistics for Stage Locations

Based on 79 locations within the MB_2006 Domain

	R^2		r		RMSE (ft)		Bias (ft)	
	Calibration	Verification	Calibration	Verification	Calibration	Verification	Calibration	Verification
Average	0.77	0.76	0.87	0.87	0.42	0.38	0.04	-0.03
Median	0.80	0.79	0.89	0.89	0.39	0.39	0.06	-0.02
Standard Deviation	0.09	0.11	0.06	0.06	0.14	0.14	0.20	0.18
Mimimum	0.50	0.52	0.71	0.72	0.15	0.16	-0.41	-0.55
Maximum	0.91	0.93	0.96	0.96	0.92	0.79	0.65	0.59

Table 12. SFWMD Lower East Coast sub-Regional (LECsR) MODFLOW Model Statistics for Stage Locations

Source: Lower East Coast Subregional MODFLOW Model Documentation, March 2006 (DRAFT), South Florida Water Management District. Calibration Period: 1986-1999; Verification Period: 1999-2000.

Based on 195 locations						
	Bias (ft)		Mean Absolute Error (ft)		RMSE (ft)	
	Calibration	Verification	Calibration	Verification	Calibration	Verification
Average	-0.01	-0.11	0.55	0.54	0.70	0.67
Median	-0.05	-0.12	0.41	0.40	0.57	0.57
Standard Deviation	0.59	0.69	0.53	0.57	0.59	0.59
Mimimum	-3.26	-5.32	0.08	0.09	0.12	0.12
Maximum	4.77	4.45	5.10	5.09	5.71	5.09
Based on 85 locations within MB_2006 Domain						
	Bias (ft)		Mean Absolute Error (ft)		RMSE (ft)	
	Calibration	Verification	Calibration	Verification	Calibration	Verification
Average	-0.04	-0.15	0.43	0.40	0.55	0.53
Median	-0.05	-0.16	0.37	0.35	0.50	0.50
Standard Deviation	0.23	0.30	0.29	0.22	0.32	0.26
Mimimum	-0.53	-0.79	0.08	0.11	0.12	0.14
Maximum	0.72	0.88	2.25	1.19	2.50	1.42

Table 13. MB_2006 Results, % of Time Model Stage is within 1 foot of Field Data.

			1989		1995	
Station	X-coord	Y-coord	# field points	Percent of Time Absolute Stage Difference < 1 ft	# field points	Percent of Time Absolute Stage Difference < 1 ft
2289096	835378	578905			365	4.4%
2287497	841274	566512			365	100.0%
3-34	825303	559313			365	98.9%
3-71	801994	564175			365	100.0%
3B-SE_B	820851	529008	365	99.5%	365	100.0%
ANGELS	806957	468810	365	99.5%	365	65.2%
BCNPA10	649101	501843			365	100.0%
BCNPA11	623422	529314			365	100.0%
BCNPA9	685212	525374			365	99.7%
EVER8	834860	367666			327	100.0%
F-179	905899	512154	365	98.6%	365	94.5%
F-319	891160	498320	365	97.8%	324	98.1%
F-358	829313	413952	365	99.5%	365	95.3%
Fpond	796565	403850	365	99.5%	365	97.5%
G-1183	857277	419462	365	86.0%	365	92.1%
G-1362	840325	462941	365	96.2%	303	98.7%
G-1363	820479	438390	365	98.4%	365	90.7%
G-1368A	891249	542725	365	77.5%	365	41.4%
G-1486	842298	425090	365	98.4%	360	93.6%
G-1487	823366	488133	365	98.6%	337	93.2%
G-1488	828485	539825	365	99.7%	355	100.0%
G-1502	793261	466320	365	98.4%	365	74.0%
G-3	885986	542697	365	14.5%	362	44.8%
G-3073	868018	494567	365	99.7%	303	88.1%
G-3253	850493	547187	365	4.4%	330	69.4%
G-3259A	853344	547139	365	28.5%	365	85.2%
G-3264A	863595	547248	365	84.1%	317	100.0%
G-3273	795899	471579	360	97.2%	365	83.6%
G-3328	896308	530092	365	100.0%	365	100.0%
G-3329	885665	530700	365	82.2%	343	97.7%
G-3354	830481	354958	363	100.0%	365	100.0%
G-3355	820958	383815	335	83.3%	332	86.1%
G-3356	846444	394457	354	69.8%	365	81.6%
G-3439	842593	510443	365	96.2%	365	98.9%
G-3465	889097	535020	365	64.4%	362	69.3%
G-3466	891068	535697	365	91.5%	348	33.3%
G-3467	896166	536028	365	99.5%	365	99.7%
G-551	856774	492878	365	98.1%	339	18.9%
G-553	874737	479153	365	97.5%	231	77.1%
G-594	836567	560636	365	46.0%	273	91.9%
G-596	818479	473697	365	98.4%	350	89.7%
G-596_B	817030	474579	365	98.9%	365	94.5%
G-613	810206	390419	365	74.5%	341	83.0%
G-614	839129	442461	365	57.0%	259	87.6%
G-618_B	787975	519305	365	100.0%	331	100.0%
G-620_B	735304	474960	365	51.2%	320	100.0%
G-757A	829529	456839	365	99.5%	309	97.7%

Table 13 (continued). MB_2006 Results, % of Time Model Stage is within 1 foot of Field Data.

			1989		1995	
Station	X-coord	Y-coord	# field points	Percent of Time Absolute Stage Difference < 1 ft	# field points	Percent of Time Absolute Stage Difference < 1 ft
G-789	803285	419854	365	99.5%	294	96.6%
G-855	831713	487197	365	100.0%	363	92.0%
G-860	880065	468034	365	99.5%	365	91.5%
G-864	820785	400774	365	88.8%	365	87.1%
G-864A	819411	400527	365	91.0%	319	92.8%
G-968	836917	581839	365	80.5%	365	77.0%
G-972	840229	575796	365	96.7%	362	100.0%
G-973	868365	558296	365	99.5%	357	93.8%
G-975	834824	558084	365	96.7%	365	99.5%
G-976	846246	540565	365	74.5%	365	97.5%
HUMBLE	810090	448375	365	99.7%	365	99.5%
KROME	826974	510620	365	100.0%	365	100.0%
L29	778650	519278	365	100.0%	365	100.0%
L31.EXT1	821639	514070	241	100.0%		
L31.EXT2	821659	508719	216	100.0%		
L31.EXT3	821680	503369	167	100.0%		
L67E	763909	490972	354	74.6%		
L67E.S	764235	470277	365	40.0%		
L67EX.E_B	764092	490972	365	83.0%	365	100.0%
L67EX.W	763909	490972	365	32.6%	365	84.7%
Loop1	686496	518914	365	0.0%	365	100.0%
Loop2	671322	513556	365	21.4%	365	100.0%
NESRS1	776611	496053	365	98.6%	365	100.0%
NESRS2	802191	505722	312	100.0%	365	100.0%
NESRS3_B	819270	511739	365	99.7%	365	63.8%
NESRS4_B	770627	475644	115	100.0%	365	100.0%
NESRS5_B	768349	472105	186	100.0%	365	100.0%
NP-112	788804	396448			358	86.6%
NP-127	786310	371405	365	100.0%	362	100.0%
NP-146	766402	335312			365	100.0%
NP-158	795528	386475	365	69.9%	348	90.5%
NP-201	746593	503552	332	43.7%	365	97.8%
NP-202	751028	482866	365	62.7%	365	93.2%
NP-203	742179	469219	365	77.8%	365	99.2%
NP-205	705999	492886	365	35.9%	365	100.0%
NP-206	764216	440698	365	76.7%	365	100.0%
NP-311	779611	405204	353	94.3%	358	92.5%
NP-31W	791629	401908	365	100.0%	364	99.5%
NP-C27	825094	352557	103	100.0%	312	97.4%
NP-C50	814433	356859			326	95.4%
NP-CHP	754121	325795	258	80.2%	332	78.9%
NP-CT3R	836491	348362	345	100.0%		
NP-CV1N	836764	348868	336	100.0%		
NP-CV1S	836582	348665	351	100.0%		
NP-CV2N	832812	350265	39	100.0%		
NP-CV2S	832807	351578	39	100.0%		
NP-CV3N	830790	350964	39	100.0%		
NP-CV3S	830699	350863	39	100.0%		

Table 13 (continued). MB_2006 Results, % of Time Model Stage is within 1 foot of Field Data.

			1989		1995	
Station	X-coord	Y-coord	# field points	Percent of Time Absolute Stage Difference < 1 ft	# field points	Percent of Time Absolute Stage Difference < 1 ft
NP-CV4N	828125	351963	39	100.0%		
NP-CV4S	828033	351862	39	100.0%		
NP-CV5N	825459	353164	333	100.0%	323	100.0%
NP-CV5S	825643	352963	210	100.0%		
NP-CV6N	822978	354064	38	100.0%		
NP-CV6S	822886	353962	39	100.0%		
NP-CV7N	821231	354764	38	100.0%		
NP-CV7S	821140	354662	38	100.0%		
NP-CV8N	817188	356263	39	100.0%		
NP-CV8S	817097	356162	39	100.0%		
NP-CV9N	814523	357263	358	100.0%	365	99.7%
NP-CV9S	814524	357162	343	100.0%		
NP-DO1	758215	378155	110	100.0%	365	85.8%
NP-EP1	837046	347355	165	100.0%	365	100.0%
NP-EP12R	839636	342419	365	100.0%	365	97.0%
NP-EP9R	803564	341578	365	100.0%	313	100.0%
NP-EPS	820443	344565	365	100.0%	365	100.0%
NP-EV6	817574	351116			362	99.7%
NP-EV7	807372	355320			293	100.0%
NP-EV8	828427	368621			327	100.0%
NP-N10	786562	410474			364	97.8%
NP-N14	775331	394289			209	77.0%
NP-NTS1	790621	401804	321	100.0%	365	98.1%
NP-NTS3	788329	401797	353	99.4%		
NP-OT3	667863	453186	334	89.8%	357	100.0%
NP-P33	757935	463700	358	57.3%	365	100.0%
NP-P34	681042	463589	365	97.5%	332	100.0%
NP-P35	700840	409940	337	96.7%	365	29.6%
NP-P36	723652	434560	324	87.3%	331	93.7%
NP-P37	759215	346399	365	88.8%	365	100.0%
NP-P38	711266	377204	365	100.0%	342	57.3%
NP-P44	748091	399272	346	78.0%	339	72.3%
NP-P46	723676	358647	365	100.0%	365	93.2%
NP-P62	727918	402263	344	77.6%	292	99.3%
NP-P67	771747	362784	365	99.5%	365	100.0%
NP-P72	754262	386465	365	48.5%	365	83.0%
NP-ROB	804093	402857			365	96.4%
NP-TSB	786076	388566	365	97.5%	365	96.4%
NP-TSH	778280	356139			362	100.0%
RUTZKE_G	796485	431502			365	99.2%
S-19	889204	535566	365	65.2%	359	47.6%
S-196A	823494	426044	365	100.0%	363	96.1%
S-68	891334	537092	365	47.9%	358	29.6%
SNAPPERN	858864	551078	81	100.0%		
SWEVER1	844599	362630	261	100.0%	206	100.0%
SWEVER2A	829384	358530	224	100.0%	365	100.0%
SWEVER2B	829026	356106	365	100.0%	365	100.0%
SWEVER3	818792	369191	365	100.0%	233	100.0%
SWEVER4	806413	367431	365	96.4%	365	100.0%
SWEVER5A	797579	347313	365	92.3%	365	100.0%
SWEVER5B	798219	348122	365	100.0%	279	100.0%
TSHilton	778073	355816			362	100.0%
Total number of stations with data				129		125
Number of stations> 90%				88		91
Number of stations > 80%				99		104
Number of stations > 70%				107		110
Average				87.6%		90.0%

Table 14. SFWMD LECsR MODFLOW Results, % of Time Model Stage is within 1 foot of Field Data.

Station	Calibration	Verification	Station	Calibration	Verification	Station	Calibration	Verification
1-7	90.6%	98.6%	G3549	99.4%	100.0%	NESRS5	87.9%	97.4%
1-9	93.9%	100.0%	G3550	99.6%	100.0%	NP112	88.2%	98.2%
2A-17	78.0%	90.9%	G3551	99.5%	98.1%	NP127	96.4%	100.0%
2B-Y	71.0%	98.8%	G3552	96.3%	97.0%	NP146	99.7%	100.0%
ANGEL	91.3%	79.5%	G3553	81.6%	88.1%	NP158	99.1%	84.2%
EVER1	99.7%	100.0%	G3554	60.0%	67.4%	NP-201	96.5%	100.0%
EVER2A	99.9%	100.0%	G3555	89.5%	89.8%	NP-202	93.8%	98.6%
EVER2B	100.0%	100.0%	G3556	85.1%	90.1%	NP-203	92.2%	100.0%
EVER3	99.8%	100.0%	G3557	99.6%	97.4%	NP-205	81.1%	87.7%
EVER4	99.6%	100.0%	G3558	97.6%	100.0%	NP-206	72.4%	65.6%
F239	76.1%	79.8%	G3559	99.7%	98.4%	NP311	80.2%	100.0%
F291	96.3%	94.1%	G3560	93.0%	92.9%	NP-33	86.4%	97.0%
F319	98.3%	97.7%	G3561	75.0%	87.9%	NP-35	100.0%	99.1%
F358	92.5%	90.2%	G3563	94.6%	100.0%	NP-36	86.2%	77.7%
F45	91.2%	80.9%	G3564	95.1%	100.0%	NP-38	99.4%	99.7%
FROGP	99.1%	98.8%	G3565	91.5%	95.2%	NP-44	58.6%	91.3%
G1074B	9.3%	6.4%	G3566	78.3%	52.4%	NP-46	96.3%	98.7%
G1166	98.1%	97.2%	G3567	95.9%	100.0%	NP-62	91.6%	95.8%
G1183	96.9%	96.0%	G3568	97.0%	100.0%	NP-67	96.0%	98.4%
G1213	81.8%	80.6%	G3570	76.5%	85.7%	NPA13	90.7%	100.0%
G1220	97.4%	98.0%	G3572	96.8%	99.5%	NPCHP	96.5%	100.0%
G1221	96.5%	91.2%	G3576	99.7%	98.8%	NPCR2	94.3%	100.0%
G1223	91.6%	95.5%	G3619	99.3%	99.8%	NPCR3	86.3%	100.0%
G1224	98.4%	96.7%	G3620	99.3%	99.5%	NPCY2	94.4%	100.0%
G1225	82.0%	87.7%	G3621	99.8%	99.3%	NPCY3	87.7%	100.0%
G1226	97.4%	95.8%	G3622	98.0%	95.4%	NPD01	83.7%	100.0%
G1260	29.4%	28.6%	G3626	79.4%	77.9%	NPD02	77.6%	100.0%
G1315	98.4%	97.0%	G3627	98.3%	97.4%	NPEP1	100.0%	100.0%
G1316	93.6%	97.7%	G3628	97.3%	92.6%	NPEPS	99.9%	100.0%
G1362	95.8%	95.4%	G3676	99.3%	100.0%	NPEV6	99.7%	100.0%
G1363	95.8%	95.8%	G3A	45.0%	19.1%	NPEV7	99.5%	100.0%
G1473	95.9%	94.0%	G551	67.7%	41.3%	NPEV8	99.6%	100.0%
G1486	98.4%	97.7%	G553	90.8%	95.1%	NPN10	94.7%	94.7%
G1487	98.4%	98.4%	G561	94.4%	96.6%	NPN14	69.0%	89.4%
G1488	99.4%	100.0%	G580A	97.0%	95.6%	NPNTS1	98.3%	96.5%
G1636	98.2%	97.2%	G614	96.2%	96.2%	NPP37	94.5%	100.0%
G1637	98.6%	94.7%	G617	90.9%	80.0%	NPROB	96.6%	96.5%
G2031	95.9%	97.2%	G620	86.5%	100.0%	NP-TSB	93.6%	89.1%
G2032	94.3%	81.6%	G757 A	97.2%	96.3%	NPTSH	99.4%	100.0%
G2033	89.6%	93.0%	G789	97.2%	96.1%	PB1491	18.4%	-34.9%
G2034	91.3%	86.5%	G852	95.9%	90.2%	PB1639	54.3%	33.0%
G2035	97.0%	95.8%	G853	40.5%	62.4%	PB1642	76.0%	88.5%
G2147	48.9%	72.7%	G855	94.2%	93.3%	PB1661	92.9%	95.4%
G2395	35.8%	10.0%	G860	98.7%	98.6%	PB1662	87.7%	68.8%
G2739	81.1%	85.7%	G864	92.5%	90.7%	PB1680	87.9%	89.5%
G2852	54.6%	60.1%	G864A	94.0%	85.7%	PB1684	92.3%	96.3%
G2866	2.0%	0.0%	G968	94.6%	97.0%	PB445	95.3%	94.9%
G3074	66.8%	54.2%	G970	99.1%	97.6%	PB561	59.9%	63.7%
G3253	13.7%	47.2%	G973	98.9%	98.0%	PB565	51.4%	77.4%
G3259A	47.9%	72.4%	G975	98.1%	99.5%	PB683	77.5%	72.6%
G3264A	98.0%	99.7%	G976	81.2%	99.5%	PB685	95.2%	93.7%
G3272	98.8%	91.8%	HUMBLE	98.6%	97.4%	PB689	96.1%	89.1%
G3273	88.0%	85.1%	JD12	96.0%	95.8%	PB732	81.0%	92.1%
G3327	97.9%	96.9%	JD26	89.5%	68.8%	PB809	54.9%	26.7%
G3328	99.3%	97.9%	JD6	47.9%	17.9%	PB831	79.4%	89.8%
G3329	92.6%	96.1%	JDMW1	57.7%	52.2%	S18	98.4%	96.0%
G3353	97.8%	100.0%	JDMW3	54.9%	61.3%	S182	96.9%	98.1%
G3355	93.0%	94.3%	KROME	94.2%	86.5%	S19	74.7%	89.7%
G3356	93.0%	90.9%	L30L67A	99.8%	100.0%	S196A	97.5%	96.1%
G3437	85.0%	68.6%	L67A	99.6%	100.0%	S329	78.6%	82.1%
G3439	93.6%	90.4%	M1024	31.0%	100.0%	S68	51.7%	62.4%
G3465	84.3%	93.3%	M1234	69.4%	14.3%	SWEV5A	95.4%	100.0%
G3466	64.2%	100.0%	NESRS1	93.0%	99.8%	SYLVA	82.6%	82.1%
G3467	97.8%	100.0%	NESRS2	99.3%	100.0%	WCA363	88.1%	88.7%
G3473	96.6%	100.0%	NESRS4	93.3%	97.7%	WPBCA	93.1%	93.5%

Summary		
Total number of stations is 195		
	Calibration	Verification
Number of stations> 90%	127	136
Number of stations > 80%	154	161
Number of stations > 70%	168	170
Average % of Time Model Stage is within 1 ft of Field Data	86.6%	87.8%

Source: Lower East Coast Subregional MODFLOW Model Documentation, March 2006 (DRAFT), South Florida Water Management District, Table 13 (Calibration) and Table 16 (Verification).

SOURCES OF ERROR

There are seven primary sources of error resulting from inputs to the MODBRANCH model. These are (not necessarily in order of importance):

1- Approximation of overland flow with linear version of the Kadlec equation,
2- Meteorological boundary conditions,
3- General head boundary conditions,
4- Geologic parameters,
5- Structure operations and implementation,
6- Topography, and
7- Field data.

OVERLAND FLOW

As discussed above, the Kadlec equation requires the user define a number of flow coefficients. These include flow conductance (K_f), depth exponent (β), and slope exponent (α). The latter two values are set to 3 and 1, respectively, which follows the usage of the SFWMD. The flow conductance values are assigned based on land use and also uses the values determined by the SFWMD. In reality, these values could vary depending on vegetation type and season. However, a more accurate determination of these values is beyond the time and budget of this study.

METEOROLOGICAL CONDITIONS

The rainfall is an important parameter, especially in the region of south Florida. The amount and timing of rainfall greatly affects the increase or decrease in stage (ground water and canal) and flows within the system. The rainfall boundary conditions used for this study were the same that are used as inputs for the SFWMM 2x2, as mentioned above. The spatial resolution is 2 miles x 2 miles and the temporal resolution is 1 day. The MODBRANCH model could give better results if finer resolution rainfall information were available. This is especially important for simulating ground water stages. Unfortunately, these data are not presently available. Future studies could include rainfall derived from NEXRAD or other methods, which would give rainfall at fine resolutions in both temporal and spatial terms. However, these data would be limited to the time periods in which NEXRAD data were actually recorded; this would exclude the calibration period of 1989.

GENERAL HEAD BOUNDARY CONDITIONS

The general head boundaries, as mentioned above, were generated as a hybrid of ground water observation well data and daily average tide stages. Unfortunately there is not a complete set of observation wells or tide gages that would more accurately define the head boundaries. In addition, the head

boundary may vary with depth. The variation in depth occurs for two reasons. First, there are saline density effects at the coastal head boundaries. The approximation used in the present study is explained in Appendix A. The second depth variation is a result of some regions being in a confined or semi-confined condition at depth. In order to have these data set, stage gages would need to be co-located and screened at different depths. There are few gages of that description in this area.

GEOLOGIC PARAMETERS

South Florida's geology is extremely heterogeneous. Measurements and tests performed at one location can give distinctly different values when done a relatively short distance away. It is important to keep this in mind when reviewing the model results. The model considers the hydrogeologic parameters input to be homogenous within each grid cell. While hydraulic conductivity and transmissivity vary from cell to cell, each is isotropic within the cell. Additionally, the parameters do not vary significantly between adjacent cells, increasing the degree of homogeneity of the model. The real world is not homogenous. There are indications that there are preferential flow paths within the surficial aquifer. These preferential flow paths are not represented by the model inputs. For this reason, the model results should be considered primarily on an areal basis, secondarily on a site-specific basis.

STRUCTURE OPERATIONS AND IMPLEMENTATION

Future refinement of structure operation routines, especially in opening and closing could result in better replication of field stages and flows. However, there is still a problem in determining exactly how each structure was operated during the calibration and verification periods.

TOPOGRAPHY

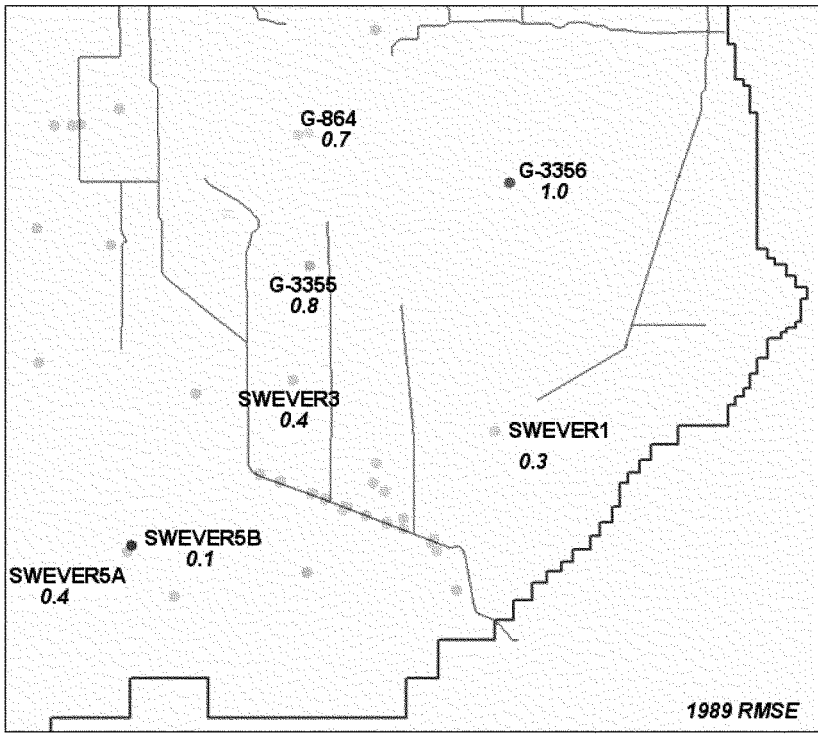
The topographic data used in the model were described above. The accuracy of these data (on the order of 0.5 feet) can significantly affect both the results of the MODBRANCH model and the interpretation of the results. The results can be affected by slight variations in elevations, since this would change the local land slope. A small change in topography could cause a significant change in flow direction due to the small water gradients found in the area. Comparison between model stages and observation well stages could have consistent errors based on the error in the observation well reference point. The average errors found between model and field data are approximately within the accuracy of the topography.

FIELD DATA

Field data are generally considered to be accurate. However, there is always some error and is occasionally significant. Figures 23 and 24 show the RMSE in

the C-111 Spreader Canal area of interest for the dry (1989) and wet (1995) years.

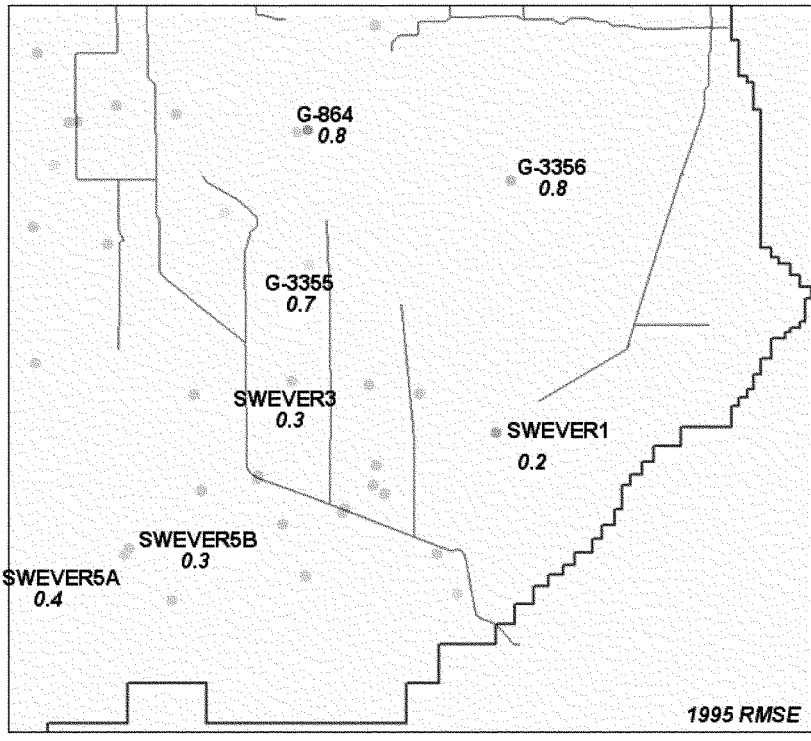
Figure 23. RMSE in vicinity of C-111SC Project, 1989 Simulation.



The 1989 RMSE for SWEVER5A is 0.4 foot; the value for SWEVER5B is 0.1 foot. This is surprising given the fact that they are nearly co-located and supports the position that field data can have significant error, in this case ~0.3 foot.

During both years, G-3356 has a RMSE of more than 0.8 foot and G-3355 has values greater than 0.7 foot. Other gages in the area range from 0.2 to less than 0.5 foot. The concern is whether or not the model is more inaccurate than the data show.

Figure 24. RMSE in vicinity of C-111SC Project, 1995 Simulation.

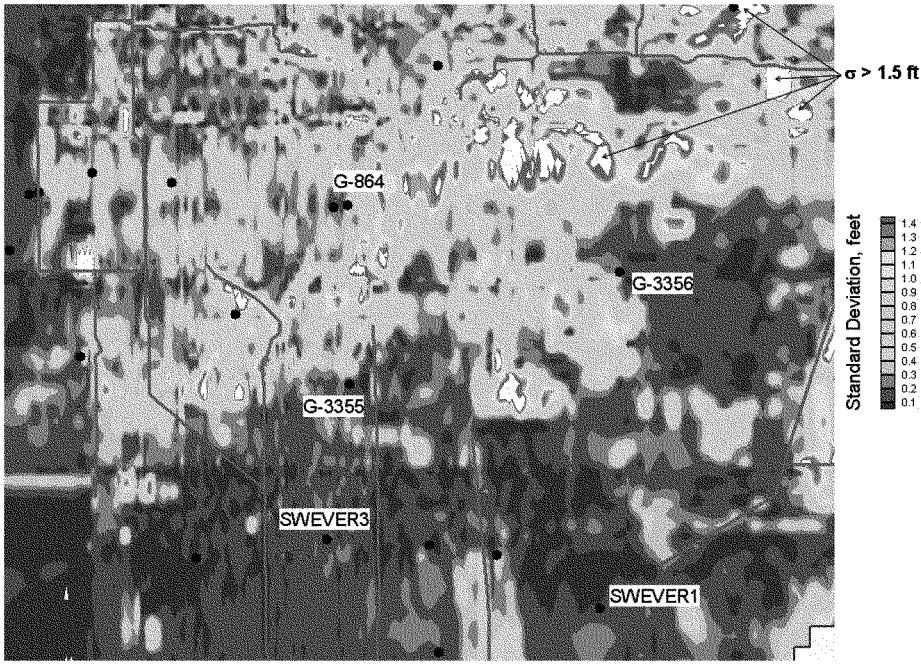


The variability in topography is described above and shown for the entire model domain in figure 8. Figure 25 shows the variability in the vicinity of the C-111SC project. Note that the gages showing the largest RMSE (G-864, G-3355, and G-3356) are in areas with large topographic variability.

Many of these stations are USGS gages and, in addition to water level data, have local ground elevations. Both the water level data and the ground elevations are referenced to a common datum. The local ground elevations reported for many of these gages is significantly different from the elevation used in the MODBRANCH model which is derived from LIDAR data. Table 15 lists twenty-six locations (figure 26) with both USGS reported ground elevations and the corresponding MODBRANCH ground elevations, both referenced to NGVD29. The average and median differences are -0.5 and -0.9 feet, respectively. These values indicate that the MODBRANCH topographic data is lower than the USGS data. This does not mean that the USGS reported ground elevation is erroneous. The MODBRANCH topographic data is an average of LIDAR data that has been processed to represent the entire MODBRANCH cell. The USGS data is a “spot-elevation” and represents only that specific location. However, the trend is clear that the USGS ground elevations tend to be higher

than the MODBRANCH elevations and that it is not beyond the realm of possibility that the field water levels are referenced to an erroneous datum.

Figure 25. MB_2006 Standard Deviation of Topographic Data within cells



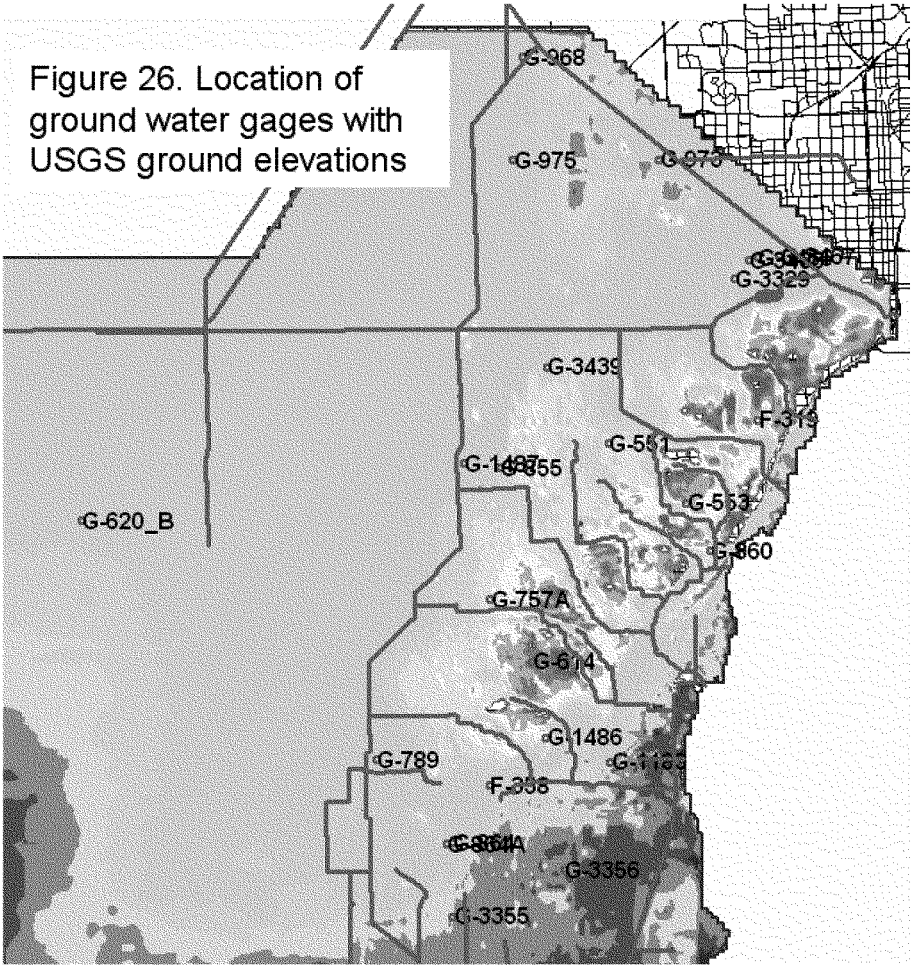


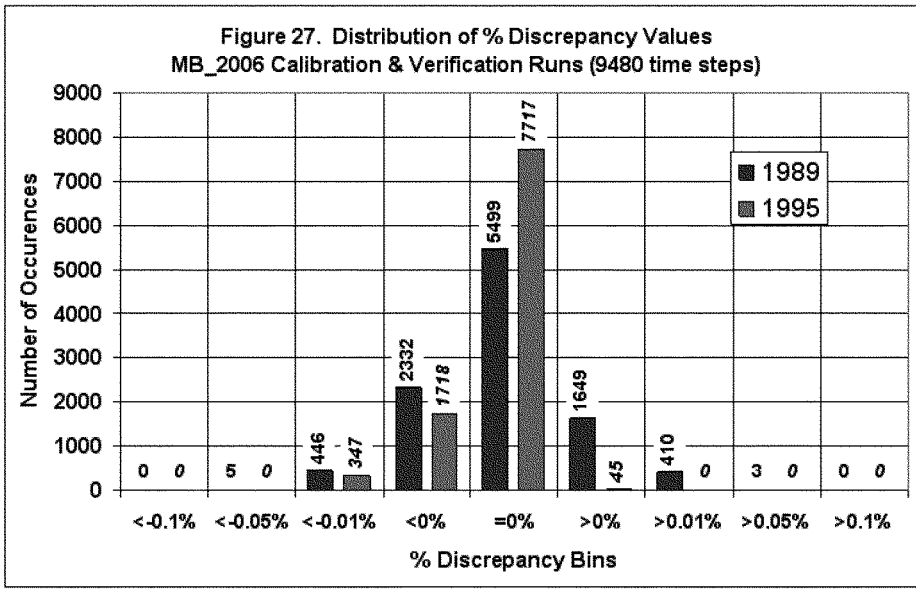
Figure 26. Location of ground water gages with USGS ground elevations

Table 15. Ground Elevation Differences, MB_2006 and USGS			
Observation Well	ground elevation, ft NGVD29		
	MODBRANCH	USGS	MODBRANCH - USGS
F-319	10.4	12.2	-1.8
F-358	7.2	8.3	-1.1
G-1183	4.2	6.2	-2.0
G-1486	9.4	10.4	-1.0
G-1487	7.7	6.8	0.9
G-3329	10.0	6.6	3.4
G-3355	**2.8**	**5.6**	**-2.8**
G-3356	**2.0**	**3.3**	**-1.3**
G-3439	6.5	5.9	0.6
G-3465	8.2	8.2	0.0
G-3466	8.3	8.3	0.0
G-3467	6.6	4.3	2.3
G-551	8.9	8.7	0.2
G-553	11.0	12.3	-1.3
G-613	7.5	7.1	0.4
G-614	12.4	11.1	1.3
G-620	5.3	6.8	-1.5
G-757A	9.1	9.9	-0.8
G-789	6.3	7.6	-1.3
G-855	7.5	7.9	-0.4
G-860	9.4	11.0	-1.6
G-864	**7.7**	**8.9**	**-1.2**
G-864a	8.0	8.3	-0.3
G-968	5.5	5.2	0.3
G-973	5.7	6.9	-1.2
G-975	5.1	7.4	-2.3
Average, feet			**-0.5**
Median, feet			**-0.9**
Standard Deviation, feet			**1.4**

VOLUME FLOWS AND MASS CONSERVATION

The MODBRANCH model prints the mass volume balance at each time step for the entire model domain. This global report is broken into input and output of canal leakage, recharge (rain), evapo-transpiration, well pumping, general head boundaries, and storage. The output totals the cumulative and instantaneous time step volumes and computes the mass balance (input – output). The

"percent discrepancy" (PD) is computed (100* (IN-OUT)/((IN+OUT)/2) and also printed for each time step. On a global basis the model should have very small PD values. Figure 27 shows the frequency of occurrence of PD for both the dry and wet years. It is obvious that, on a global basis, the MODBRANCH model has very little mass discrepancy or mass imbalance.



The mass balance for specified sub-regions is not an output of the MODBRANCH model. However, certain utilities can extract water movement from one area to the next. The types of volumes (recharge, evapotranspiration, horizontal flow, and storage) that can be extracted depend on the output controls implemented when the model is run. Due to disk space limitations, the model is generally run with the horizontal and vertical flows output. When this is done only a partial mass balance can be computed by delineating transects that enclose a specified area. This balance computes only the horizontal flow volumes and does not include the volume changes in storage, rainfall (recharge) or evapo-transpiration.

Figure 28 shows a sub-region of Taylor's Slough with arrows indicating the direction of positive flow. To get the flow volume balance, it is only necessary to compute the difference between the inflows and the outflows. In this case the inflow volumes are through the sections labeled "Taylor's Slough North Side" and "Taylor's Slough West Side." The other two sections are the outflow. Note that the west side was defined along Ingraham Highway. The Taylor's Slough region is an area of high interest and is why it was chosen as an example of flow volume balance.

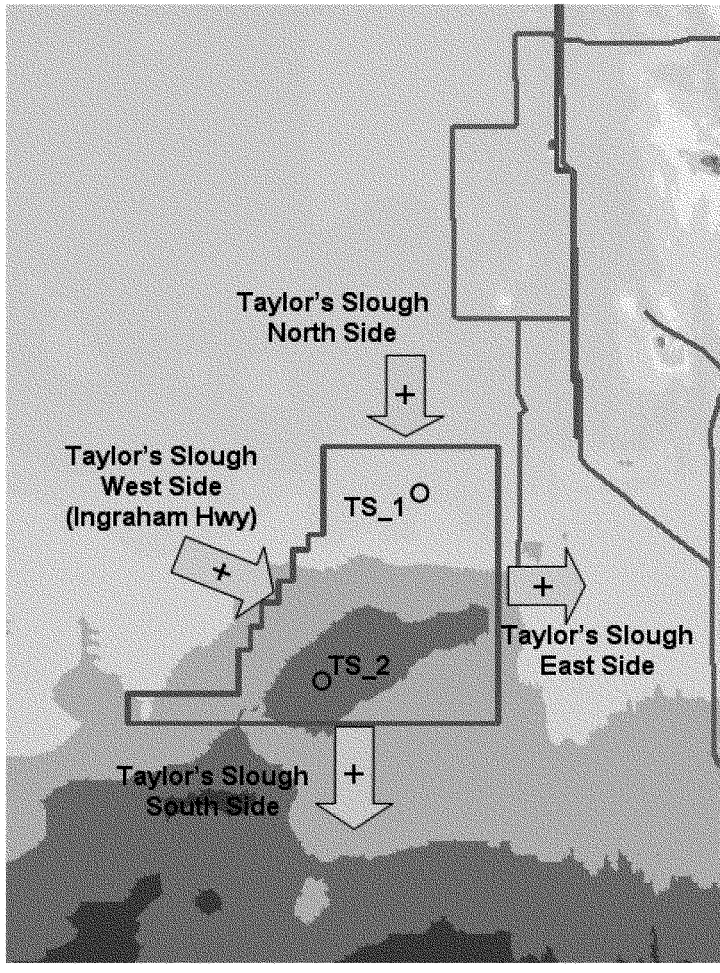


Figure 28. Taylor's Slough Sub-region. Arrows indicate direction of positive flows.

The volume flows through the sections is shown on a monthly basis in table 16. An estimate of expected head change is computed by dividing the volumes (acre-feet) by the area enclosed by the sections (9,979 acres). These computations result in estimated head changes *due to horizontal flow differences* of +0.87 foot for 1989 and -0.47 foot for 1995.

Table 16. Mass Balance of Horizontal Flows, Taylor's Slough Subregion.

Area = 9,979 acres

Volumes in acre-feet

1989

Month	West Side	North Side	East Side	South Side	Net In - Net Out	Average Head Change (net Volume/area), feet
Jan	-251	626	-557	517	415	0.04
Feb	-223	513	-664	341	613	0.06
Mar	-391	691	-823	184	939	0.09
Apr	-363	471	-636	154	590	0.06
May	-402	644	-950	37	1,155	0.12
Jun	-353	657	-976	22	1,257	0.13
Jul	432	612	-752	512	1,284	0.13
Aug	535	687	-488	785	925	0.09
Sep	718	774	-391	951	932	0.09
Oct	487	735	-413	1,218	417	0.04
Nov	-26	665	-447	1,106	-20	0.00
Dec	-99	554	-667	906	216	0.02
Total	**64**	**7,629**	**-7,762**	**6,733**	**8,723**	**0.87**

1995

Month	West Side	North Side	East Side	South Side	Net In - Net Out	Average Head Change (net Volume/area), feet
Jan	899	934	272	1,652	-91	-0.01
Feb	777	616	367	1,310	-284	-0.03
Mar	906	348	483	1,364	-593	-0.06
Apr	442	250	557	1,144	-1,009	-0.10
May	281	279	65	810	-314	-0.03
Jun	616	497	-192	896	409	0.04
Jul	928	734	-666	1,408	920	0.09
Aug	959	744	-560	1,943	320	0.03
Sep	1,438	743	-1,083	3,377	-114	-0.01
Oct	1,868	1,035	-1,482	6,016	-1,631	-0.16
Nov	2,026	1,135	-1,033	5,466	-1,272	-0.13
Dec	1,506	831	-97	3,451	-1,017	-0.10
Total	**12,646**	**8,146**	**-3,369**	**28,835**	**-4,675**	**-0.47**

If the only water moving into and out of the area were the horizontal flows, the differences would be closer to the values shown in table 16: +0.87 and -0.47 ft for the dry and wet years. However, there are other volumes that are not represented in these tables: rainfall, evapo-transpiration and change in storage. These volumes are obviously significant.

Table 17 gives monthly totals of rainfall, evapo-transpiration (ET) and storage for the Taylor's Slough sub-region. These values are obtained through the use of the USGS utility program ZONEBUDGET.

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Figure 17. Volume of Water moving in and out of Taylor's Slough Subregion

Area = 9979 acres

Volumes are in acre-feet

1989

Month	Rainfall	Evapo-Transpiration	Storage IN	Storage OUT	Net In - Net Out	Average Head Change, (Net In - Net Out) / Area, feet
Jan	715	2,542	2,000	584	-411	-0.04
Feb	8	2,252	1,629	0	-615	-0.06
Mar	209	1,893	877	131	-938	-0.09
Apr	2,512	2,845	1,632	1,887	-589	-0.06
May	1,943	2,821	1,236	1,533	-1,174	-0.12
Jun	2,931	2,633	918	2,471	-1,253	-0.13
Jul	7,595	4,733	2,523	6,620	-1,236	-0.12
Aug	7,074	4,485	2,573	6,076	-914	-0.09
Sep	4,271	4,022	2,079	3,292	-964	-0.10
Oct	1,446	3,609	2,728	1,002	-436	-0.04
Nov	350	2,889	2,674	122	13	0.00
Dec	982	2,827	2,367	735	-213	-0.02
Total	**30,037**	**37,552**	**23,237**	**24,452**	**-8,730**	**-0.87**

1995

Month	Rainfall	Evapo-Transpiration	Storage IN	Storage OUT	Net In - Net Out	Average Head Change, (Net In - Net Out) / Area, feet
Jan	2,133	3,287	2,674	1,421	99	0.01
Feb	859	3,303	3,287	517	327	0.03
Mar	1,618	4,305	4,259	954	618	0.06
Apr	2,261	4,642	4,767	1,363	1,023	0.10
May	5,220	5,101	3,978	3,748	350	0.04
Jun	12,492	4,732	2,605	10,798	-434	-0.04
Jul	5,202	4,935	2,339	3,539	-933	-0.09
Aug	9,250	4,556	1,847	6,904	-364	-0.04
Sep	7,401	3,892	1,568	5,042	35	0.00
Oct	9,237	3,229	2,674	6,961	1,722	0.17
Nov	780	3,060	3,745	311	1,154	0.12
Dec	522	3,009	3,446	82	877	0.09
Total	**56,976**	**48,051**	**37,189**	**41,640**	**4,475**	**0.45**

Note that the volume shown in table 17 complements the volumes in table 16 and that the average head change balances. The output from ZONEBUDGET includes the percent discrepancy for the subregion for each stress period (1 day). The percent discrepancy is 0.00% which indicates that the model is conserving mass, not only globally but also locally.

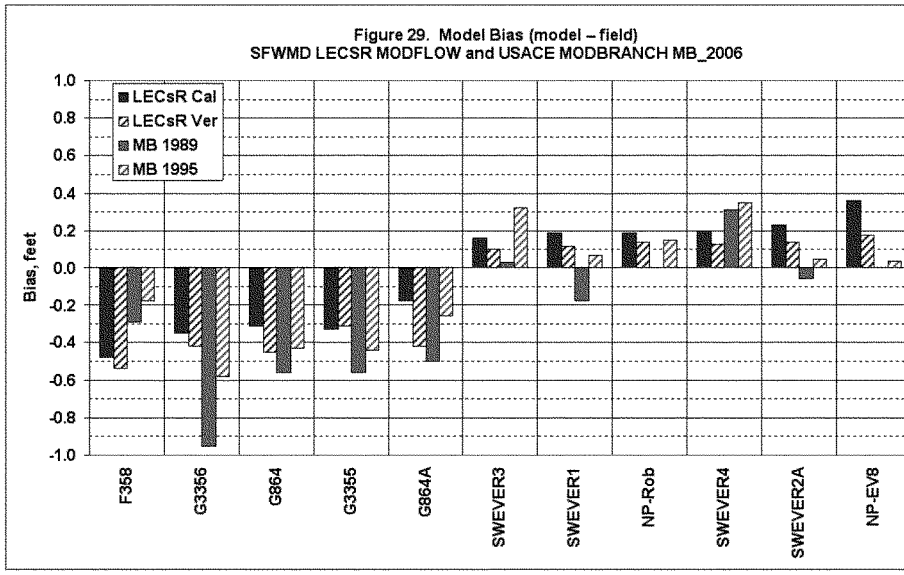
MODEL APPLICABILITY

The most reliable use of numerical models is in relative comparisons between two or more simulations. The use of any model in absolute terms is fraught with issues regarding the accuracy of the models. In the discussion above, three distinct models (MB_2006, SFWMM2x2 v5.4, and SFWMD LECsR) all have similar calibration and verification statistics, in spite of having different grid sizes, boundary conditions, and simulation periods. If the RMSE can be used as a reliable estimate of the accuracy a model, it appears that the best accuracy within the model domain that one could hope for with stage is about 0.5 ft.

The MB_2006 model was developed to be used for two projects: the C-111 Spreader Canal (C-111SC) and the ENP Seepage Management (ENPSM) projects.

The C-111SC project area (figure 21) has a number of gages in its periphery but only few in the interior. Possible errors at these gages have been discussed above. Unfortunately, without other gages nearby, the potential errors can not be isolated and corrected. The facts that (a) the SFWMD LECsR model shows the same trends (figure 29) as the MODBRANCH MB_2006 and (b) the topographic data shows large discrepancies, indicates that the field data may have errors that can't be replicated by the model.

The results in the vicinity of the ENPSM project (figure 21) show good agreement between the model and the field data sets (see figures 19-22 and supporting tables). In addition to good agreement for the dry and wet years, the model source code has been modified to have time-varying horizontal flow barriers. This will be useful when simulating the ENPSM barrier plans, which are supposed to test seasonal operations.



CONCLUSIONS

The MODBRANCH MB_2006 has been tested using dry (1989) and wet (1995) years. The results indicate that the model is adequate for testing scenarios within the model domain. The accuracy of the model, as is the case for any model, depends primarily on the accuracy of the inputs. The MB_2006 model is shown to be as accurate as both the SFWMD LECsR model and the SFWMM2x2 v5.4 model.

The primary drawback is that the model requires long computation times in order to simulate a 13-month period while both of the SFWMD models run many years is just a few hours. Obviously the MB_2006 model is not to be used for long-term simulations.

The strengths of the MB_2006 model are:

- Structure operation rules are very flexible,
- the canals are located more precisely than either the SFWMM2x2 or the LECsR models due to finer grid resolution,
- operational "triggers" are located with more precision than the SFWMM2x2,
- features (such as detention areas) which are below the scale of the SFWMM2x2 can be adequately simulated,
- near field effects of canal/structure operations can be more accurately simulated than with the SFWMM2x2, and
- canal stages and flows are a function of operational rules and local ground water stages.

The results of the model, at the level of accuracy produced, can be used with confidence in determining the relative differences between different alternatives. However, the users of the model should be careful when comparing absolute values. Model results are an indication of what may happen under certain conditions, but not necessarily what will happen.

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A.18 SUMMARY OF VALUE ENGINEERING ACTIONS

ER-11-1-321 5 November 2009

Summary of Value Engineering Actions for the
Final C-111 Spreader Canal Western Project Integrated Project Implementation Report
and Environmental Impact Statement – November 2009

The initial Draft Value Engineering study report was issued on January 2008 containing a series of VE proposals and comments for review, coordination and PDT decision actions to include accept for implantation into the Western PIR project, or to reject proposals that were documented as problematic or otherwise undesirable. The VE report included proposals for change or refinement of features developed to the initial Tentatively Selected Plan (TSP) level, and also the 30% level design for Frog Pond Detention Area being developed by South Florida Water Management District under their State Expedited Program initiative.

Following PDT meeting dated 21 February and 12 March 2008, actions were identified for each proposal and comment by the PDT. As some recommendations were complicated and required further study efforts. The Final Value Engineering Report was issued in April 2008 with actions noted for specific proposals and comment recommendations that would be studied. No final implementation direction or procedures for full or partial implementation was identified at this early stage for the developing the Draft PIR.

The Final Western C-111 Spreader Canal Western Project PIR and the SFWMD design submittals for North and South components of the C-111 Spreader Canal Western Project features, including the Frog Pond Detention Area and Pump Station, Aerojet Canal and Pump Station, the South C-111 Control Structure and L-31 E Canal plug and operational changes, have now reached a stage of development to support a review and reissue of the Final VE report.

The Revised Final Value Engineering Report, dated October 2009, is reissued with noted implementation actions based on detailed coordination and review with the Final PIR, and the SFWMD design submittals for North and South components of the C-111 Spreader Canal Western Project features. The updated total Western PIR 1 project features are estimated to be approximately $163 million (FY2010 dollars).

The design revisions basically follow the original developing TSP from January 2008, but are much more refined with modifications, feature layouts, quantities and capacities for the pump stations and the lower C-111 water control structure. Related revisions to the PIR and design features, as recommended in the original Value Engineering report, have been reviewed and coordinated with a final level of revisions to the April 2008l Value Engineering report, and now reflect adjustments for quantities and unit cost updated to FY2010. Both First Cost and Life Cycle Cost are presented in the following summary:

REVISED FINAL SUMMARY OF PROPOSALS / RECOMMENDED ACTION

PROPOSAL NUMBER	DESCRIPTION	POTENTIAL SAVINGS	RECOMMENED ACTION
C-1*	**Move FPDA intake pumps north ~~and add new gated structure~~ in C-111 to reduce back-water stage effects in C-111**		**See Final**
	(Alt A – Gate without well point system)	$ 3,996,000	**PIR Plan**
	(Alt B or C - With well point system)	($ 5,328,000)	**Rejected**
	***(Final Implemented Alternative – Relocated intake pump station and lined delivery canal (Reduced impacted lands to ~12%)**	**$ 5,111,000**	**Final PIR Modified and Implemented**
C-2*	**Optimize of the number of pump stations and pumping capacity**	**$21,127,000**	**Modified and Implemented**
	Life Cycle Cost Savings	**$ 9,877,000**	
C-3	**Reduce Inflow Design Flood to less than the Probable Maximum Flood**	**($1,334,000)**	**Modified and Implemented**
	(Alt A – 400 Foot Weir)	$ 664,000	See above
	(Alt A – Fuse Plug)	$ 1,328,000	See above
C-4	Revise Frog Pond Detention Area slopes to 3H:1V	$ 754,000	**Design issue Rejected**
C-5	Consider lower internal levees for Frog Pond Detention Area	$ 823,000	**Design issue Rejected**
C-6	Look to reduce the size of pilot components – One-half mile spreader canal	$ 6,627,000	Deferred to PIR 2
C-7*	Build one 3,000 CFS plug structure and add second structure in PIR 2 if needed	**$ 1,911,000**	**Modified and Implemented**
	Life Cycle Savings	**$ 263,000**	
	Estimated Total First Cost Savings	**$ 28,149,000**	
	Estimated Total Life Cycle Cost Savings	**$ 10,140,000**	
	Estimated Total Cost Savings	**$ 38,289,000**	

Notes: 1. PIR 1 proposals are considered cumulative savings as indicated by *: C-1, C-2 and C-7. Proposals indicated have been confirmed as implemented. Proposal C-3 is considered a value added improvement beyond the original VE proposal and reflects slightly additional cost.
2. Initial actions for VE proposals indicated by PDT Minutes from 21 February and 12 March 2008 meetings addressing proposals and comments. See minutes attached in Appendix E of Supporting Documents.
3. Updated proposal cost estimates developed from 28 October 2009 Draft Western C-111 Spreader Canal Project Implementation Report and Draft Environmental Assessment and C-111 PIR 1 design documents. Revised Final Costs Estimates are provided for Proposals C-1, C-2 and C-7 in Appendix F.

Proposal C-1 Revisions and Implementation: The concept proposed was the relocation of the pump station and supply channel with water deliveries from the north into FPDA. The pump station relocation will have influence on C-111 stage effects to impacted properties near the pumping station. Furthermore, the pump delivery from the north places the FPDA hydraulic influence during any event where pumping occurs within the header canal – without the filling of all three storage cells. The original estimated impacted lands were identified as 13,000 acres. Current estimated impacted lands are reduced to 11,565 acres (12% reduction).

The VE options for controlled return pumping of ground water movement to the east from FPDA influencing takings of impacted private lands including agricultural operations has been realized with the new FDPA site design. Estimated potential impacted private lands were originally identified as 800 acres. A reduction in original VE estimated acres was made, from 400 acres (50%) to approximately 90 acres (12%), because of improved operations within FPDA.

The additional C-111 control structure and/or return pumping from well points was not required; however, improvements to the inlet channel were made to reduce seepage losses with an added concrete liner. Revised estimated savings reflect the control structure and well points are replaced with cost allowance for the liner.

Revised final estimated savings are $5,111,000. See revised final estimates provided in the Revised Final Value Engineering Report, Appendix F.

Proposal C-2 Revisions and Implementation: The concept proposed to optimize the number and capacity of pump stations was incorporated into FPDA and Aerojet Pump Stations based on modeling and expected deliveries to the project by C-111. As presented, the VE proposal recommended retaining only one pump station, but if two were required, optimization by downsizing could be considered. The two pump stations were resized from 750 to 250 CFS and 500 to 250 CFS respectively. There is spare capacity to add one additional 75 CFS pump to both stations if Eastern PIR 2 or RECOVER analysis indicate additional capacity is required.

Revised final estimated first cost savings are $21,127,000. Life cycle savings are estimated to be an additional $9,877,000 (Present Worth). See revised final estimates provided in Appendix F.

Proposal C-3 Revisions and Implementation: The concept proposed was to reduce the original 800 foot emergency overflow weir by approximately 50% considering the low hazard potential for Frog Pond Detention Area. The final design has provided 2-400 weirs for the upper two cells and one 300 foot weir for the south cell. The weirs are simplified for construction and use off-site manufactured Articulated Concrete Mats in lieu of concrete auger-cast piles, concrete beams and cast in place concrete weir slab.

The final total lengths of weir are a slight increase, but provided control weir discharge from each cell. The combination of three smaller weirs and change of materials does not result in any savings. The improvements are considered a minor cost for a value added solution to the project.

Revised final estimated costs are identified as an increase of $1,334,000. See revised final estimates provided in Appendix F.

Proposal C-4 Revisions and Implementation: The concept proposed was rejected as two design issues were considered – one, balance of cut and fill; and two, cover for potential Copper contaminated soil using zones embankments (if required).

No revised final estimated costs were developed and no savings are indicated.

Proposal C-5 Revisions and Implementation: The concept proposed was rejected as two design issues were considered – one, balance of cut and fill; and two, continuous access with constant crest elevations throughout Frog Pond Detention Area levees.

No revised final estimated costs were developed and no savings are indicated.

Proposal C-6 Revisions and Implementation: The concept proposed was identified to be carried into the Eastern C-111 PIR.

No revised final estimated costs were developed and no savings are indicated for PIR 1.

Proposal C-7 Revisions and Implementation: The concept proposed was for one control structure and it is incorporated into the PIR and final design. As developed, the control structure reflects both the VE proposal and comment identifying the structure to be developed as an operating gated structure (See Comment 4.).

Revised final estimated first cost savings are $1,911,000. Life cycle savings are estimated to be an additional $263,000 (Present Worth). See revised final estimates provided in Appendix F.

The Revised Final Value Engineering Report, dated October 2009, has been submitted for inclusion with Final Western C-111 Spreader Canal project PIR documents.

A.19 VALUE ENGINEERING STUDY REPORT

U.S. ARMY CORPS OF ENGINEERS

U.S. ARMY CORPS OF ENGINEERS, JACKSONVILLE DISTRICT

VALUE ENGINEERING STUDY REPORT

REVISED FINAL REPORT COPY

Sponsored By: South Florida Water Management District and U.S. Army Engineering District, Jacksonville

JANUARY 2008
Revised APRIL 2008 and
Revised OCTOBER 2009 for Final Design Implementation Actions

VALUE ENGINEERING TEAM STUDY

DOD SERVICE: USACE **VALUE ENGINEERING OFFICER:** Fred McAuley
CONTROL NO: CESAJ-VE-08-003-C

Revised Final Value Engineering Report on the

114605 WESTERN C-111 SPREADER CANAL - PIR 1

MIAMI-DADE COUNTY, FLORIDA

January 2008
***Revised April 2008* and**
Revised October 2009 for
Final Design Implementation Actions

STUDY SPONSOR: South Florida Water Management District & Jacksonville District

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VALUE ENGINEERING TEAM STUDY

TABLE OF CONTENTS

Page No.

Cover 1

Table of Contents 2

Project Description and Background 4

Executive Summary 10

Summary of Proposals 11

Proposals:

C-1 Move FPDA intake pumps north and add new gated structure in C-111 to reduce back-water stage effects in C-111 (Real Estate Takings) 12

C-2 Optimize of the number of pump stations and pumping capacity 22

C-3 Reduce Inflow Design Flood to less than the Probable Maximum Flood . 27

C-4 Revise Frog Pond Detention Area slopes to 3H:1V 33

C-5 Consider lower internal levees for Frog Pond Detention Area 37

C-6 Look to reduce the size of pilot components – One-half mile spreader canal 43

C-7 Build one 3,000 CFS plug structure and add second structure in Phase 2 if needed 45

Value Engineering Comments 48

VALUE ENGINEERING TEAM STUDY

TABLE OF CONTENTS

Supporting Documents: 55

Appendix A: Contact Directory 56

Appendix B: Speculation List 58

Appendix C: Cost Model 60

Appendix D: Function Analysis System Technique (FAST) Diagram 63

Appendix E: PDT Minutes 21 February and 12 March 2008 65

Appendix F: Revised Final Estimated Savings Based on Draft Western C-111 Spreader Canal Project Implementation Report and Draft Environmental Assessment and Final Phase 1 Design Documents - 28 October 2009 .. 78

VALUE ENGINEERING TEAM STUDY

PROJECT DESCRIPTION AND BACKGROUND

PROJECT TITLE:	Western C-111 Spreader Canal – PIR 1
PROJECT LOCATION:	Miami – Dade County, Florida

The C-111 Canal is the southernmost canal of the Central and South Florida Flood Control Project and is located in south Miami-Dade County. The canal serves a basin of approximately 100-square-miles and functions primarily to provide flood protection and drainage for the agricultural areas to the west and south of Homestead, Florida. Southwest of Homestead and Florida City and just south of the agriculturally developed area, C-111 is joined by C-111E and courses south to southeast through extensive marl wetland prairie and coastal mangrove marsh before it ends in Manatee Bay. The C-111 canal and S-18C (located just south of the confluence of C-111E and C-111) were completed in 1966 and the S-197 structure was completed in 1970. S-197 provides a gravity outlet for stormwater runoff during flood conditions and acts as a barrier to prevent saltwater intrusion into the freshwater wetlands of the Southern Glades Wildlife and Environmental Area (SGWEA) located to the north of the Everglades National Park's (ENP) eastern panhandle. The C-111 Canal is also the final segment of the South Dade Conveyance System for maintaining water supply and flood protection. The C-111 Canal also provides a means to deliver water to ENP's Taylor Slough and the eastern panhandle area to meet the minimum water delivery schedule, under Federal Statute (P.L. 91-282).

A Project Delivery Team was formed to prepare a PIR for the implementation of the proposed C-111 Spreader Canal project. The PDT determined that the proposed project as originally described in the Yellow Book could not meet the goals and objectives envisioned for the C-111 Spreader Canal project and therefore could not simply be reaffirmed with project feature optimization. In accordance with programmatic guidance, the PDT then reformulated the proposed project, developing more specific goals and objectives for the planning process that would maximize environmental restoration potential within the project area. Management measures were formulated that included Stormwater Treatment Areas, canal construction and backfilling, and pump stations. Management measures were combined to produce 21 alternative plans that were screened based on constraints such as environmental degradation to adjacent areas, redundancy with other alternatives, costs significantly above projected levels, etc. Subsequent screening of the alternative plans produced a final array of 7 plans that were all primarily based on the concept of distributing water from the proposed C-111 Spreader Canal to the east, underneath U.S. Highway 1 and Card Sound Road.

The proposed C-111 Spreader Project will be implemented in two phases via a Phase I and Phase II PIR. Phase I, or the Western PIR, will mainly focus on improving water quality and environmental conditions in Florida Bay and surrounding waters via overland flows through Taylor Slough. Phase I would also include the construction of features included in the Future Without Project Condition that were authorized by the 1994 C-111 South Dade GRR and provide a conceptual plan for the remainder of the project to be addressed in the Phase II, or the Eastern PIR.

The Phase II PIR will build upon information obtained from the construction and initial operation of the Phase I project, and will include features necessary to achieve the remaining restoration objectives for the study area not addressed by the Phase I project.

Western PIR Phase I:
All of the alternatives, including the SFWMD's A8 alternative, will include the Future Without Project Condition. Additional alternatives would include such other features as the Frog Pond, Aerojet Canal, Ingram Highway, Loveland Slough as a Water Quality infiltration basin, etc. Operational changes will also be considered for each of the additional alternatives. The construction features of the Future Without Project Condition include the following features of the 1994 C-111 South Dade GRR:

- Construction of the eastern spreader canal, C-111N from C-111 to U.S. Highway 1
- A 50 CFS Spreader Canal pump
- 10 plugs in C-110
- Backfilling of L31W from S176 westward all of the way to S332

The construction of the authorized C-111 South Dade eastern spreader canal, C-111N was to be deferred to the CERP C-111 Spreader Canal project; however, for reliable modeling to be produced, it is likely that real time data from the operation of the authorized C-111 South Dade eastern spreader canal, C-111N feature will be needed. Construction and operation of the authorized C-111 South Dade eastern spreader canal, C-111N east to U.S. Highway 1 will provide actual data that will be utilized to evaluate if the desired environmental recovery is attained in the ecosystem. Analysis of the data that is acquired will allow for the addition of future pumping capacity as well as possible re-alignment.

By moving the YB proposed alignment north from 432nd Street to 424th Street, a 50 CFS pump could be constructed on an existing canal to possibly further enhance the project. Construction and operation of the authorized C-111 South Dade eastern spreader canal, C-111N at this location will provide the necessary data to possibly modify aspects of the proposed project in the proposed Phase II expansion. As such, the Phase I PIR will provide an analysis and recommendation as to proper alignment and construction of the authorized C-111 South Dade eastern spreader canal, C-111N as analyzed in the 1994 C-111 South Dade GRR. Overall plan selection for the Phase I PIR will be based on system formulation benefits and costs in the study area, which will be equal to next-added increment benefits and costs.

PIR 1 Alternative Formulation Briefing (Tentative Selected Plan) - Alternative 2D:
Two main components of Alternative 2D are the Frog Pond Detention Area (FPDA) and a FPDA pump station. This alternative collects water that is currently being discharged through S-177, S-18C and S-197 and pumps it into the proposed Frog Pond Detention Area. While it does provide detention of stormwater and excess flows down C-111, it also provides a hydraulic ridge that effectively reduces groundwater flows from west to east. Keeping groundwater towards the west allows for the more natural flow of water in Taylor Slough eventually reaching Florida Bay in a non-point source manner.

The FPDA is approximately 530 acres with a maximum water depth of 3 feet; this maximum depth is near stage 8 feet. The FPDA pump station is located south of S-176 on C-111; the pump station will turn on when C-111 stages reach 4.0 feet and will remain on until the canal is at elevation 3.6 feet or the FPDA has reached the maximum 3 feet water depth, whichever occurs first. Total pumping capacity of the FPDA pump station is 750 cubic feet per second (CFS), and as currently envisioned, the pump will intercept two-thirds of the flow through S-176, most of which would otherwise have been discharged via S-177.

This alternative adds a second 500 CFS pump station just upstream of S-177 and a canal leading to the existing Aerojet Road Canal. This feature builds upon the effectiveness by extending the hydraulic ridge southward, and by increasing the installed capacity in order to capture up to 2/3 of the flows which would otherwise be discharged to tide via S-177. This proposed additional pump station intercepts water upstream of S-177 in the C-111 canal. In alternative 2D, 2/3 of the water which would otherwise be discharged via S-177 is evenly split between the Aerojet Road Canal pump station and the FPDA pump station. That portion of intercepted water routed to the FPDA pump station is then discharged into a proposed northern extension of the Aerojet Canal at a point just south of Ingraham Highway. As currently conceived, both the Aerojet Road Canal and FPDA pump stations will begin pumping simultaneously when the C-111 stage reaches 4.0 feet. When C-111 stage recedes to 3.6 feet, the pump will turn off. The additional flow being delivered to the Aerojet Road Canal will assist in creating a hydraulic ridge to prevent seepage out of Taylor Slough towards C-111. The stage in the lower part of the Aerojet Road Canal will be kept no higher than 3 feet, elevation 5 feet. A berm will be constructed surrounding Aerojet Road Canal to facilitate higher stages within the Aerojet Road Canal.

C-111 Spreader Canal Acceler8 Components:
The Frog Pond Detention Area (FPDA) will be executed under SFWMD's Acceler8 initiative. FPDA contains 3 cells with distribution channels and weirs for water distribution in/out and gated outlet structure to be constructed on the 530 acre site. The 750 CFS pump station features 3-200 CFS diesel and 2-75 CFS electric drive pumps.

VALUE ENGINEERING TEAM STUDY

PROJECT DESCRIPTION AND BACKGROUND

PROJECT TITLE:	C-111 Spreader Canal – PIR 1
PROJECT LOCATION:	Miami – Dade County, Florida

The current estimated cost for construction features for PIR 1 Alternative 2D is $71 million. Real estate cost is estimated at $41.4 million. The Acceler8 estimated cost for the Frog Pond Detention Area including pump station and gated outlet structure and conveyance canal is $55.8 million (Based on 30% Preliminary level of design).

See the Supporting Documents for the Value Engineering Team Members, the Speculation List, Cost Models, FAST Diagram (a logic diagram identifying project functions), and Supporting Information for Proposals and comments.

REVISED FINAL REPORT SUMMARY: The Value Engineering report is revised and reissued dated October 2009 with implementation actions noted based on the Final Western C-111 Spreader Canal Integrated Project Implementation Report and Environmental Impact Statement, and the SFWMD design submittals for North C-111 Spreader Canal Phase 1, Frog Pond Detention Area including Pump Station S-200, and the South C-111 Phase 1 features including Aerojet Canal and L-31 E Canal, Pump Station C-199, and the South C-111 Control Structure S-198.

The design revisions basically follow the developing TSP from January 2008, but are more refined with modifications feature layouts, quantities and capacities for pump stations and the south water control structure as recommended in the original Value Engineering report. The Value Engineering proposals have been reviewed and coordinated with changes implemented in the Final PIR and design documents, and revisions to the final Value Engineering report reflect adjustments for quantities and unit cost are updated to FY2010.

The updated total Western PIR Phase 1 project features are estimated to be approximately $163 million (FY2010 dollars).

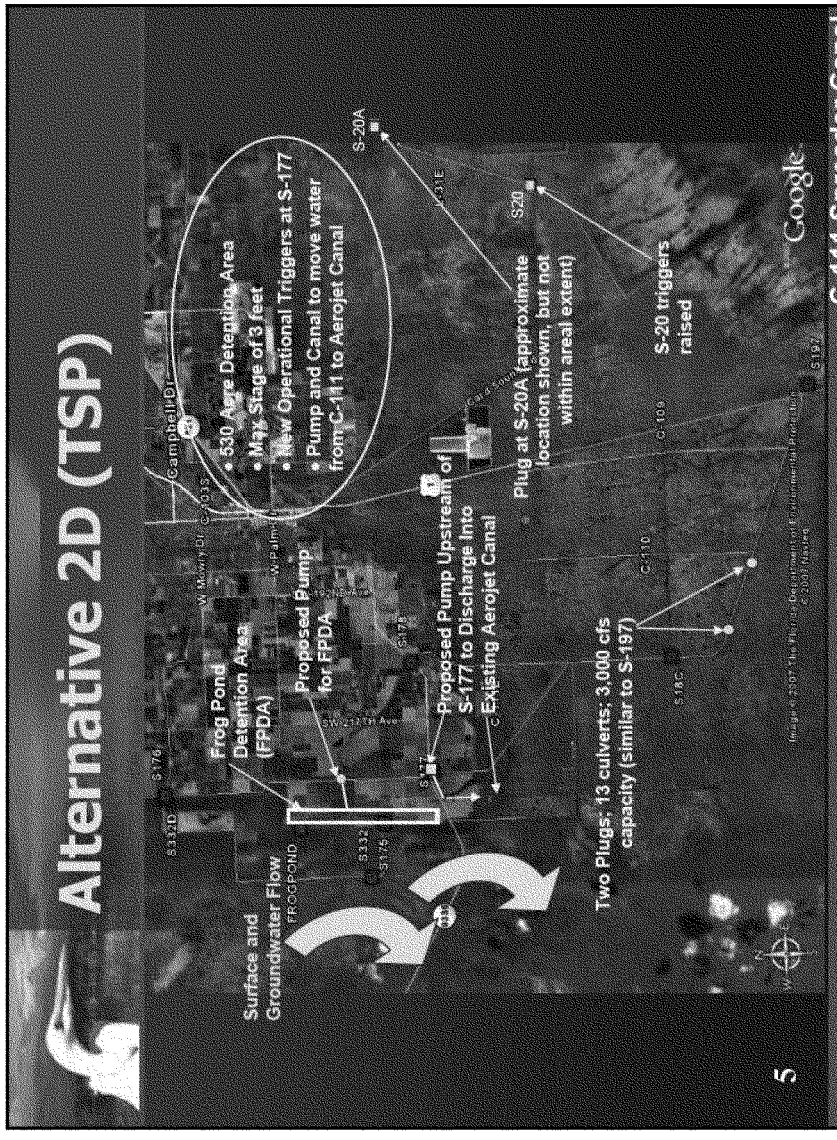
VALUE ENGINEERING TEAM STUDY

PROJECT DESCRIPTION AND BACKGROUND

PROJECT TITLE: C-111 Spreader Canal – PIR 1

PROJECT LOCATION: Miami – Dade County, Florida

C-111 Spreader Canal Alternative 2D – TSP Site Map



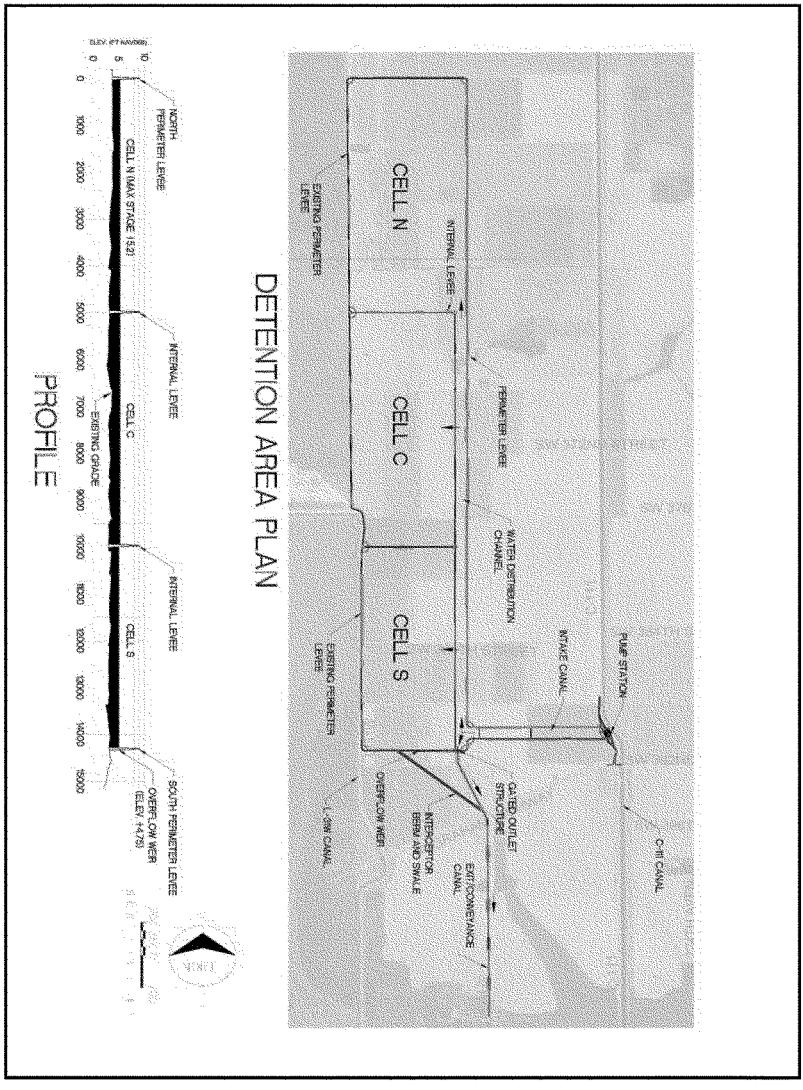
VALUE ENGINEERING TEAM STUDY

PROJECT DESCRIPTION AND BACKGROUND

PROJECT TITLE: C-111 Spreader Canal – PIR 1

PROJECT LOCATION: Miami – Dade County, Florida

C-111 Spreader Canal Accerle8 Project – Frog Pond Detention Pond Site Map (3 Cell Detention Pond, 750 CFS Pump Station, Gated Out-flow Structure and Conveyance Canal)



VALUE ENGINEERING TEAM STUDY
EXECUTIVE SUMMARY

The formal VE study workshop was conducted from 3 through 7 December 2007. The participants included Project Delivery Team (PDT) members and the Value Engineering team including South Florida Water Management Division (SFWMD), supplemental District In-house team members, and Charleston and Vicksburg District representatives.

Value Engineering (VE) is a process used to study the functions a project is to accomplish. As a result, the VE team takes a critical look at how these functions are being met, and it identifies alternative ways to achieve the equivalent function while increasing the value, and the cost ratio of the project. The project was studied using the Corps of Engineers standard Value Engineering (VE) methodology, consisting of five phases:

Information Phase: The Team was presented figures, descriptions of project work, and cost estimates to fully understand the work to be performed and the functions to be achieved. Cost Models (see Appendix C) were compared to determine areas of relative high cost to ensure that the team focused on those parts of the project that offered the most potential for cost savings.

Speculation Phase: The Team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members contributed ideas and critical analysis of the ideas was discouraged (see Appendix B).

Analysis Phase: Evaluation, testing and critical analysis of all ideas generated during speculation was performed to determine potential for savings and possibilities for risk. Ideas were ranked by priority for development. Ideas that did not survive critical analysis were deleted.

Development Phase: VE team members developed the selected priority ideas identified during analysis into written proposals. Proposal descriptions and possible impacts to schedule and funding were identified for each item discussed. Savings were estimated where realized.

Presentation Phase: Presentation is a two-step process. First, the VE Study Report is being distributed for review (by PDT and all appropriate project supporters and decision-makers). Review comments are to be coordinated for decision on any proposals recommended by the study report. Final coordination will include a formal Presentation conference for recommendation of actions to be taken on specific VE proposals. Actions reflecting each proposal are to be annotated on Summary of Proposals / Recommended Action. Further formal coordination of VE action items will be through the project PM's and VEO.

VALUE ENGINEERING TEAM STUDY

REVISED FINAL SUMMARY OF PROPOSALS / RECOMMENDED ACTION

PROPOSAL NUMBER	DESCRIPTION	POTENTIAL SAVINGS	RECOMMENED ACTION
C-1*	**Move FPDA intake pumps north ~~and add new gated structure~~ in C-111 to reduce back-water stage effects in C-111**		**See Final**
	(Alt A – Gate without well point system)	$ 3,996,000	**PIR Plan**
	(Alt B or C - With well point system)	($ 5,328,000)	**Rejected**
	***(Final Implemented Alternative – Relocated intake pump station and lined delivery canal (Reduced impacted lands to ~12%)**	**$ 5,111,000**	**Final PIR Modified and Implemented**
C-2*	**Optimize of the number of pump stations and pumping capacity**	**$21,127,000**	**Modified and Implemented**
	Life Cycle Cost Savings	**$ 9,877,000**	
C-3	**Reduce Inflow Design Flood to less than the Probable Maximum Flood**	**($1,334,000)**	**Modified and Implemented**
	(Alt A – 400 Foot Weir)	$ 664,000	See above
	(Alt A – Fuse Plug)	$ 1,328,000	See above
C-4	Revise Frog Pond Detention Area slopes to 3H:1V	$ 754,000	**Design issue Rejected**
C-5	Consider lower internal levees for Frog Pond Detention Area	$ 823,000	**Design issue Rejected**
C-6	Look to reduce the size of pilot components – One-half mile spreader canal	$ 6,627,000	Deferred to PIR 2
C-7*	Build one 3,000 CFS plug structure and add second structure in Phase 2 if needed	**$ 1,911,000**	**Modified and Implemented**
	Life Cycle Savings	**$ 263,000**	
	Estimated Total First Cost Savings	**$ 28,149,000**	
	Estimated Total Life Cycle Cost Savings	**$ 10,140,000**	
	Estimated Total Cost Savings	**$ 38,289,000**	

Notes: 1. PIR 1 proposals are considered cumulative savings as indicated by *: C-1, C-2 and C-7. Proposals indicated have been confirmed as implemented. Proposal C-3 is considered a value added improvement beyond the original VE proposal and reflects slightly additional cost.

2. Initial actions for VE proposals indicated by PDT Minutes from 21 February and 12 March 2008 meetings addressing proposals and comments. See minutes attached in Appendix E of Supporting Documents.

3. Updated proposal cost estimates developed from 28 October 2009 Final Western C-111 Spreader Canal Project Implementation Report and Environmental Impact Statement and C-111 PIR 1 design documents. Revised Final Costs Estimates are provided for Proposals C-1, C-2 and C-7 in Appendix F.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 (1) PAGE NO: 1 OF 10

DESCRIPTION: Move FPDA intake pumps north and add new gated structure in C-111 to reduce back-water stage effects in C-111 (Real Estate Takings)

ORIGINAL DESIGN: Both the PIR TSP and A8 design have Frog Pond Detention Area (FPDA) intake pumps located upstream of S-177. The TSP design has the pump and associated intake canal located at about the midpoint of the north/south axis of the FPDA. The A8 design has the pump/canal located at the south end of the FPDA.

PROPOSED DESIGN (Alternative A): Relocate FPDA intake pump station and canal to the northern end of the FPDA and add a new gated structure in C-111 just downstream of the intake. New gated structure should have the same capacity as S-177. New gated structure could be integrated with intake pump house if cost effective to do so. With intake pump located at the north end of FPDA, opportunity exists to extend the Distribution Canal to the full N/S length of the FPDA. This VE proposal applies to both TSP and A8 plans.

New gated structure operations: New structure has same stage triggers as S-177. Flood flows in excess of the FPDA intake pumping rate could eventually trigger new gate to open to prevent flooding. As flood flows in C-111 recede to the point of equaling the intake pumping rate, the new gate closes to reduce the backwater effect in C-111 that is due to seepage from FPDA. After pumping ceases reopen new gate once the new structure's tailwater becomes equal to or less than the headwater.

PROPOSED DESIGN (Alternative B):
Same as (a) but include well points along west bank of C-111 and north edge of FPDA. Length of well point array and pump capacity TBD through optimization via design scale groundwater modeling. Well point array discharges to FPDA intake canal and the pump could be integrated with FPDA pump house.

PROPOSED DESIGN (Alternative C): Same as (b) but without new gated structure in C-111 if modeling shows infrequent closing of gate or if the well point array is sufficiently effective in reducing increased C-111 stage durations.

ADVANTAGES:
1. Should reduce extent of increased stage durations in C-111 and the associated adverse impacts to groundwater stages thereby reducing the acreage of agricultural lands needed in the final Real Estate takings analysis.
2. Reduction in Real Estate takings makes the project more acceptable to some stakeholders.
3. Reduction in Real Estate takings keeps more productive agricultural land in play from the NED perspective.
4. Extension of Distribution Canal allows for longer hydraulic ridge.
5. Cost savings in Real Estate should outweigh cost of new project components – gated structure and well points.

DISADVANTAGES:

1. Increased costs for new project components
2. Could result in reduction in project benefits by triggering more openings of S-177 than the in proposed design.
3. Could result in shifting adverse groundwater impacts from areas northeast of FPDA to other areas directly east.
4. Reduction in Real Estate takings keeps more productive agricultural land in play which could be a disadvantage from a downstream Water Quality perspective.
5. Additional modeling needed to determine any change to impacted lands.

JUSTIFICATION:

FPDA Objectives:

• Provide hydration of wetlands south (and west) of the Frog Pond area through diversion of high flows from C-111 thereby maintaining hydration in Taylor Slough and increasing freshwater discharges to Florida Bay.

• Reduce fresh water discharges through S197 to the maximum extent practicable, particularly during/following major storms

Problem: Obtaining these objectives with Alt2D apparently results in flooding impacts to the north and east of the Frog Pond area. Based on AFB documentation TAB 3 Section 3.4.2 Physical Features and LERRD Requirements, Alt2D no SC shows 13,076 acres of real estate required/impacted (Table 3-5) while Alt2D with SC shows 19,143 acres required/impacted (Table 3-4). Intuitively this indicates that approximately 13000 acres of real estate impacts are due to components other than the SC. Presumably these impacts result from induced flooding in areas north and east of the FPDA. The induced flooding results from simulated increases in groundwater elevations which are likely caused by an increase in stage durations in C-111 upstream of S-177.

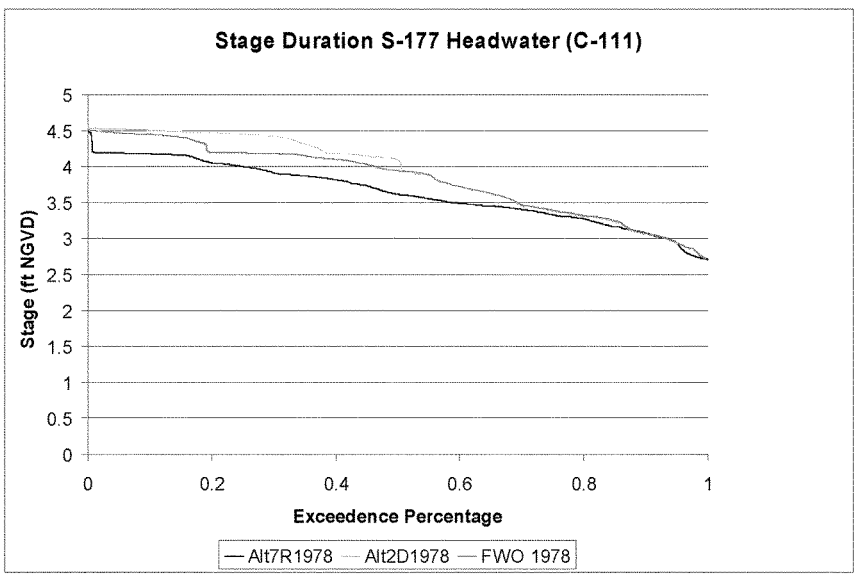
Analysis: The modeling used to generate data for the AFB real estate requirements compares the MODBRANCH base case Alt7R versus the various alternative plans. The subregional MODBRANCH model takes upstream boundary conditions from the regional model SFWMM. Since MODBRANCH run Alt7R takes boundary conditions from SFWMM run Alt7R5 and the MODBRANCH alternatives runs take boundary conditions from the Future Without Project SFWMM run 2050B3, it is difficult to parse the effects of a given alternative from the effects of the different boundary condition sets. Nevertheless, comparing results of three scenarios can provide insight into the effects of the alternative plans. The following stage duration graphs were prepared for this purpose. MODBRANCH stage data for the S-177 headwater are plotted for three model runs; Alt7R, FWO, and Alt2D.

Three graphs are provided for each of the years simulated; 1978, 1989, and 1995 (average, dry, and wet). These graphs show the C-111 stage duration curves increase for Alt2D relative to both Alt7R and FWO in all three cases. This is likely due to the

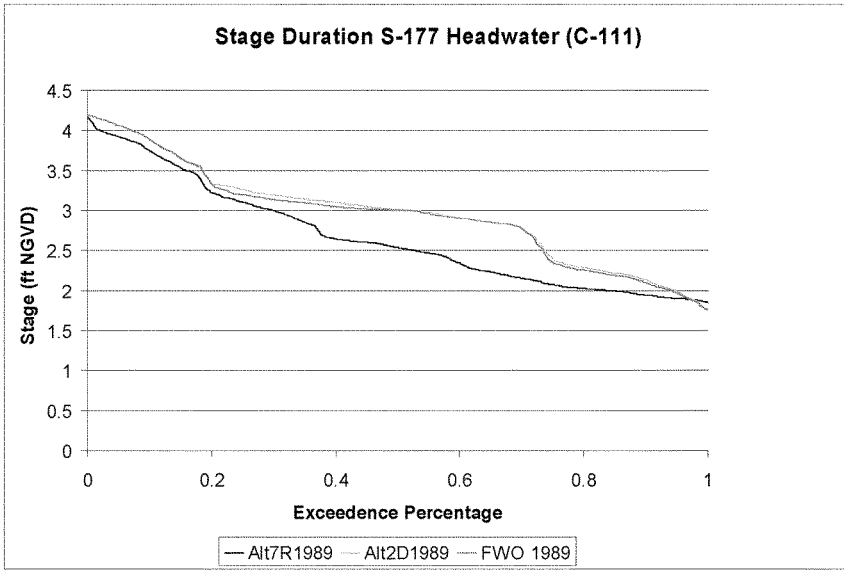
"dynamic storage" characteristic inherent to the FPDA conceptual design. In other words, the volume of water that would have passed through S-177 and out of the system is now entrained upstream of S-177 through the action of the FPDA intake pump. As flood flows are pumped into the FPDA, some water seeps back into C-111 and is then re-circulated back into the FPDA. This cycle continues until the flood event is over and the canal stage returns to equilibrium with groundwater. This results in the extension of the duration of a given canal stage which in turn may shift more MODBRANCH model cells into the "impacted lands" category as defined in the AFB Preliminary Real Estate Plan (Appendix D, Section D.14 Induced Flooding).

The intent of this VE proposal is to counteract the predicted increase in the C-111 stage duration curves. This is done by trying to limit the areal extent of the FPDA dynamic storage effect in C-111. The purpose of the new structure is to isolate the reach of C-111 which has the short seepage path from the FPDA back to C-111, thus the recommendation to relocate intake pump and canal to the north. When closed during FPDA pumping, the new structure should limit the "backwater" effects in C-111 from propagating northward. However, since the new structure must remain open to allow passage of flows greater than the intake pump capacity, its usefulness will be limited to periods of excess flow less than or equal to the proposed pump capacity (750 cfs in A8). Therefore, the well point array is proposed to augment (or supplant) the new structure and accomplish the suggested solution should the structure alone be insufficient to mitigate the adverse impacts to C-111 stage duration.

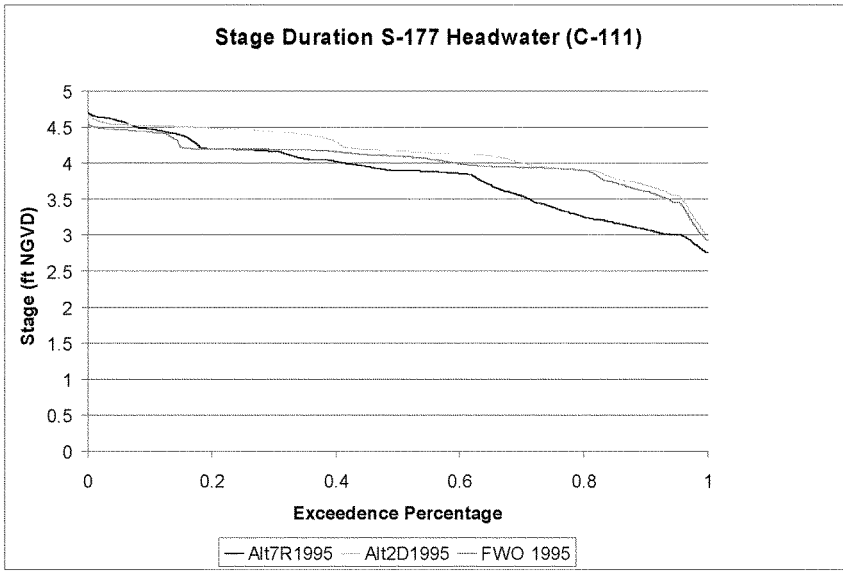
Stage Duration Graph 1978



Stage Duration Graph 1989



Stage Duration Graph 1995



Alternative A presents a concept using current project features and techniques to deliver FPDA water supply from the north and makes use of gravity flow by extending the distribution channel to the exit conveyance canal. Proposal Alternative B and C add an operational gate structure on C-111 and a possible well point system to capture and return seepage driven by FPDA. By reducing seepage impacts to lands to the north and east of FPDA, a portion of the total 13,000 (approximately 600 to 800 of impacted acres which are privately owned) and may be reduced. Estimated savings assume 400 acres of privately owned lands may be reduced or eliminated from real estate takings. Two possible savings estimates are developed – the first one uses only the relocated pump station and new gate structure and the second one using the well point system too. Possible savings for Alternative A are calculated as $4.0 million without the well point system, and Alternative B and C are calculated as -$5.3 million to -$1.924 million (negative) depending on a the use of a well point system if required.

REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed was the relocation of the pump station and supply channel with water deliveries from the north into FPDA. The pump station relocation will have influence on C-111 stage effects to impacted properties near the pumping station. Furthermore, the pump delivery from the north places the FPDA hydraulic influence during any event where pumping occurs within the header canal – without the filling of all three storage cells. The original estimated impacted lands were identified as 13,000 acres. Current estimated impacted lands are reduced to 11,565 acres (12% reduction).

The VE options for controlled return pumping of ground water movement to the east from FPDA influencing takings of impacted private lands including agricultural operations has been realized with the new FDPA site design. Estimated potential impacted private lands were originally identified as 800 acres. A reduction in original VE estimated acres was made, from 400 acres (50%) to approximately 90 acres (12%), because of improved operations within FPDA.

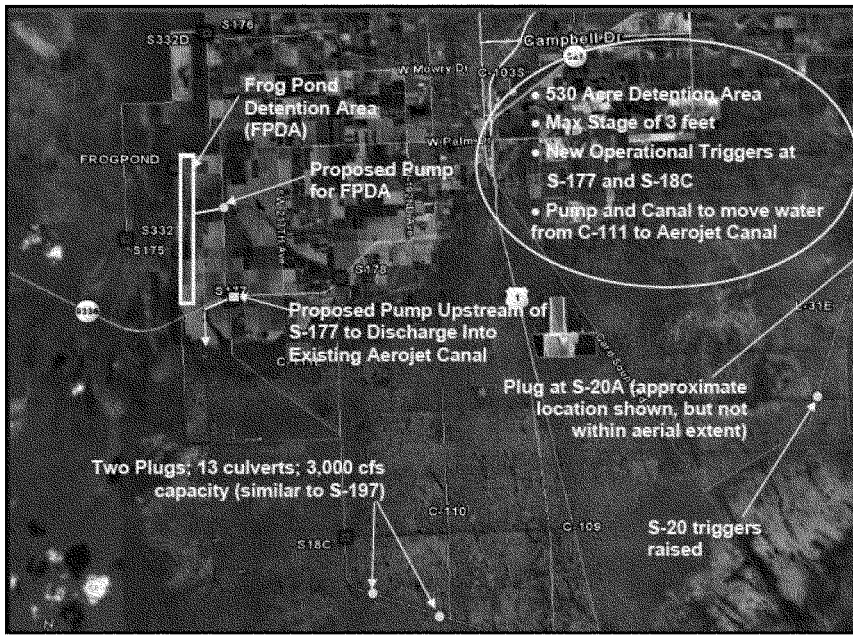
The additional C-111 VE control structure and/or return pumping from well points was not required; however, improvements to the inlet channel were made to reduce seepage losses with an added concrete liner. Revised estimated savings reflect the VE control structure and well points are replaced with cost allowance for the liner.

Revised final estimated savings are $5,111,000. See revised final estimates provided in Appendix F.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 PAGE NO: 6 OF 10

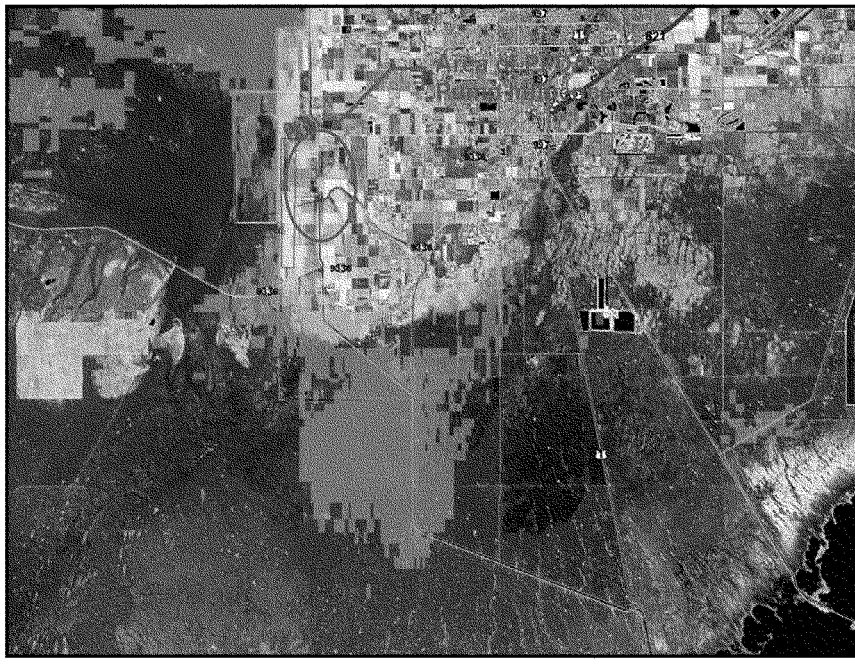
PIR Alternative 2D Plan



VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 PAGE NO: 7 OF 10

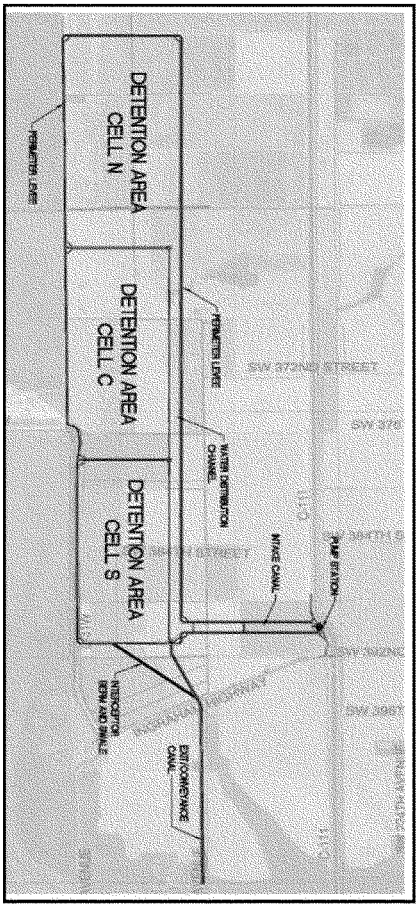
PIR Alternative 2D Plan – Real Estate Impacted Lands Map

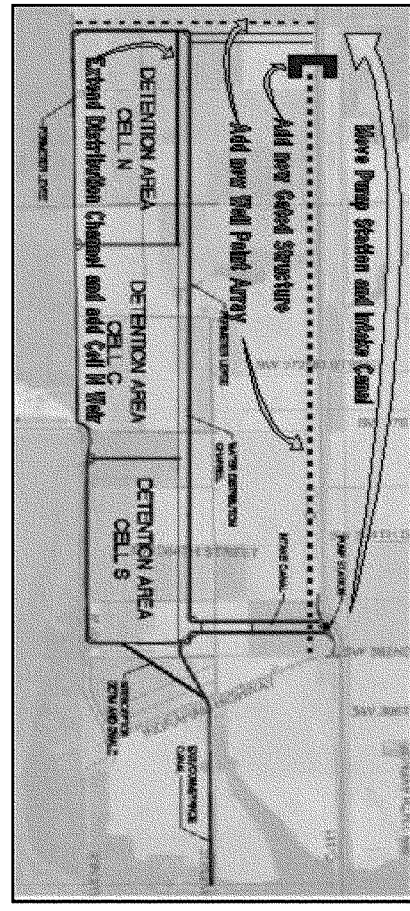


VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 PAGE NO: 8 OF 10

Current and Proposed Accelor8 FPDA Plan
(Applies to PIR Plan Too)





VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 PAGE NO: 9 OF 10

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Move FPDA intake pumps north and Line Canal from C-111 PS to reduce back-water stage effects in C-111 (W/o Well Point System Added)

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
South Pump Station - 750 CFS	CFS	750	$26,048.00	$19,536,000
Real Estate Impacted (Private Land)	Ac	400	$49,500.00	$19,800,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$39,336,000

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
North Pump Station - 750 CFS	CFS	750	$26,048.00	$19,536,000
Canal Liner PS to FPDA	SF	246,844	$7.00	$1,727,908
Well Point System (Not used)				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$21,263,908

	Net Cost Decrease/Increase		$18,072,092
*	Mark-ups	48.00%	$8,674,604
	Total Cost Decrease/Increase		$26,746,696

* Mark-ups:- All Mark ups included in Unit Pricing. Original PIR estimate is adjusted using 20% Contingencies ; Plus 20% PED & CM and 2.61% Escalation = 48% . Final PIR also included the same Mark up in Unit Pricing for FY2009 Indexed Pricing.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 PAGE NO: 10 OF 10

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Move FPDA intake pumps north and add new gated structure in C-111 to reduce back-water stage effects in C-111 (Well Point System Added)

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
South Pump Station - 750 CFS	CFS	750	$17,600.00	$13,200,000
Real Estate Impacted (Private Land)	Ac	400	$13,000.00	$5,200,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$18,400,000

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
North Pump Station - 750 CFS	CFS	750	$17,600.00	$13,200,000
New Gated Structure	Ea	1	$2,500,000.00	$2,500,000
Well Point System	LF	18,000	$350.00	$6,300,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$22,000,000
	Net Cost Decrease/Increase			-$3,600,000
*	Mark-ups	48.00%		-$1,728,000
	Total Cost Decrease/Increase			-$5,328,000

* Mark-ups: Contingencies - 25%, plus PED & CM - 18% = 48%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-2 (5, 7, 8) PAGE NO: 1 OF 5

DESCRIPTION: Optimize of the number of pump stations and pumping capacity

ORIGINAL DESIGN: The TSP design as conceptualized was to have two separate C-111 pump stations. The northern pump station was sized at 750 cfs and the southern pump station was sized at 500 cfs. The northern pump was situated towards the northern half of the Frog Pond, mostly to take advantage of the existing grade to encourage flow naturally to the south. The southern pump was located such that conveyance would take place on the southern side of Ingram Highway.

PROPOSED DESIGN: It is recommended that further assessment of pumping plant capacities and number of pump stations be conducted for optimization. Optimization may be achieved with resizing, or with the Acceler8 design concept utilizing one pump station to serve both the Frog Pond Detention Area and the Aerojet Canal. In light of C-111 capacity limitations, reducing the overall pump capacity is also proposed for assessment. If two pump stations are supported, reductions may be considered to Acceler8's 750 CFS capacity design.

ADVANTAGES:

1. A single pump station or re-sized capacity station(s) significantly reduces the construction and operational costs of the project.
2. Optimization will be matched to anticipated C-111 deliveries with other C-111 projects operational.
3. Phase 2 can be used to modify a short fall in performance.
4. The Acceler8 design may be reevaluated for capacity and serve as the single pump station solution.

DISADVANTAGES:

1. The installed capacity of the project would be reduced.
2. If more water is made available to the C-111 Spreader Canal project in the future, additional features would need to be constructed to provide maximum restoration and potentially for flood protection.
3. There is an inherent disadvantage to moving the Frog Pond Detention Area pump to the southern end of the Frog Pond. (The ground elevation falls from the north to the south. Filling the detention area from the south requires more internal distribution infrastructure.)

JUSTIFICATION: Optimization should be matched to anticipated C-111 deliveries. There is still uncertainty in how much water will be available due to potential changes to S-332 structures which may reduce the flows to the project. Consideration is also given to the Phase 2 (second PIR) spreader canal. As currently stated, the designed pump capacities for the complete project may exceed the amount of water that will be delivered in the future. Phase 2 can be used to modify a short fall in performance, whereas excess in capacity will result in cost without benefits. A range of cost avoidance/savings is identified for Phase 1 using 750 CFS total pump capacity. Future project savings may result if Phase 2 modification is not required. Potential savings are developed with PIR unit pricing and are estimated as $14.7 million.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-2 PAGE NO: 2 OF 5

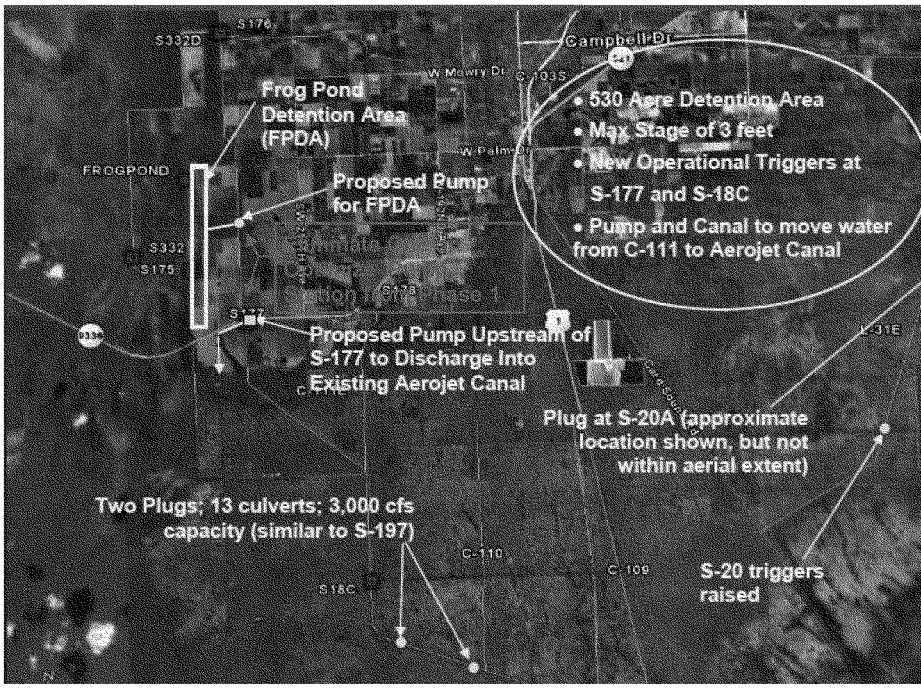
REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed to optimize the number and capacity of pump stations was incorporated into FPDA and Aerojet Pump Stations based on modeling and expected deliveries to the project by C-111. As presented, the VE proposal recommended retaining only one pump station, but if two were required, optimization by downsizing could be considered. The two pump stations were resized from 750 to 250 CFS and 500 to 250 CFS, respectively. There is spare capacity to add one additional 75 CFS pump to both stations if Eastern PIR Phase 2 or RECOVER analysis indicates additional capacity is required.

Revised final estimated first cost savings are $21,127,000. Life cycle savings are estimated to be an additional $9,877,000 (Present Worth). See revised final estimates provided in Appendix F.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-2 PAGE NO: 3 OF 5

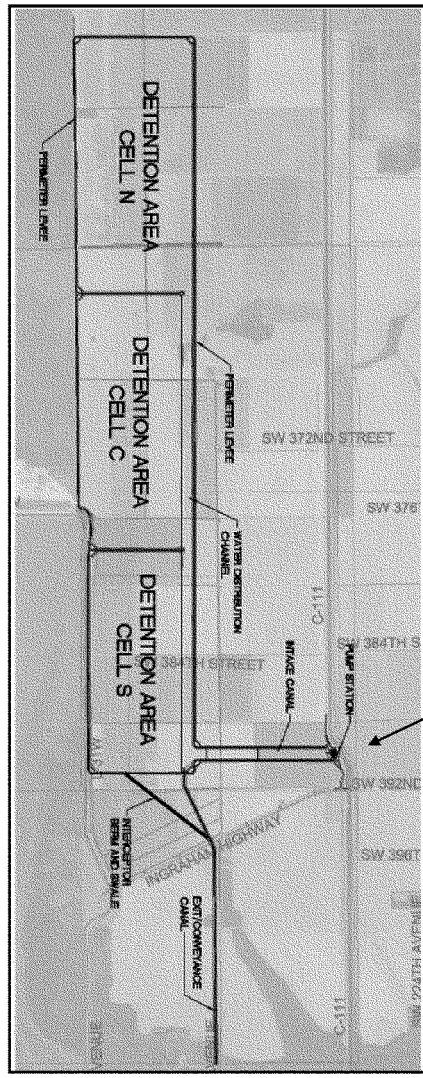
PIR Alternative 2D Plan



VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-2 PAGE NO: 4 OF 5

Acceler8 Frog Pond Reservoir and Pump Station Plan
(Includes Delivery to Aerojet Canal)



Optimize from 750 CFS Pump Station To 250CFS w/ Future 75 CFS Pump if Required

Not Shown: Aerojet Pump Station Optimized from 500 CFS to 250 CFS PS w/ Future 75 CFS Pump if Required.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-2 PAGE NO: 5 OF 5

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Optimize of the number of pump stations and pumping capacity

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
North FPDA: 2-200CFS, 2-75CFS	CFS	750	$17,600.00	$13,200,000
South FPDA: 2-200CFS, 2-50CFS	CFS	500	$19,923.00	$9,961,500
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$23,161,500

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
One North or South FPDA: 750CFS	CFS	750	$17,600.00	$13,200,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$13,200,000
	Net Cost Decrease/Increase			$9,961,500
*	Mark-ups	48.00%		$4,781,520
	Total Cost Decrease/Increase			$14,743,020

* Mark-ups: Contingencies - 25.0%, plus PED & CM - 18% = 48%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-3 (9, 10, 11) PAGE NO: 1 OF 6

DESCRIPTION: Reduce Inflow Design Flood to less than the Probable Maximum Flood

ORIGINAL DESIGN: PIR 1 Alternative 2D includes the FPDA feature further defined by the Acceler8 30% design. Per A8 Preliminary Design Report Vol. I Section 5.1.3 Detention Area Perimeter Levees and Section 5.1.5 Overflow Weir, the perimeter embankment crest elevation is 9.0 ft NAVD88 and the combined operational and emergency overflow weir length is 800 feet. The original design of these two components results, in large part, from selection of the Probable Maximum Flood (PMF) as the Inflow Design Flood (IDF). The overflow weir structure will consist of a series reinforced concrete grade beams keyed into the underlying cap rock with auger-cast-piles. Cross beams will be utilized at pile locations. A reinforced concrete top slab will be constructed between the grade beams supported by compacted fill. The top slab will provide a continuous, drivable concrete surface across the top of the levee that also prevents erosion.

PROPOSED DESIGN: The FPDA is a Low Hazard Potential impoundment with less stringent design requirements. Selection of an IDF less than the PMF would likely result in a lower crest elevation for the perimeter embankment and a shorter overflow weir. Alternative A – Reduce overflow weir length to 400 Feet (approximately 50%). Alternative B - Use of a fuse plug or low section in the embankment instead of the hardened overflow weir (an alternative for consideration).

ADVANTAGES:

1. Lowering the perimeter embankment elevation reduces earth moving quantities and the associated construction costs.
2. From a project life perspective, use of a fuse plug to allow for controlled failure of the FPDA may be more cost effective than designing the FPDA to safely pass flood flows greater than the IDF.
3. The current design includes a training dike directing potential weir flow into Aerojet Canal.

DISADVANTAGES:

1. Depending upon the magnitude and duration of the flood wave that would result from controlled failure of the FPDA, there could be adverse impacts to Ingraham Highway.

JUSTIFICATION: The FPDA has been determined to be a Low Hazard Potential Classification (HPC) CERP impoundment. Accordingly, per DCM-1, an IDF less than the PMF may be adopted for low hazard impoundments. The Incremental Damage Assessment (IDA) procedure recommended in DCM-1 could be used to determine the minimum IDF for the FPDA. Section 2.2.2 of DCM-2 suggests routing the 24-hour 100-year event (instead of PMP) to determine the MWSL for low hazard impoundments. Furthermore, DCM-3 indicates that an emergency overflow spillway for Low HPC impoundments should be considered but is not required. A low HPC impoundment should be able to safely pass the IDF.

However, overtopping failure of the FPDA from events greater than an IDA derived IDF should not produce increased damages, therefore controlled failure via a fuse plug or low section of the embankment may be acceptable.

Finally, DCM-3 Section 3 discusses determination of the most economical combination of surcharge storage vs. spillway capacity. Once the minimum IDF has been identified, recommend that this cost optimization process be performed to find the most economical overflow spillway length vs. embankment freeboard.

Estimates savings are developed assuming as much as 50% of the 800 foot long weir may be reduced (Alternative A) or 100% is a fuse plug alternative is used (Alternative B). Consideration for the reduced length overflow weir is shown as more likely selection of the two alternatives. Savings are estimated as $664,000 to $1,328,000 respectively.

REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed was to reduce the original 800 foot emergency overflow weir by approximately 50% considering the low hazard potential for Frog Pond Detention Area. The final design has provided 2-400 weirs for the upper two cells and one 300 foot weir for the south cell. The weirs are simplified for construction and use off-site manufactured Articulated Concrete Mats in lieu of concrete auger-cast piles, concrete beams and cast in place concrete weir slab.

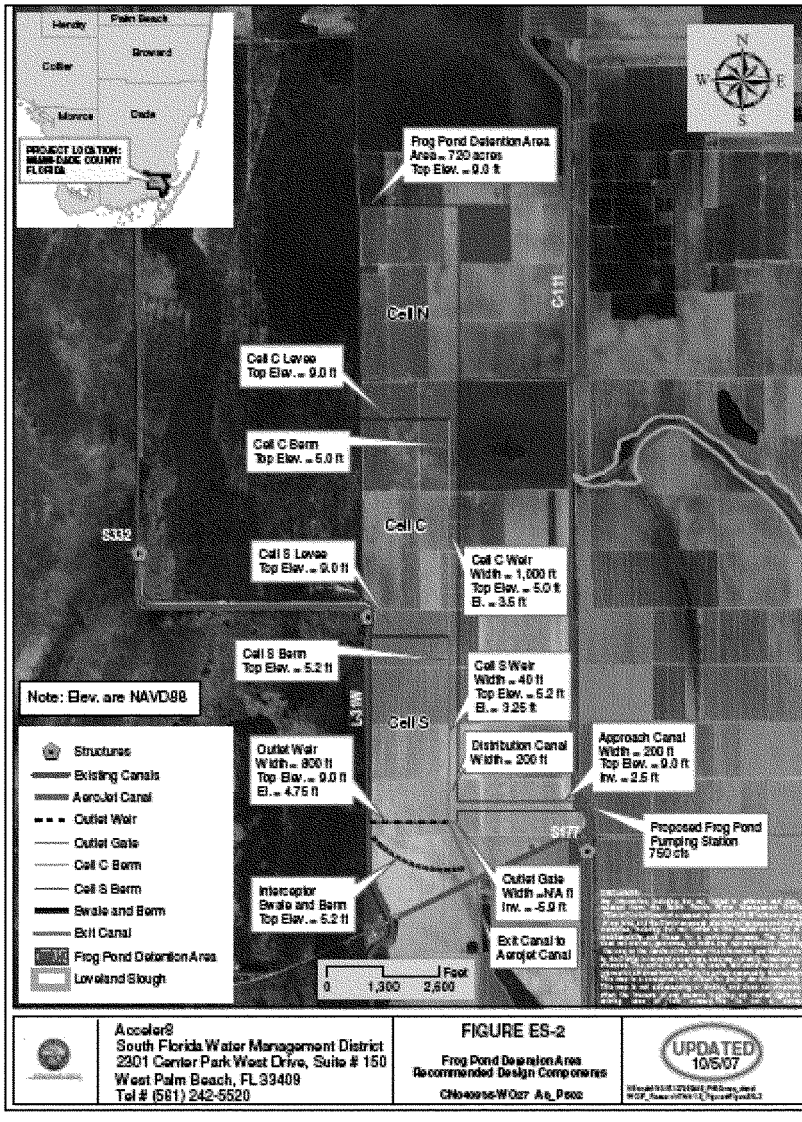
The final total lengths of weir are a slight increase, but provided control weir discharge from each cell. The combination of three smaller weirs and change of materials does not result in any savings. The improvements are considered a minor cost for a value added solution to the project.

Revised final estimated costs are identified as an increase of $1,334,000. See revised final estimates provided in Appendix F.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-3 PAGE NO: 3 OF 6

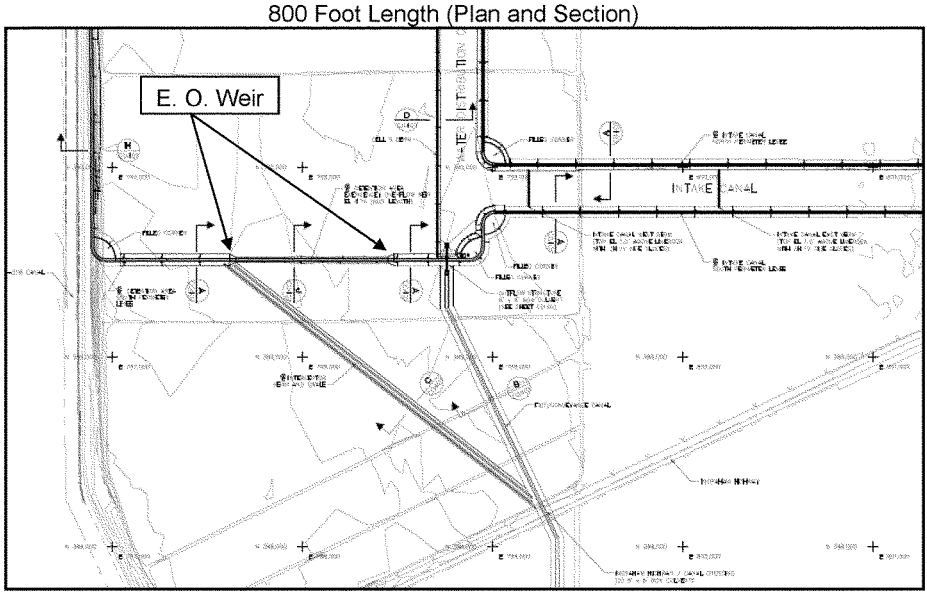
Acceler8 FPDA Design Components
(Emergency Overflow Weir – Top of Berm Elev. 9 Feet, Top of Weir Elev. 4.5 Feet and 800 Foot Width)

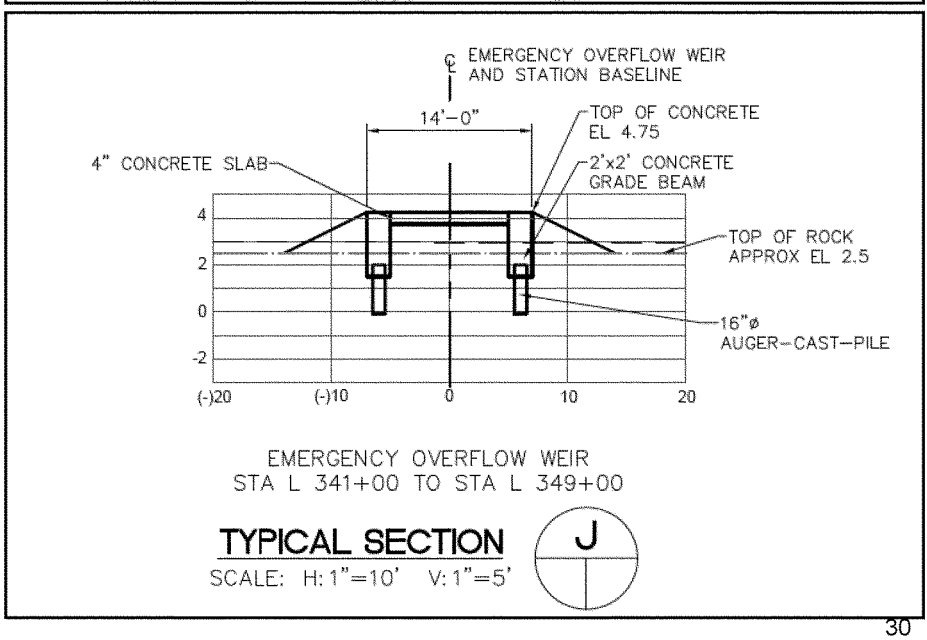


VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-3 PAGE NO: 3 OF 6

Emergency Overflow Weir – Top of Berm Elev. 9 Feet, Top of Weir Elev. 4.5 Feet and 800 Foot Length (Plan and Section)





VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-3 PAGE NO: 5 OF 6

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Reduce Inflow Design Flood to less than the PMP - Alt. A - 400 Foot Weir

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
800' Emergency over flow weir				$0
Grade Beams (2" X 2' X 1,600')	CY	475	$1,375.00	$653,125
Concrete Slab (.33' X 10' X 800')	CY	98	$856.00	$83,888
Auger-cast Pile (16" X ~7.5' @ 20' o.c.)	LF	600	$35.00	$21,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$758,013

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
400' Emergency over flow weir				$0
Grade Beams (2" X 2' X 1,600')	CY	238	$1,375.00	$326,563
Concrete Slab (.33' X 10' X 800')	CY	49	$856.00	$41,944
Auger-cast Pile (16" X ~7.5' @ 20' o.c.)	LF	300	$35.00	$10,500
Higher Berm Section (400' @ Elev. 9')	CY	3,100	$14.57	$45,167
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$424,174
	Net Cost Decrease/Increase			$333,840
*	Mark-ups	98.94%		$330,301
	Total Cost Decrease/Increase			$664,140

*A8 Mark-ups: Gen. Contractor Mark-up (Includes Gen Cond., Mob.,Sales Tax, Mob., Overhead, Profit, Contin., Esc., Bond/Insurance) 98.94%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-3 PAGE NO: 6 OF 6

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Reduce Inflow Design Flood to less than the PMP (Alt B - Fuse Plug)

DELETIONS

	ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
	800' Emergency over flow weir				$0
	Grade Beams (2" X 2' X 1,600')	CY	475	$1,375.00	$653,125
	Concrete Slab (.33' X 10' X 800')	CY	98	$856.00	$83,888
	Auger-cast Pile (16" X ~7.5' @ 20' o.c.)	LF	600	$35.00	$21,000
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
			Total Deletions		$758,013

ADDITIONS

	ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
	Fuse Plug - Higher Berm Section	CY	6,200	$14.57	$90,334
	(800' @ Elev. 9')				$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
			Total Additions		$90,334
		Net Cost Decrease/Increase			$667,679
	*	Mark-ups	98.94%		$660,602
		Total Cost Decrease/Increase			$1,328,281

*A8 Mark-ups: Gen. Contractor Mark-up (Includes Gen Cond., Mob.,Sales Tax, Mob., Overhead, Profit, Contin., Esc., Bond/Insurance)98.94%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO:	C-4 (19)	PAGE NO: 1 OF 4
DESCRIPTION:	Revise Frog Pond Detention Area slopes to 3H:1V	

ORIGINAL DESIGN: Current design by the A8 team at SWFMD calls for a surface runoff detention basin labeled as Frog Pond Detention Area (FPDA). The three cell FPDA will be approximately 14,000' long with cell widths varying from 2,000' to 2,200'. Existing grade in the FPDA varies between +2.5 and +4.0 ft NAVD. The top elevation of the perimeter levee around the pond is +9.0 ft NAVD. Side slopes of the perimeter levee will be 4H:1V.

PROPOSED DESIGN: It is recommended that the use side slopes of 3H:1V for new sections of the perimeter levee around Frog Pond be considered. The intermediate levees are addressed under another proposal.

ADVANTAGES:
1. Reduces construction time.
2. Reduces borrow material and fill placement required and the associated costs.
3. Slope still conforms to EM 1110-2-1913, "Design and Construction of Levees", with respect to being acceptable for surfaces to be mowed.
4. Stability should be adequate and 3H:1V slope follows other smaller CERP projects for wave run-up containment.

DISADVANTAGES:
1. Steeper side slopes present perceived risk to mowing equipment
2. Slope stability analysis and modeling would be needed to determine wave run-up effects for the design change.

JUSTIFICATION: The FPDA is a low-hazard impoundment project. There is little risk, if any, to public safety if the slightly smaller section was used to achieve a steeper – more efficient section. In addition to reducing construction effort and associated time and cost for reducing levee size, the A8 PDT should also consider not seeding the bottom and lower portion of berms on the interior of the detention basin. The area is not expected to be visited by public, and these portions of the berms are frequently under water. Savings are estimated as $754,000.

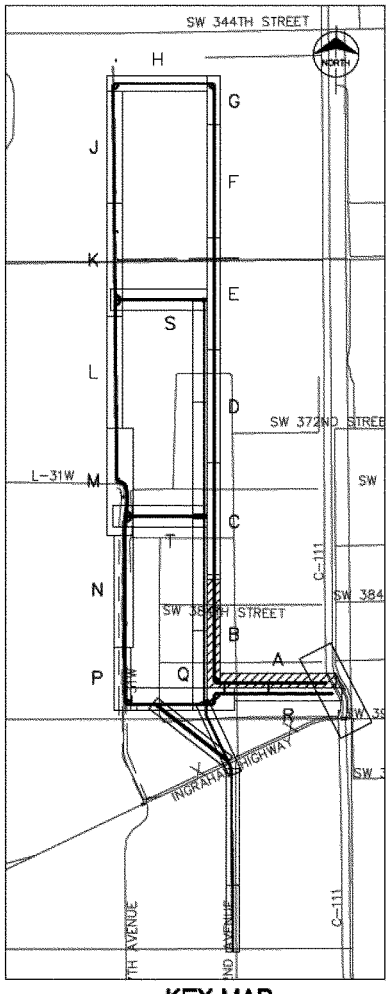
REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed was rejected as two design issues were considered – one, balance of cut and fill; and two, cover for potential Copper contaminated soil using zones embankments (if required).

No revised final estimated costs were developed and no savings are indicated.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-4 PAGE NO: 2 OF 4

KEY MAP, Showing Areas used in quantity computations

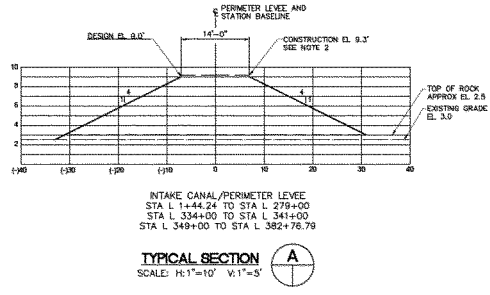


KEY MAP

NOT TO SCALE

The map to the left shows how the reaches are designated for the Frog Pond perimeter levee. Reaches J through P represent an existing levee on the east bank of Taylor Slough. The side slopes of this levee are 4H:1V.

The table on the following page shows rough quantity takeoffs based on extrapolating a typical cross section, bottom footprint, and surface area for each reach based on an average height for that reach.



VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-4 PAGE NO: 3 OF 4

QUANTITIES BASED ON 4H:1V SIDESLOPES

REACH	BEGINNING STATION	ENDING STATION	AVG. BOTTOM ELEV	AVG. TOP ELEV	VOLUME (CY)	BOTTOM FOOT-PRINT (SY)	SURFACE AREA (SY)
A	0+00	26+00	4.0	9.00	16370.4	9822.2	15773.3
B	26+00	52+00	3.5	9.00	19066.7	10400.0	16946.2
C	52+00	78+00	2.5	9.00	25037.0	11555.6	19292.0
D	78+00	104+00	2.5	9.00	25037.0	11555.6	19292.0
E	104+00	130+00	2.0	9.00	28311.1	12133.3	20464.9
F	130+00	156+00	3.5	9.00	19066.7	10400.0	16946.2
G	156+00	167+00	2.2	9.00	11413.9	5035.6	8459.7
H	167+00	187+50	4.0	9.00	12592.6	7555.6	12133.3
J - P	EXISTING LEVEE						
Q	326+00	332+00	8.0	12.00	2666.7	2000.0	3098.7
Q	332+00	334+00	3.0	12.00	3333.3	1111.1	1935.1
Q	334+00	340+50	2.0	9.00	6533.3	2800.0	4722.7
Q	340+50	348+50	2.0	4.75	2037.0	2222.2	3229.3
Q	348+50	360+00	2.0	9.00	13066.7	5600.0	9445.3
				TOTAL	184,532.4	92,191.1	151,738.8

QUANTITIES BASED ON 3H:1V SIDESLOPES

REACH	BEGINNING STATION	ENDING STATION	AVG. BOTTOM ELEV	AVG. TOP ELEV	VOLUME (CY)	BOTTOM FOOT-PRINT (SY)	SURFACE AREA (SY)
A	0+00	26+00	4.0	9.00	13963.0	8377.8	13173.3
B	26+00	52+00	3.5	9.00	16153.7	8811.1	14086.2
C	52+00	78+00	2.5	9.00	20968.5	9677.8	15912.0
D	78+00	104+00	2.5	9.00	20968.5	9677.8	15912.0
E	104+00	130+00	2.0	9.00	23592.6	10111.1	16824.9
F	130+00	156+00	3.5	9.00	16153.7	8811.1	14086.2
G	156+00	167+00	2.2	9.00	9530.1	4204.4	6963.7
H	167+00	187+50	4.0	9.00	10740.7	6444.4	10133.3
J - P	EXISTING LEVEE						
Q	326+00	332+00	8.0	12.00	2311.1	1733.3	2618.7
Q	332+00	334+00	3.0	12.00	2733.3	911.1	1575.1
Q	334+00	340+50	2.0	9.00	5444.4	2333.3	3882.7
Q	340+50	348+50	2.0	4.75	1813.0	1977.8	2789.3
Q	348+50	360+00	2.0	9.00	10888.9	4666.7	7765.3
				TOTAL	155,261.6	77,737.8	125,722.8

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-4 PAGE NO: 4 OF 4

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Revise Frog Pond Embankment Slopes to 3H:1V

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
				$0
Excavate/Fill Embankment 4H:1V	CY	151,700	$14.57	$2,210,269
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$2,210,269

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
				$0
Excavate/Fill Embankment 4H:1V	CY	125,700	$14.57	$1,831,449
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$1,831,449
	Net Cost Decrease/Increase			$378,820
*	Mark-ups	98.94%		$374,805
	Total Cost Decrease/Increase			$753,625

*A8 Mark-ups: Gen. Contractor Mark-up (Includes Gen Cond., Mob.,Sales Tax, Mob., Overhead, Profit, Contin., Esc., Bond/Insurance) 98.94%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-5 (23) PAGE NO: 1 OF 6
DESCRIPTION: Consider lower internal levees for Frog Pond Detention Area

ORIGINAL DESIGN: The current concept for the Frog Pond Detention Area basin divides the basin into three cells with transverse dikes (Elevation 9'), which serves several functions including compartmentalizing water being held temporarily and reducing risk of fetch effects on basin. The longitudinal interior levee (Elevation 5') separates the distribution channel to and from the pump station which fills and drains the basin from the southeast corner. The perimeter levee around the basin will have a top elevation of +9.0' NAVD, except where it ties into an existing levee along Taylor Slough with a top elevation of +12.0' NAVD. There are some areas where the top elevation will have to be restored or where existing low points will have to be filled in.

PROPOSED DESIGN: Consider one of two options for reducing interior transverse levees: either reducing the height to be even with the longitudinal interior levee (Elevation 5') for the water distribution channel, or eliminating them altogether. The proposal is developed with a 14' wide crest width.

ADVANTAGES:
1. Reduces construction time.
2. Reduces borrow/fill material required and associated costs.
3. Impoundment is a low-hazard project, and there is little risk, to public safety if the interior levee is overtopped during the extremely rare periods when the basin is full.
4. Cells are not required for operational purposes.
5. Interior levees would not need to be accessed during flood conditions, so building them high enough, wide enough, and compacted enough for vehicular access is not required.
6. If modeling and USACE/SAJ policy indicate that transverse levees are needed to reduce wave development, they do not need to be as tall as they are; they simply need to be a short "speed bump" constructed from random earth fill and occasionally rebuilt if necessary, or short mounds of rock.
7. Transverse levees to reduce fetch are actually breakwaters, so they do not even need to be continuous

DISADVANTAGES:
1. Transverse levees provide a difference in wave development, and modeling is required to determine whether there is any difference on run-up and perimeter levee height.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-5 PAGE NO: 3 OF 6

JUSTIFICATION: The reduced 5 foot elevation for the transverse levees keep a defined water distribution for t e three cells of FPDA. The 14 foot wide crest width provide access for the two levees. The FPDA is a low-hazard impoundment project, and there is little risk to public safety as proposed.

If modeling and USACE/SAJ policy indicate that transverse levees are needed to elevation 9 feet to reduce wave development, they should be treated as dry bed breakwaters, not designed as conventional levees. They do not need to be as tall or as wide as flood control levee structures. Savings would be reduced accordingly. As proposed, the savings are estimated as $823,000.

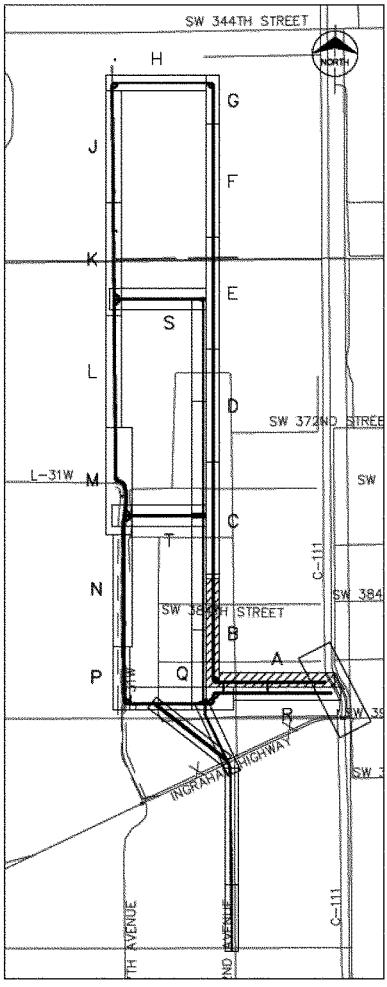
REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed was rejected as two design issues were considered – one, balance of cut and fill; and two, continuous maintenance access with constant crest elevations throughout Frog Pond Detention Area levees.

No revised final estimated costs were developed and no savings are indicated.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-5 PAGE NO: 3 OF 6

KEY MAP, Showing Areas used in quantity computations



KEY MAP
NOT TO SCALE

More detailed plans of reaches S and T are shown on the following page, illustrating the two transverse levees which are the subject of this proposal.

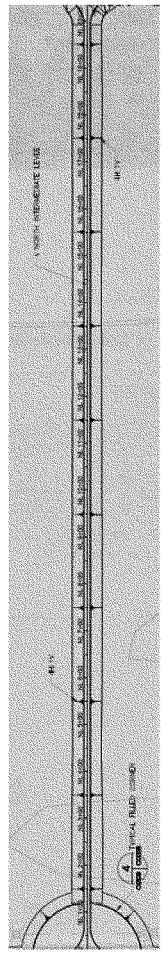
The northern transverse levee, Reach S, is approximately 2,050 feet long, and has a base elevation of about +3.0 NAVD, and a top elevation of +9.0 NAVD. The southern transverse levee, Reach T, is about 1,800 feet long and has the same approximately base and top elevations. Both levees tie into an existing levee with a top elevation of approximately +12.0 NAVD on the west, and the water distribution channel dike on the east, which has a top elevation of +5.0 NAVD, except where the dike is lowered for a weir.

The weir for Cell C is 1,000 feet long, and armored with articulated concrete mat. The weir for Cell S is 40 feet long, and also armored.

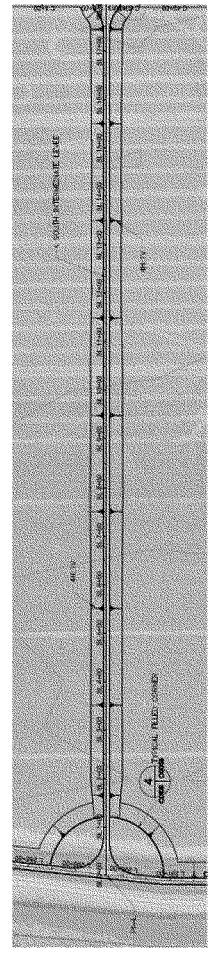
VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-5 PAGE NO: 4 OF 6

PLANS OF TRANSVERSE LEVEES



PLAN - S

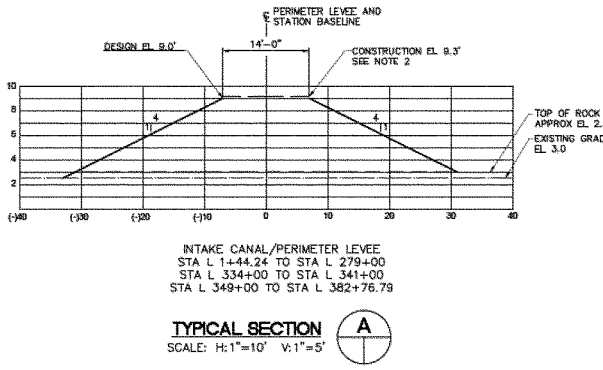


PLAN - T

VALUE ENGINEERING PROPOSAL

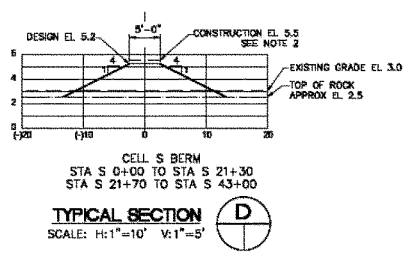
PROPOSAL NO: C-5 PAGE NO: 5 OF 6

Plans currently show the following cross section to be used for both of the transverse levees:



The cross section for a 6.6 ft. tall levee (Elevation 9') with side slopes of 4W:1H is assumed to be about 260 CF per lineal foot of levee.

If a 14 foot crest width for a 2.5 foot tall levee is substituted (Elevation 5'), to match the top elevation of the dike along the water distribution channel, as shown in the drawing below, the cross section would only be 60 CF per lineal foot.



Quantities in the following estimate are based on total length for the two levees at 3,850 feet. For purposes of analysis, the only change made was the elevation of the levee.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-5 PAGE NO: 6 OF 6

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Consider lower internal levees for FPDA

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
				$0
Excavate/Fill Embankment 4:H:1V - Elev 9'	CY	37,000	$14.57	$539,090
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$539,090

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
				$0
Excavate/Fill Embankment 4:H:1V - Elev 5'	CY	8,600	$14.57	$125,302
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$125,302
	Net Cost Decrease/Increase			$413,788
*	Mark-ups	98.94%		$409,402
	Total Cost Decrease/Increase			$823,190

*A8 Mark-ups: Gen. Contractor Mark-up (Includes Gen Cond., Mob.,Sales Tax, Mob., Overhead, Profit, Contin., Esc., Bond/Insurance) 98.94%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-6 (13) PAGE NO: 1 OF 2

DESCRIPTION: Look to reduce the size of pilot components – One-half mile spreader canal

ORIGINAL DESIGN: An additional pilot feature is under consideration for a one Mile long easterly spreader canal with 375 CFS pump station similar to the Yellow Book Alternative Plan 1. The pilot feature does not appear in the current AFB drawings. As a pilot feature, it has not been formulated for benefits.

PROPOSED DESIGN: If the pilot feature is desired, it may be developed at a scaled down dimension and capacity – say a one-half mile long pilot spreader canal with 187.5 CFS pump station.

ADVANTAGES:
1. Approximately 50% less wetland impacts.
2. Easer to reverse.
3. Less likely to impact private lands.
4. Almost 50% cost savings.

DISADVANTAGES:
1. Shortening canal is more likely to understate backwater effects.
2. A half-mile length will not distribute water directly into slough.

JUSTIFICATION: This recommendation was made largely because of the pilot nature of this feature, and recognition that, unless incorporated into the ultimate plan, these costs (and wetland impacts) would represent "sunk" costs. Also recognizing that the pilot feature's pump station will need to compete for water with other western PIR recommended features, and the already installed S-332b, S-332c, and S-332d pump stations. Some PDT members have questioned the accuracy of the modeling efforts for this feature. In this recommendation, also consider that three independent modeling efforts have indicated that the pilot location proposed appears to be too far north to be able to be incorporated into the final plan. It is estimated that the cost savings associated with this proposal would be on the order of $6.6 million, and that direct impacts to high quality wetlands could be reduced by no less than 3.6 acres (assumes 60' canal width).

The VE team recognizes the learning opportunities associated with constructing cross sections, and installing pump capacities, proportional to those anticipated within the final plan, and has not identified any VE opportunities related to these aspects.

REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed was identified to be carried into the Eastern C-111 PIR (Phase 2).

No revised final estimated costs were developed and no savings are indicated for PIR 1.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-6 PAGE NO: 2 OF 2

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Look to reduce the size of pilot components

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
One mile spreader canal	CY	42,000	$65.00	$2,730,000
Pilot Pump Station	CFS	375	$16,600.00	$6,225,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$8,955,000

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
One-half mile spreader canal	CY	21,000	$65.00	$1,365,000
Pilot Pump Station	CFS	188	$16,600.00	$3,112,500
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$4,477,500
	Net Cost Decrease/Increase			$4,477,500
*	Mark-ups	48.00%		$2,149,200
	Total Cost Decrease/Increase			$6,626,700

* Mark-ups: Contingencies - 25.0%, plus PED & CM - 18% = 48%

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-7 (16) PAGE NO: 1 OF 3

DESCRIPTION: Build one 3,000 CFS plug structure and add second structure in Phase 2 if needed

ORIGINAL DESIGN: Alternative 2D includes two plugs for C-111 Canal identified with 3,000 CFS capacity to be similar to S-197. The location for the plugs is south along C-111 between S-18C and S-197. At this stage the structures are not described in detail, but are expected to be developed with more efficiency than the existing 13 culvert S-197 structure and will be operational structure features, not just plugs. Being operable for adaptive management is considered imperative.

PROPOSED DESIGN: The proposed alternative eliminates one 3,000 CFS plug structure from Phase 1. Following construction placement of Phase 1 features, assessments of operational performance by features and adaptive changes are to be developed for Phase 2. If it is determined the structure is needed, it may be added back into the project under Phase 2.

ADVANTAGES:

1. Elimination of one of two operable control (plug) structures reduces cost to execute Phase 1.
2. Performance of Phase 1 will determine if the structure is needed and it may be added back into Phase 2.
3. If the structure is not needed, reduced impact from construction along the C-111 Canal will be incurred.
4. If not required, net cost savings will be realized.

DISADVANTAGES:

1. Assessment of performance of the remaining structure will be added to Phase 2.

JUSTIFICATION: The PDT should consider the possible level of service and benefits using only one plug for Phase 1 along the lower C-111 Canal. Retaining the northern plug structure should be considered as the presence of the "Tiger Teeth" breaches below the north plug location may limit the effectiveness of the southern plug structure. Should the Phase 2 assessments determine the second structure is needed, it may be added to the Phase 2 PIR. However, if the structure is not required, the project will realize a cost avoidance/savings of approximately $2.9 million using the PIR unit pricing and mark-ups.

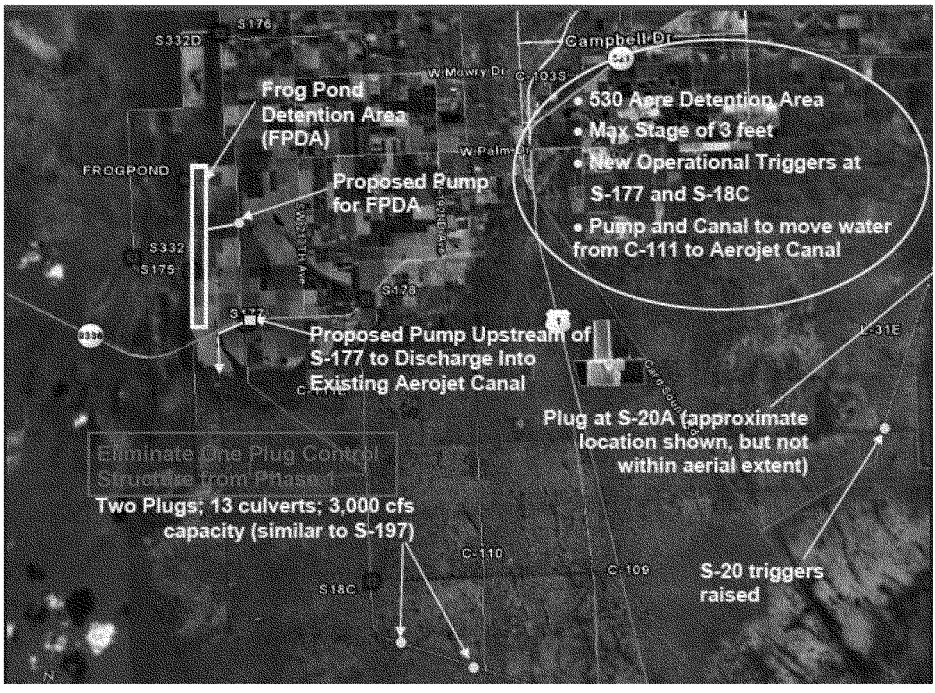
REVISED FINAL REPORT UPDATE SUMMARY: The concept proposed was for one control structure and it is incorporated into the PIR and final design. As developed, the control structure reflects both the VE proposal and comment identifying the structure to be developed as an operating gated structure (See Comment 4.).

Revised final estimated first cost savings are $1,911,000. Life cycle savings are estimated to be an additional $263,000 (Present Worth). See revised final estimates provided in Appendix F.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-7 PAGE NO: 2 OF 3

PIR Alternative 2D Plan



VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-7 PAGE NO: 3 OF 3

COST ESTIMATE WORKSHEET

PROPOSAL DESCRIPTION: Build one 3,000 CFS plug structure and add second structure in Phase 2

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Plug Structure - 3,000 CFS	LS	1	$2,000,000.00	$2,000,000
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$2,000,000

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$0

	Net Cost Decrease/Increase		$2,000,000
*	Mark-ups	47.50%	$950,000
	Total Cost Decrease/Increase		$2,950,000

* Mark-ups: Contingencies - 25.0%, Plud PED & CM - 18% = 47.50%

VALUE ENGINEERING COMMENTS

1. ***Raise levels in L-31 Canal (Speculation Idea 2):*** The L-31W Borrow Canal could in theory serve as the "Frog Pond header" and/or serve as the hydraulic cutoff canal to reduce see seepage from Taylor Slough. While it has the potential to be a very effective cutoff wall, there may be some sensitivity because of its proximity to the park. Initially it was felt that ENP would probably object to export groundwater (or surface water) into the park. This would require the project to maintain the canal stage lower, and/or match park stages. In fact, during a December 2007 project meeting, ENP representatives indicated an interest in this idea. Discussion and means of overcoming any difficulties executing this idea are recommended for coordination with ENP. In order to be true to the process, the team should explore this idea further.

Details to be considered include possible construction of a second berm on the Park side if the Canal is on the west side, or constructing a new canal east of the levee. If this could be done, another advantage would be that the existing crossing under Ingrahm Hwy could be utilized and the south of Hwy canal might be used in lieu of the Aerojet Road Canal.

2. ***Use multiple spreader canal locations (Speculation Idea 14).*** This idea proposes that more than one location and configuration for the spreader canal(s) be considered for delivering water to these coastal wetlands. Canals could be located at more than one location that mimics the surrounding topography. They can be located to over flow for different discharge events. Lower events could be diverted closer to the bay while larger events could overflow and spread further away at a higher topography. These overflow or spreader canals could possibly be located along converted roadbeds or drainage works. This idea is more pertinent to the Phase 2 PIR.

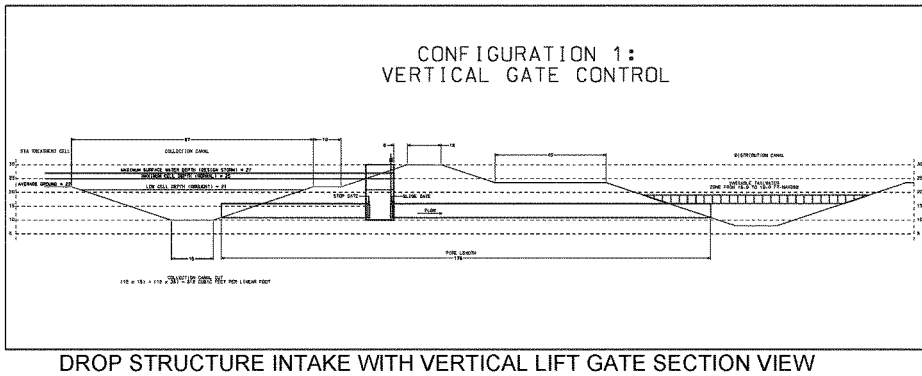
These arrangements could offer benefits by utilizing gravity flows over more areas that could take advantage of different discharge events.

3. ***Stockpile excavation from spreader system to fill C-111 (Speculation Idea 15).*** The long range goal of the C-111 Spreader Canal Project is ecological restoration of the Southern Glades and Model Lands. This includes restoring more natural flow of surface runoff to estuaries which have been deprived of high flows of fresh water being channeled around the area by floodways such as C-111 rather than across it, and, at the same time, reducing the intense slug of fresh water carried by C-111, overpowering the delicate salinity balance downstream. This is expected to be eventually remedied by channeling some of the flow into a spreader canal system, and thereby reducing the C-111 flow. Once the spreader canal system is capable of taking enough of the floodwater flows, the current cross-section of C-111 downstream can be reduced or filled in without risk of increasing upstream flooding. A time lag between excavation of the spreader canal system and filling in C-111 will be required to secure public acceptance of the performance of the new system. Therefore, it is recommended that the material being excavated for the new canals be stockpiled until it can be used for filling in C-111.

4. Identify 3,000 CFS Plug Structures as Operational Structures (Speculation Idea 17). This comment shares information developed from the Indian River lagoon – South C-23/24 STA gated structures VE study. Average conditions ranged from average ground elevation (Low Pool) of 22 Feet to high pool (Storm level) of 27 feet or ~5 feet total operational depth. The alternatives studied included:

Alternative 1: Drop Structure with Vertical Lift Gate Control
Alternative 2: Drop Structure Intake with Vertical Weir Gate
Alternative 3: Drop Structure Intake with Obermeyer Spillway Gate

Alternative 1: Drop Structure with Vertical Lift Gate Control



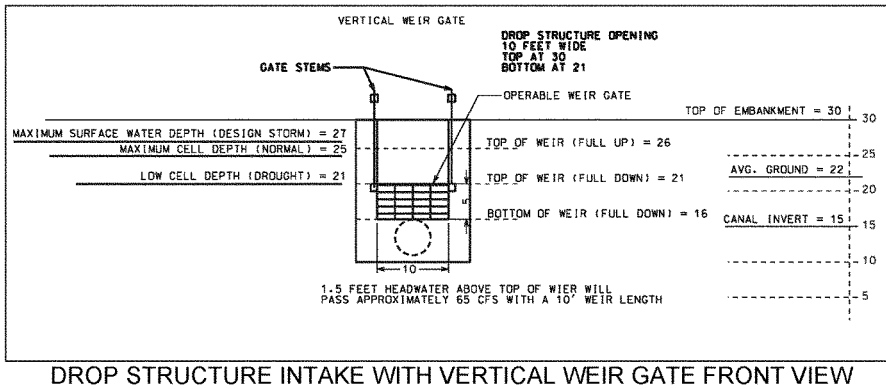
DROP STRUCTURE INTAKE WITH VERTICAL LIFT GATE SECTION VIEW

The discharge culvert will be constructed with a vertical gate. Flow and depth control is accomplished by the gate opening and accounting for the headwater and tailwater elevations.

Advantages:
1. Simplicity in design
2. Standard and readily available equipment is used.

Disadvantages:
1. Structure discharge is influenced by tailwater condition which can be variable.
2. Desired treatment cell depths would require closer operations monitoring and potentially more frequent gate operations.
3. Small gate openings would be required for high head and low flow requirement. Less than a 1-foot gate opening is needed for the maximum design flow.
4. Longer culvert length required.
5. Larger collection canal required.
6. Damaging downstream velocities could occur if gates opened to far.
7. Matching flow into collection canal to maintain relative cell depth is difficult.

Alternative 2: Drop Structure Intake with Vertical Weir Gate



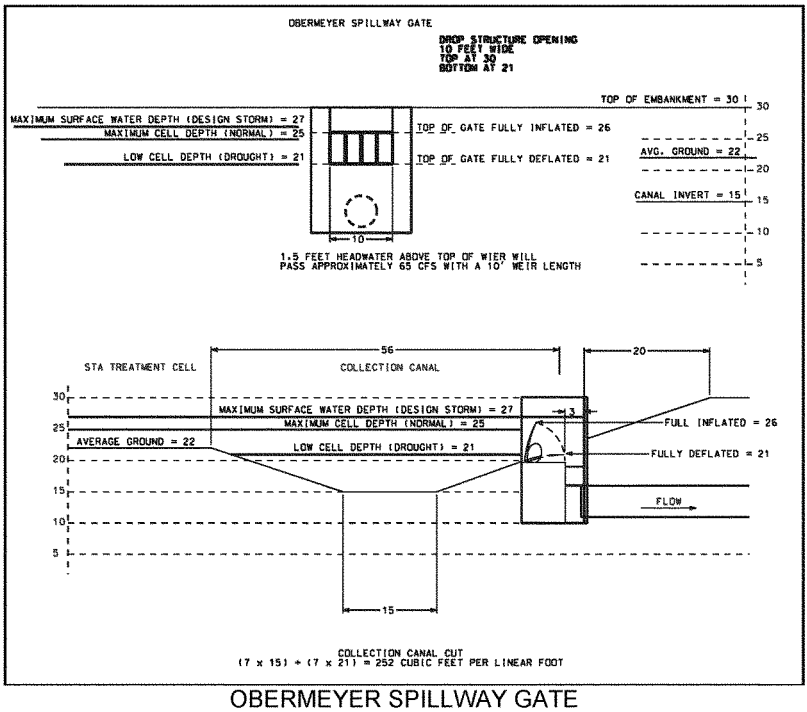
DROP STRUCTURE INTAKE WITH VERTICAL WEIR GATE FRONT VIEW

The operable weir gate is 10 feet in length and 5 feet in height. The 10 foot weir length will provide a flow of 65 CFS with a headwater depth of approximately 1.5 feet above the top of the gate.

Advantages:
1. Simplicity in design
2. Standard and readily available equipment is used.
3. Structure discharge is not influenced by tailwater condition.
4. Superior flow and depth control for the treatment cells.
5. Shorter culvert length required.
6. Smaller collection canal required.
7. During emergency spillway discharges the operable weir gate flow in the full up position would assist.
8. Discharge over the top of gate introduces oxygen into water.

Disadvantages:
1. Damaging downstream velocities may occur if gates are lowered to full down position with treatment cell depths above 2 feet.
2. Power distribution to each structure is required.

Alternative 3: Drop Structure Intake with Obermeyer Spillway Gate



OBERMEYER SPILLWAY GATE

The Obermeyer spillway gate is 10 feet in length and 5 feet in height in the fully inflated position. The 10 foot weir length will provide a flow of 65 CFS with a headwater depth of approximately 1.5 feet above the top of the gate.

Advantages:

1. Simplicity in design
2. Structure discharge is not influenced by tailwater condition.
3. Superior flow and depth control for the treatment cells.
4. Shorter culvert length required.
5. Smaller collection canal required.
6. During emergency spillway discharges the operable weir gate flow in the full up position would assist.
7. Discharge over the top of gate introduces oxygen into water.
8. One centralized equipment building can be used for compressors, air dryer, receiving tank, and controls to operate all the structures at discharge points for Cells 1-2 and another for Cells 3-5.

Disadvantages:
1. Damaging downstream velocities may occur if gates are lowered to full down position with treatment cell depths above 2 feet.
2. Gate system is sole source item requiring sole source justification.

Comparisons -
Telemetry and Monitoring: Telemetry and monitoring would be similar for all three options. The number of tailwater parameters may be greater with Alternative 1 because of the tailwater influence on structure discharges. Alternative 3 may have a reduced number of RTUs required for overall monitoring and control due to the ability to centralize the equipment and controls in a centralized equipment building.
Reliability: Reliability would be similar for all three options. Alternative 3 may be more reliable due to the reduced number of mechanical failure points. Redundant turbine air compressors are the weakest failure point in the system. These redundant turbines would serve all four outlet discharge structures at Cells 1-2 and all six at Cells 3-5. Alternatives 1 and 2 will require motors for each gate or a total of ten.
Flexibility: Flow through the STA treatment cells requires maximum flexibility and the ability to fine-tune the depths in small increments for various flow rates and a wide range of headwater and tailwater scenarios. Alternatives 2 and 3 provide the required flexibility.
Costs Summary: Costs are being analyzed and are dependant on the overall system design level of detail provided for estimating purposes. Operations and Maintenance costs are anticipated to be lower for Alternatives 2 and 3.

Alternative Gate Structures Life Cycle Cost Comparisons @ 5 1/8%

STA Control Structure	First Cost with Contingency	Annual Repair/ Replacement/ O&M (Annualized)	Life Cycle Cost (Present Worth)	Total Cost (Present Worth)	Alternative Ranking
Alternative 1 - Vertical Gate Structure	$2,942,875	$123,446	$2,392,448	$5,335,323	3
Alternative 2 - Vertical Weir Gate Structure	$2,980,250	$104,094	$2,017,391	$4,997,641	1
Alternative 3 - Obermeyer Gate Structure	$3,117,725	$107,229	$2,078,145	$5,195,870	2

*Life Cycle Cost based on 100 year service life

This offers some detailed information on operational gate structures for the PDT's use during detailed design development.

5. Develop zoned embankment – place contaminated soils on exterior side of Frog Pond Detention Area (Speculation Idea 20). Potentially, top soils in the FPDA will be slightly elevated with residual agricultural by-products from years of farming. Copper may be the main constitute of concern. Should soil contamination be identified as a problem, it is recommended the top soils be placed on the exterior side of the embankments to limit water exposure and contact with wading birds and other species. If more top soil areas are remaining on site than would be needed for the exterior face topping, any remaining insitu areas may be disked to reduce the threshold levels for those exposed surface areas.

6. Consider compartmentalizing both the Frog Pond Reservoir, and Aerojet Road Canal features so as to create three cascading basins, within each feature (Speculation Idea 21). Based on a review of information provided, it appears as if there currently exists approximately 1.5 to 2 feet of topographical fall between the northern and southern limits of both the Frog Pond Reservoir, and the Aerojet Road Canal. Because the effectiveness of the hydraulic cut-off features will be largely dependent on their ponding depths, and because Everglades National Park are reportedly likely to require that maximum ponding stages do not exceed 2.5' above existing ground, the VE Team recommends that the PDT and A8 consider compartmentalizing both the Frog Pond Reservoir, and Aerojet Road Canal features so as to create three cascading basins, within each feature. The two intermediate structures necessary to create the three cascading basins (within each feature) should be located as close to the locations of the ½ foot "drops" as reasonably practicable, and the structures should be designed to pass design flows with minimal (e.g. 0.1') head loss.

7. Eliminate FG&FWC road – Remove other manmade features from the coastal floodplain (Speculation Idea 22). As shown on report plates, this road crosses the coastal flood plain in an East to West direction (perpendicular to sheet flow). It imposes an anthropogenic environmental degradation on the project area by impeding natural sheet flow through these coastal wetlands. This speculation idea suggests the road be removed and its location be considered for reuse. In addition to improving sheet flow, this site could also offer opportunities as a spreader canal location. Future cost savings would be realized by making low cost fill available for canal filling or other project purposes. Re-using a disturbed area as a project feature could decrease negative project feature installation impacts and lower those feature's installation costs.

The PDT should consider inventorying and assessing removal/reuse of all out of service manmade features in this coastal floodplain. Other roads, canals and drainage features may also impede restoration of coastal wetlands and flow patterns.

8. Increase Stages in Frog Pond Distribution Channel (Speculation Idea 25). The distribution channel within Frog Pond reservoir appears to have been designed as a single continuous above ground feature which begins to overtop the Aerojet Road Canal discharge, and independent cell weirs, incrementally with each 0.25' increase in stage above existing ground. It is recommended that the PDT and A8 evaluate both above ground and, and below ground cascading distribution channels (please see Comment 6 - VE Idea 21 for additional related cascading recommendations). In order to maximize the distribution channel's hydraulic cutoff potential, this idea recommends that each cascading channel segment be allowed to stage to the maximum stage acceptable to Everglades National Park (ENP) prior to overtopping the weirs which feed the reservoir's individual cells. The PDT and A8 team may also evaluate the effects of constructing the distribution canal along the western portion of the reservoir to maximize hydraulic cutoff potential, while minimizing return seepage to the C-111 Canal. An advantage would be to maximize hydraulic cutoff potential for given water availability. One disadvantage is noted - Depending on location, this may increase seepage to C-111 or ENP.

Hydraulic cutoff potential appears to be strongly correlated with increased stages. Because of its large area, it takes a significant volume of water to increase stages within the Frog Pond reservoir even slightly. Increasing stages within the distribution canal would appear to consume significantly less water. The need to provide the most water efficient means of decreasing seepage from the headwaters of Taylor Slough is even more given the competing water demands associated with other Western PIR recommended features, and the already constructed S-332b, S-332c, and S-332d features. Cascading the seepage cut-off canal would allow each segment to stage to the maximum stage acceptable to ENP. While relocating the distribution canal nearer to ENP may present some challenges related to exporting water, it is important to note that A8's "Cell S", which is the highest head cell, is currently contiguous to ENP, and makes partial use of the L-31N Levee.

9. Coordinate with C&SF C-111 Miami-Dade project for placement of fill plugs in Aerojet Canal (Speculation Idea 26). Since more than one C-111 project is being developed (C&SF and CERP), it is recommended coordination between the two projects be made for selection of plugs for the Aerojet Canal. Execution for construction may be directed to the selected project.

SUPPORTING DOCUMENTS

CONTACT DIRECTORY

VALUE ENGINEERING STUDY SIGN-IN SHEET
C-111 SPREADER CANAL AFB
3 – 7 DECEMBER 2007

NAME / ORGANIZATION / TELEPHONE NUMBER

*Fred McAuley, EN-T VE Team Facilitator, 904-232-1903

*Jimmy Matthews, EN-TI, 904-232-2087

*Graham Story, EN-WI, 904-232-1158

*Ali Rezaie, EN-GS, 904-232-1432

Tracy Leeser, EN-C, 904-232-1043

*Bill Easley, SAC/OVEST, 843-329-8152

*Brandy Alexander, MVK, 601-631-5680

*John Shaffer, SFWMD, 561-681-2563 X 3722

Sue Wilcox, PD-ES, 904-232-1115

Ali Rozaie, EN-GS, 904-232-1432

*Sam Honeycutt, EN-GS, 904-232-1970

*Eddie Douglass, EN-WH, 904-232-1403

*Jorge Jaramillo, SFWMD, 561-242-5520 X 4021

*VE TEAM MEMBER

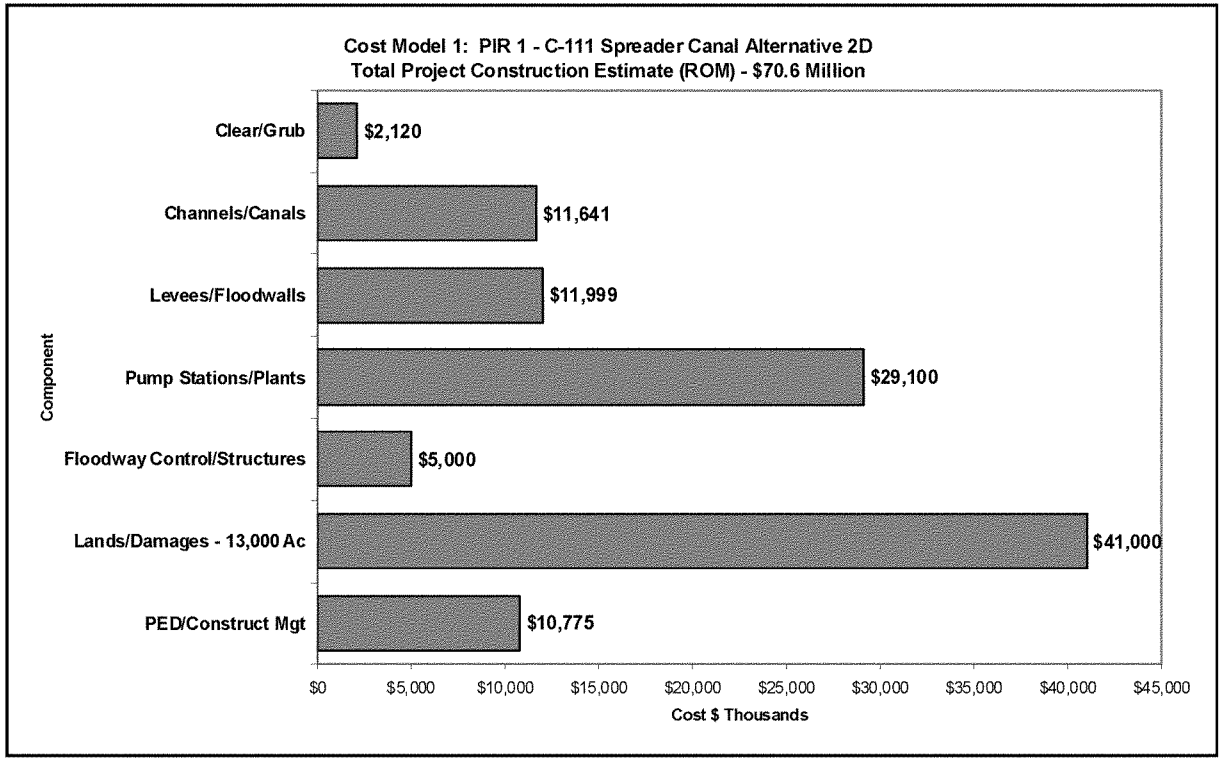
SPECULATION LIST

VALUE ENGINEERING TEAM STUDY
APPENDIX B

	C-111 SC Phase 1 Speculation List D = Develop Idea; X = Eliminate Idea; C = Comment on Idea	Action	Assigned	Savings (m)
1	Place pump to north of Frog Pond and add new C-111 structure to minimize back-water stage effects in C-111(Real estate takings)	D	GS	$
2	Raise level in L-31	C	FM/JS	
3	Develop Alt 4D plus Frog Pond	X		
4	Pick up water from S-177 and spread to Model Lands	Ph 2	N/A	
5	Revisit flow and pump capacity - one or two pump stations	D	ED	$
6	Place cut-off wall on north limit of Frog Pond	X		
7	Coordinate with upstream S-177 capacities (modeled 80% ~1,400 CFS)	See 5	ED	
8	Optimize A8 pump capacity - less than 750 CFS (350 - 500 CFS	See 5	ED	
9	Reduce inflow design flows to less than PMP - Use low hazard analysis. Reduce or eliminate hardened overflow structure	D	GS	$
10	Use lesser design event and fuse plug vs. overflow structure	See 9	GS	
11	Optimize spillway design to control cost, location, other	See 9	GS	
12	Define impoundment effects on Ingram Hwy	Done	GS	
13	Look to reduce size of pilot components	D	FM/JS	$
14	Use multiple spreader canal locations	C/Ph 2	JM	
15	Stockpile excavation from spreader system to fill C-111	C/Ph 2	BE	
16	Build one 3,000 CFS plug structures and add second on Phase 2 if needed	D	JM	$
17	Identify 3,000 CFS plug structures - operable weir or gated	C	FM	
18	Add Tiger teeth upstream of new plug(s)	X		
19	Revise Frog Pond slopes to 3:1	D	BE	$
20	Develop zoned embankment - use back side of berm for soil with chemical issues	C	SH/BT	
21	Consider cascading effect on reservoir or Aerojet - some topo exists	C	FM/JS	
22	Eliminate FG&FWC road - use for fill for plugs, C-111, other	C	JM	
23	Consider lower internal bench to reduce fetch containment	D	BE	$
24	Shallow water habitat within Frog Pond reservoir	X		
25	Increase stages in delivery canal in Frog Pond to establish cut-off north of Ingram Hwy	C	FM/JS	
26	Coordinate with C&SF C-111 Miami/Dade and placement of fill plugs in Aerojet Canal	C	FM/MC	
27				

COST MODELS

COST MODEL


Cost Model 1: PIR 1 - C-111 Spreader Canal Alternative 2D
Total Project Construction Estimate (ROM) - $70.6 Million
Component
Clear/Grub
$2,120
Channels/Canals
$11,641
Levees/Floodwalls
$11,999
Pump Stations/Plants
$29,100
Floodway Control/Structures
$5,000
Lands/Damages - 13,000 Ac
$41,000
PED/Construct Mgt
$10,775
$0
$5,000
$10,000
$15,000
$20,000
$25,000
$30,000
$35,000
$40,000
$45,000
Cost $ Thousands

C-111 SC TOTAL COST ALTERNATIVES 1C THROUGH 6D

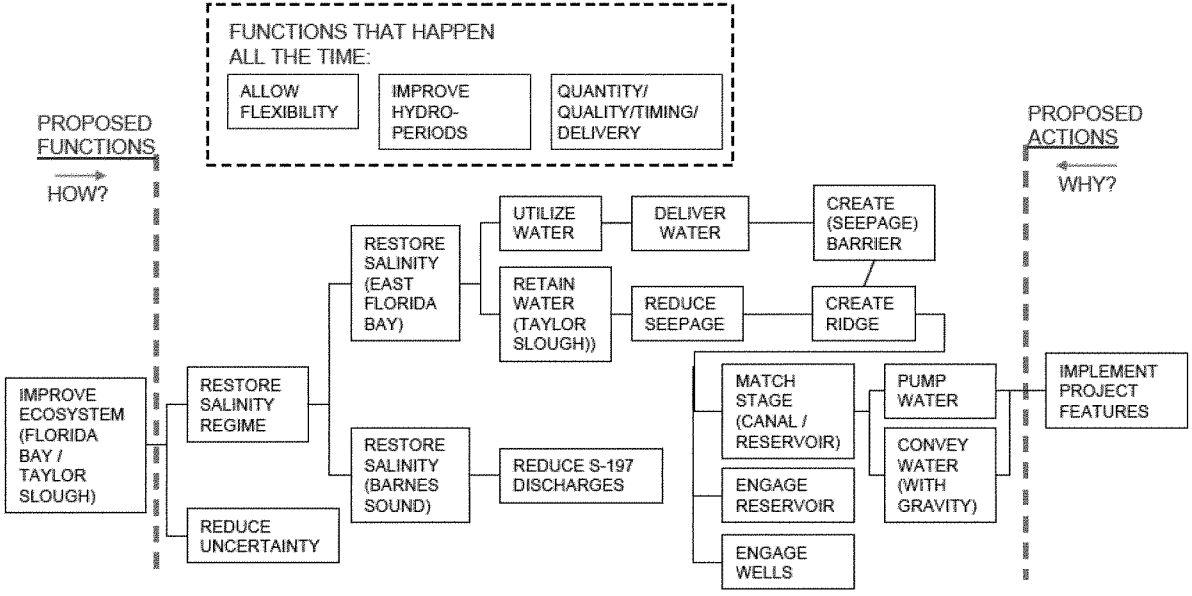
Alternative	Construction	Real Estate	Total Cost
1C	$41,600,000	$12,500,000	$54,100,000
1D	$50,100,000	$36,400,000	$86,500,000
2D	$77,500,000	$41,400,000	$118,900,000
3D	$85,900,000	$42,600,000	$128,500,000
4D	$24,400,000	$29,000,000	$53,400,000
6D	$402,100,000	$35,400,000	$437,500,000

Construction cost figures include IDC, S&A, PED
Restudy Estimate in FY99 Dollars - $94M
Restudy Cost (2006) plus 20% then escalated - $134M

FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM

C-111 SC FAST DIAGRAM

PIR 1 - C-111 SPREADER CANAL AFB AND ACCELER8 COMPONENTS
South Florida Water Management District & Jacksonville District



FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM

PDT Meeting Minutes
21 February and 12 March 2008

PROJECTS
C-111 Spreader Canal
Project Delivery Team
Meeting Summary

Wednesday, 21 February 2008 09:00 AM – 04:00 PM

To: C-111 Spreader Canal (C-111SC) Project Team

From: Everglades Partners Joint Venture (EPJV)

Subject: Project Delivery Team (PDT) Teleconference

Participants (Agency):

- **U.S. Army Corps of Engineers (Corps)** – Michael Collis, Eddie Douglass, Ed Dunlop, Bob Evans, Shawn Komlos, Don Nelson, Diane Oxendine, Paul Stevenson, Brad Tarr, Ray Wimbrough, Kevin Wittmann, Frank Zepka
- **RECOVER** – Patty Goodman
- **South Florida Water Management District (SFWMD)** – John Shaffer, Shi Kui Xue,
- **U.S. Fish and Wildlife Service (USFWS)** – Rick Fike
- **National Park Service (NPS) - Biscayne Bay National Park (BBNP)** – Sarah Bellmund
- **National Park Service (NPS) – Everglades National Park (ENP)** – Ed Kearns
- **Florida Department of Environmental Protection (FDEP)** – Inger Hansen
- **Miami-Dade County Department of Environmental Resources Management (DERM)** – Gwen Burzycki
- **EPJV** – Rudy Wynn

Participants (Public):

- **Everglades Foundation** – Tom Van Lent
- **Audubon Society (Public)** - Megan Tinsley

John Shaffer welcomed the C-111 SC PDT Meeting attendees. Introductions were made and the agencies represented were noted. Michael Collis reviewed the agenda and reviewed the purpose of the meeting: To discuss the C-111 SC value engineering report, review AFB document comments / responses, provide an update on the upcoming AFB meeting and operational plan strategy.

Operational Plan Strategy (J. Shaffer):

- The team needs to begin work on the Initial Operating Plan (IOP) as soon as possible. Carol Wehle (SFWMD) has made a commitment to provide up to $70 million dollars in funds to construct as many features as possible within PIR 1 (Western PIR).
- The C-111 SC AFB document has recently been updated to incorporate IAR suggestions. The C-111 SC IAR plan was coordinated early in the planning process with DOI and FDEP, and feedback was provided.
- Shawn Komlos, who is on the IAR team, advised the C-111 SC team that they

are attempting to expand the scope of IAR on the C-111 SC project. He noted that the IAR team is looking at all of CERP, and that the view of the overall system is a much higher priority than at the team level. There are no known variables that would adversely affect the C-111 SC project at this time.

- It is now incorporated in the language of the C-111 SC AFB document that IAR concerns will be addressed for both PIR 1 and PIR 2.

ITR Comment Review (R. Wimbrough):

- There were two unresolved comments from the ITR of the C-111 SC AFB document.
- Members of the C-111 SC PDT team were previously forwarded copies of the ITR comments and responses to provide feedback. As of the day of the meeting, there was no feedback given.
- Comment #1735311 – unresolved: *Future without-project condition: It would be helpful to understand the difference between existing conditions and the assumptions about future without-project conditions. In an earlier discussion (page 3-26), it was mentioned that there have been some changes in the simulations for future water deliveries to the project area. If there are differences between existing and future without project hydrologic conditions, it would be helpful to understand the magnitude of those differences, including the addition of a simulation using existing conditions and a benefit assessment based on those conditions.*
  Discussion: Shawn Komlos discussed this issue with the ITR reviewer, Robert Koenig, and at this time he still would like to see the modeling done. Alternative 7R needs to be compared to GM 4 to insure it meets existing condition guidelines. Kevin Wittmann agrees this needs to occur as well as the generation of habitat calculations. Ray Wimbrough advised the team the unresolved comments will be presented to HQUSACE at the C-111 SC AFB meeting for their advisement and guidance. The team's AFB response to this comment will be that existing conditions modeling will be run and habitat calculations completed for the existing conditions. This is necessary to complete the savings clause analysis. Ray Wimbrough will generate a pre-AFB submittal for HQUSACE's review prior to the meeting.
- Comment #1735581 – unresolved: *Using the "pre-drainage" simulation of the study area as a target condition raises some concerns. This simulation assumed that all man-made structures would be removed from the model domain. To be consistent with evaluations for the alternatives, I assume that means that all structures within the project area would be removed. Therefore, structures, activities, and water withdrawals from elsewhere in the watershed would remain in place and could still have an impact on the hydrological conditions in the project area. Unless we could remove all features/activities/water withdrawals within other parts of the watershed that may affect the hydrological conditions in the project area, we could never attain the optimal historic hydrological condition (assuming that such a condition even exists) of the project area. The primary assumption inherent in the methodology used to generate benefits is that returning hydrological conditions to the pre-drainage conditions would maximize benefits. This assumption might work if a fully natural historic hydrological condition could be restored to the project area. If we fall short of that, there may*

be some alternative physical distribution of hydrologic conditions that could generate the optimal biological response; i.e. with less water to work with, it may be more beneficial to limit the area through which water is re-routed. The methodology being used for benefit analysis cannot accommodate the evaluation of such alternatives.
Discussion: Boundary conditions were taken from the NSM, and members of the C-111 SC PDT believe the ITR reviewer is not familiar enough with the CERP program to fully understand the benefit analysis process utilized. Gwen Burzycki noted the project stakeholders want pre-drainage conditions to be the target and for that reason CERP evaluations are calculated in that manner. The team agreed to respond to this comment at the AFB meeting noting this analysis was utilized to meet stakeholder concerns and to meet natural system conditions.

- Michael Collis reinforced the need to get the pre-AFB submittal to HQUSACE at the earliest possible opportunity to expedite the process.
- Ray Wimbrough is the point of contact for any questions regarding the C-111 SC AFB ITR.

AFB Meeting Plan and Update (R. Wimbrough):

- Suggestions made during the recent IAR workshop were incorporated into the C-111 SC AFB document over the last two weeks. These revisions were in Tabs 2 and 3, focusing on project objectives, collaborative learning and learning opportunities from the project.
- Gwen Burzycki noted that the Southern Glades and Model Lands need to be categorized as separate areas in the AFB document – they are currently incorrectly noted. Additionally, she questioned why the PDT was not given the opportunity to review the document before it was sent to HQUSACE for review. Michael Collis noted that the creation of the AFB document was a consistent topic of the Team's weekly meetings and that the document is located in Documentum and has been accessible to the Team during the entire AFB process. To address Mrs. Burzycki's concerns, the C-111 SC PDT team will be provided one month to review the document and submit feedback on the AFB document before the meeting with HQUSACE. Needed changes and revisions will be placed into an "Errata" document for inclusion in the AFB document.
- Inger Hansen questioned as to whether the AFB document goes for public review. The AFB document is not reviewed by the public because it is primarily a planning document, but the Draft PIR will be open to public review.
- John Shaffer noted Tab 2 revisions also included possible changes to the project and opportunities.
- Bob Evans queried as to the timeframe the C-111 SC team is looking at to learn from PIR 1. Ray Wimbrough responded this is one of the major issues with implementing IAR. The POM and project monitoring plan will need to address the issue. The team intends to utilize monitoring set up by other projects, as well as share C-111 SC resources in exchange. Shawn Komlos pointed out that monitoring which is consistent between project teams must be a priority.
- Patty Goodman advised the team to start looking for pre-construction monitoring and identifying the resources the team has available. The team needs to do preemptive monitoring to set a project baseline. Thus far, the ASR project is the only project to accomplish this. Shawn Komlos requested the team prioritize the

monitoring they want to perform as some of the items listed will ultimately be pulled from the suite.

Public Comment

- Tom Van Lent (Everglades Foundation) stated he is interested in the project operational plan (POM) and feels it is important to understand the proposals to be put forth – especially regarding S-332 E, which he feels has always been more of a C-111 SC PDT project than an Acceler8 (now known as SFWMD Everglades Engineering) project. With C-111 SC features being designed by SFWMD Everglades Engineering, it is very important the POM be ready to go.
  On IAR, Mr. Van Lent stated he remains confused on what exactly it means. In listening to the discussions thus far in the meeting, definitions seem widely varied.
  Mr. Van Lent believes that clear objectives for the C-111 SC project design are very important.
  On the AFB and ITR, Mr. Van Lent noted he is not quite sure of the acronyms designation. He feels the AFB review comments are incomplete because review from other parties was not done. This may lead to surprises for the C-111 SC team later in the process.
- Megan Tinsley (Audubon Society) – no comment at this time.

Review of the C-111 SC VE Presentation (M. Collis):

- Michael Collis reviewed the C-111 SC VE Study in a PowerPoint presentation to re-familiarize the team with the study results.
- In recommendation C-1 of the VE study it is suggested well point systems be utilized. Bob Evans requested information on how the costs of these wells were calculated. Michael Collis responded he would find out and advise.
- John Shaffer noted during the presentation that the IAR workshop team strongly encouraged researching changing triggers at features to bring the water levels to the maximum. Doing so will help prevent wasting water and maximize the project's restoration opportunities.
- Michael Collis cautioned putting forth the perception that the team takes direction from the public. All project work is to be based on leadership's guidance. John Shaffer added that the IAR workshop teams input is only advisory in nature.

Lunch Break

Site Visit (R. Wimbrough):

- Ray Wimbrough briefed members of the C-111 SC PDT on the specifics of the project site visit to be held on 22 February 2008.

C-111 SC VE Discussion and Recommendation Dialogue (M. Collis):

- Michael Collis opened up the meeting to discussion and recommendations on the VE team results.
- Recommendation C-1: The C-111 SC team opted not to move forward on this recommendation. The project was modeled without a gated structure and the cost of a new gated structure is a concern. The northern pump is placed in the northern section of the FPDA in the models.

- Recommendation C-2: The C-111 SC team opted not to move forward on this recommendation. The team feels two pump stations are needed for the following reasons: 1. operational flexibility, 2. the size of the area, and 3. flood protection for Ingraham Highway.
  Discussion: The team discussed incorporating a C-111 SD project seepage management feature that is not being built by that project. The feature occurs north of the FPDA and Lucky Hammock. The purpose of the feature would be to provide seepage management for the 332 D pond. Gwen Burzycki questioned why this was not addressed when the team was working up project alternatives. Shawn Komlos requested additional information on why this feature was deferred to the C-111 SC project – was it dropped from the C-111 SD project for a technical reason? John Shaffer responded the feature was dropped at the same time as the plugging of the C-110, so he does not believe it is for technical reasons.
  Ed Kearns stated this feature needs to be looked at now, along with existing features to help gauge how the team needs to design. ENP does not want water flowing into the park; they just want the water that is currently there to remain. The Cape Sable seaside sparrow subpopulation C is located along the western edge of the park. Should water flow into that area, the team will have a section 7 violation.
  Gwen Burzycki noted the northern seepage management feature (C-111 SD feature) is needed to eliminate damaging flows out of S-197. Shawn Komlos noted this discussion is leading towards reformulation. Ed Kearns disagreed stating it is more along the lines of feature optimization. Gwen Burzycki noted this is a policy issue and not a team decision.
  John Shaffer noted the SFWMD leadership has made a commitment to provide up to $70 million dollars in funds to construct as many features as possible within PIR 1 (Western PIR)., so if the team wants this feature now is the time to work it in.
  Bob Evans will need to model the inclusion of this feature to assist the team in making a determination on its inclusion in the C-111 SC project. Michael Collis noted the team will make a recommendation to leadership and they will decide the appropriate course of action.

Public Comment:

- Tom Van Lent (Everglades Foundation) – no comment at this time.
- Megan Tinsley (Audubon Society) – no comment at this time.

C-111 SC VE Discussion and Recommendation Dialogue Continued (M. Collis):

- Recommendation C-3: The team believes this is a design issue and therefore it will be addressed in the design phase.
- Recommendation C-4: The team believes this is a design issue and therefore it will be addressed in the design phase.
- Recommendation C-5: The team believes this is a design issue and therefore it will be addressed in the design phase.
- Recommendation C-6: This recommendation has been table for future discussion.
- Recommendation C-7: The team will not pursue this recommendation without

additional modeling. The Team noted that the majority of the benefits of the TSP come from modeling that incorporated two plugs. Any recommendation to remove a plug would need modeling to ensure that there would be no loss in benefits.

- Due to time constraints, discussion of the VE Study comments was postponed for a future discussion.

Public Comment:

- Tom Van Lent (Everglades Foundation) – Gratified to hear John Shaffer and the SFWMD have thought about how to make the Frog Pond Detention Area a seepage control project. This is a great improvement.
  Mr. Van Lent had a number of comments on the TSP and VE study, but he felt this was really not a forum where public comment is useful. He indicated he has issue with the USACE's handling of the meeting and public comment period and will direct his concerns and feedback to members of the SFWMD in the future.
- Megan Tinsley (Audubon Society) – no comment at this time.

Next Meeting

- To be determined.

PROJECTS
C-111 Spreader Canal
Project Delivery Team
Meeting Summary

Wednesday, 12 March 2008 09:00 AM – 03:30 PM

To: C-111 Spreader Canal (C-111SC) Project Team

From: Everglades Partners Joint Venture (EPJV)

Subject: Project Delivery Team (PDT) Teleconference

Participants (Agency):

- **U.S. Army Corps of Engineers (Corps)** – Michael Collis, Eddie Douglass, Bob Evans, Shawn Komlos, Fred McAuley, Sal Resurreccion, Brad Tarr, Ray Wimbrough, Kevin Wittmann
- **South Florida Water Management District (SFWMD)** – John Shaffer, Shi Kui Xue,
- **U.S. Fish and Wildlife Service (USFWS)** – Rick Fike
- **National Park Service (NPS) – Everglades National Park (ENP)** – Amy Renshaw
- **Miami-Dade County Department of Environmental Resources Management (DERM)** – Gwen Burzycki
- **EPJV** – Rudy Wynn

Participants (Public):

- **National Parks Conservation Association** – Sarah Fain
- **Audubon Society** - Megan Tinsley
- **Sierra Club (Miami)** – Mark Oncavage

Michael Collis welcomed the C-111 SC PDT Meeting attendees. Introductions were made and the agencies represented were noted. He reviewed the agenda and the purpose of the meeting: To discuss the C-111 SC value engineering comments that were not covered during the February 21, 2008 PDT meeting and discuss the concept of the pilot features.

Value Engineering Comments (M. Collis):

Comment #1: Raise levels in L-31 Canal (Speculation Idea 2):

- Discussion on comment #1 indicated it would prove too difficult, and expensive to match the level of the L-31 Canal with the level of the surrounding marsh. Several attendees pointed out the only way to match the level of the marsh by backfilling the L-31 Canal. The PDT chose not to pursue this comment.

Comment #2: Use multiple spreader canal locations (Speculation Idea 14):

- Discussion of comment #2 was postponed for later in the agenda. See Pilot Spreader Discussion summary.

Comment #3: Stockpile excavation from spreader system to fill C-111 (Speculation Idea 15):

- The PDT believes the team will be stockpiling excavation for backfill during the construction phase. This item can be addressed more thoroughly during design.

Public Comment:

- Megan Tinsley (Audubon Society) noted data was released last week indicating there is a 37% drop in roseate spoonbill nesting sites in Florida Bay. She thanked the C-111 SC PDT for their efforts in restoring freshwater flow to Florida Bay.
- Sarah Fain (NPCA) stated she is confused on the potential multiple spreader locations and / or the pilot spreader canal. She queried as to the intent of the spreader canal(s)? She noted the environmental community's interest in stage raises within the project footprint.
- Mark Oncavage (Sierra Club – Miami) queried as to the goals of the project and team. What are you trying to restore with the project?

Value Engineering Comments – Continued (M. Collis):

Comment #4: Identify 3,000 CFS Plug Structures as Operational Structures (Speculation Idea 17):

- Gwen Burzycki pointed out the team needs to keep in mind the potential for manatees to venture into this area, and be prepared for that to be a potential check-off list.
- Discussion of utilizing one structure / plug versus two indicated more research needs to be done on this feature. Michael Collis noted the costs will need to be evaluated, as well as detailed modeling on the differences between one plug and two. Ed Kearns (ENP) also has information that will need to be reviewed in determining the route the team should take on this comment.
- Michael Collis indicated the team should stick with two plugs for now and pull one if the data indicates a single plug would prove as effective.

Comment #5: Develop zoned embankment – place contaminated soils on exterior side of Frog Pond Detention Area (Speculation Idea 20):

- Initial scrape downs in the FPDA have indicated high levels of copper contamination according to Bob Taylor. Michael Collis noted that testing on performed on soil before it is ever used for project purposes. However, contaminated soils could also be capped.
- The PDT agreed that this comment is a design issue and will be addressed during that phase of the project.

Comment #6: Consider compartmentalizing both the Frog Pond Reservoir, and Aerojet Road Canal features so as to create three cascading basins, within each feature (Speculation Idea 21):

- The PDT agreed that this comment should be assessed during the design phase of the project.

Comment #7: Eliminate FG&FWC road – Remove other manmade features from the coastal floodplain (Speculation Idea 22):

- Bob Evans noted that he was unsure as to whether the FG / FWC Road was included in the model. John Shaffer pointed out if the road is not in the model, the project may not attain benefits from its removal. Michael Collis requested Bob Evans review the model to determine whether the road was included in the model and advise the team of his findings.
- Gwen Burzycki suggested the roadbeds can be used as project fill material, not just for the C-111 SC project, but for any restoration work in the area.

- Rick Fike noted the VE Study recommended removing all man-made features, not just roads and suggested this may be an issue to look at in PIR 2.
- The PDT agreed this comment should be addressed in PIR 2.

Comment #8: Increase Stages in Frog Pond Distribution Channel (Speculation Idea 25):

- Comment #8 has already been incorporated into the project, therefore no further discussion ensued.

Comment #9: Coordinate with C&SF C-111 Miami-Dade project for placement of fill plugs in Aerojet Canal (Speculation Idea 26):

- The PDT agreed coordination between the C-111 SC and C-111 SD projects are ongoing.

Public Comment:

- Megan Tinsley (Audubon Society) expressed concern over the C-111 SC project potentially utilizing plugs in the lower C-111 Canal at a cost of $9 million dollars if the canal is to be filled regardless. Stakeholders in the area would prefer to see higher water levels there.
- Sarah Fain (NPCA) would like to see the canal filled, but wants to see the benefits comparison between using a single plug versus two.
- Mark Oncavage (Sierra Club – Miami) had no comment during this public comment period.

Lunch: 11:30 AM to 12:30 PM

Pilot Spreader Discussion (Michael Collis):

- Michael Collis reviewed the minutes on the team's previous discussions regarding the pilot spreader canal. During those meetings the PDT had decided to have a 1 mile long spreader canal located at 424th Street. The first section would be a feeder canal to get the spreader canal away for the C-111 Canal in an effort to reduce backflow and take advantage of the topography. The team had also decided to optimize the size of the pump to insure the canal is filled as needed.
- John Shaffer noted the SFWMD has some concerns over the cost of constructing the canal, and that they believe those funds could be spent more wisely elsewhere.
- Shawn Komlos suggested the C-111 SC PDT research the option of using perforated piping in the construction of the canal to lessen the cost of the project, improve portability and allow the team the ability to lengthen or shorten the canal as needed. Rick Fike agrees this might be a good approach. John Shaffer agrees that non-perforated pipe is a good way to move water away from the canal, but does not agree with using non-perforated piping as the spreader canal.
- Gwen Burzycki requested the team utilize a decision tree to help in determining the proper pump size for the project.
- Regardless of pump size, John Shaffer pointed out the team needs to get as much monetary coverage as possible up front.

Public Comment:

- Megan Tinsley (Audubon Society) had no comment during this public comment period.
- Sarah Fain (NPCA) noted she is trying to determine the purpose of the pilot project. She noted IAR dictates that a pilot project be built big enough to attain benefits and learn simultaneously. She questioned as to whether any of the scenarios discussed provided benefits. She also requested the team discuss potential wetland destruction due to the construction of a pilot spreader canal. She is not sure the NPCA likes this idea at this time.
- Mark Oncavage noted the project seems compartmentalized, and that the C-111 SC PDT needs to think on a bigger scale. He would prefer to see the project re-worked so that not just small pieces are restored.

Pilot Spreader Discussion - Continued (Michael Collis):

- Construction on PIR 1 is currently scheduled to begin in September 2009. PIR 2 will possibly begin in 2015. To maximize the opportunity for learning, the pilot features will need to be in place for at least two years. Shawn Komlos noted that any test shorter than two years will not provide the information needed due to high levels of ground saturation.
- John Shaffer advised participants leadership has requested pilot features now be termed physical models, therefore summary notes will reflect this change in terminology.
- The C-111 SC PDT team agreed that the ditch being utilized at 424th Street is to be cleaned out prior to running the physical model spreader canal. A 50 cfs pump will be utilized and ramped up as needed.
- Brad Tarr pointed out BBCW has a great monitoring plan, but can only use MAP at this time. The C-111 SC project can expect to see the same determination. Michael Collis pointed out the team just needs to formulate a monitoring plan at this time, and not worry about costs. Gwen Burzycki suggested the team point out to leadership that no learning will be attained from the physical models unless the appropriate monitoring is performed.
- The attendees focused the discussion on design, and opted not to discuss details at this time. Attendees expressed their concern over scarring the landscape in the area of the physical model spreader canal and suggested the use of a shallow configuration for the feature.

Public Comment:

- Mark Oncavage (Sierra Club – Miami) noted he would like to see the goals of restoration kept in mind. Monitoring should reflect what you are attempting to do with the project. In his opinion, the project is lost between the forest and the trees. The team needs to focus on goals and look at your construction as a means of meeting those goals.
- Megan Tinsley (Audubon Society) had no comment during this public comment period.

Pilot Spreader Discussion - Continued (Michael Collis):

- Attendees noted the monitoring network for the physical model spreader canal needs to be broad enough to determine if a backwater effect does occur, where it runs out.
- Shawn Komlos requested Eddie Douglass cost out the spreader canal, pipe and ditch with piping to get a better understanding of the cost difference between the two projects. Eddie Douglass replied he can cost out the price of a 1/2 mile section of closed pipe and the prepping of the drainage ditch. Increments of perforated pipe can also be costed out.
- Shawn Komlos would like to see the physical spreader canal constructed with perforated piping and placed on top of the ground, not in the ditch. This would allow the piping to be moved as needed for testing in other locations. The flexible piping would also have less impact on landscapes. John Shaffer noted roads would still be needed to move the piping into these areas.
- Gwen Burzycki noted the team would receive a lot of regulatory kickback on putting in roads for a temporary feature.
- The PDT team agreed to run 1/2 mile of solid piping from the canal to the ditch, clear dredge and plug the next 1/2 mile in increments. Discharges will begin at the ½ mile mark, then move to the 1/4 mile mark and finish at the 1/8 mile mark. This refinement may require a modification of the report. Michael Collis noted this information will just need to be written up in the DPIR as a part of IAR

Public Comment:

- Megan Tinsley (Audubon Society) noted she appreciates the discussion on the physical model spreader canal and hope this can get off the ground because she believes benefits can be realized.
- Mark Oncavage (Sierra Club – Miami) recommended the team keep in mind the everglades urban interface when discussing seepage management. He also reminded the team of the FP&L Turkey Point's intent to take up to 90 million gallons of water a day out of the system and to consider how that might affect the project; particularly in testing groundwater to determine the effects of such a drawdown.

Water Quality Discussion:

- John Shaffer met with farmers in the Loveland Slough agricultural area, and toured the farms surrounding the slough. Only four farmers have property that is contiguous to the slough. One of these farms is not farming due to a consent agreement established with DERM. Gwen Burzycki believes the farmer in question was clearing the slough without a permit. Loveland Slough is considered jurisdictional wetlands.
- John Shaffer noted the other farmers are also interested in clearing the slough around their lands to insure proper drainage is attained. Amy Renshaw replied that it seems more detrimental to clear the slough out of vegetation than to just allow the water to flow through as is. John Shaffer added it takes roughly one hour from the time S-178 is opened until the water exits the fields.

- The C-111 SC PDT agreed physical model source control at Loveland Slough is a feature that should be pursued in PIR 1, pending no concerns from HQUSACE or the USACE Office of Counsel.
- The team discussed the infiltration basin that will be constructed on a five acre site south of holiday hammock, with a quarter acre site (the "lollipop" north of S-178) for the water quality test.
- The hydrologic and water quality sites are separate due to a lack of funding for property purchases on the part of SFWMD. However, the water quality at the "lollipop" site is very poor and thus makes the site very suitable for the testing.
- The water quality site will need to be costed out, and will only pull 5 cfs during high conditions. John Shaffer noted it would be best if the water could be pulled down from the water quality feature to the infiltration basin. Eddie Douglass agreed to cost out the piping for that feature.
- Shawn Komlos recommended the team push forward with these features as quickly as possible, as he believes the FDEP will ultimately require mandatory BMPs in the area.
- The C-111 SC PDT agreed to pursue the physical model infiltration basin and water quality features in PIR 1.
- John Shaffer will be organizing a sub-team in the near future to work on the physical model water quality features.

Public Comment:

- Megan Tinsley (Audubon Society) had no comment during this public comment period.
- Mark Oncavage (Sierra Club – Miami) had no comment during this public comment period.

Meeting Closed

Next Meeting

- To be determined.

Revised Final Estimated Savings Based on Draft Western C-111 Spreader Canal Project Implementation Report and Draft Environmental Assessment and Final Phase 1 Design Documents 28 October 2009

REVISED FINAL COST ESTIMATE WORKSHEET

C-1 PROPOSAL DESCRIPTION: Move FPDA intake pumps north to reduce back-water stage effects in C-111 (Real Estate Takings)

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Original FPDA 3-200 CFS, 2-75 CFS	CFS	750	$26,050.00	$19,537,500
CWBS Index FY2009 to FY2010	LS	0.02	$19,537,500.00	$408,100
Reduced Takings Real Estate Impacted 12%	Ac	90	$53,060.00	$4,775,400
[($30.730 M/776 Ac) X 1.34 Contingency]				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$24,721,000

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Move North FPDA 3-200 CFS, 2-75 CFS	CFS	750	$26,050.00	$19,537,500
Install Concrete Liner for Delivery Canal	SF	246,844	$3.88	$957,755
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$20,495,255
	Net Cost Decrease/Increase			$4,225,745
*	Mark-ups	20.96%		$885,716
	Total Cost Decrease/Increase			$5,111,461

* Included in Unit Price: Gen. Contractor Mark-up - Included in Unit Prices (Overhead Field Office/Home Office/Sales Tax/Profit/Bond) and Contingencies also applied for Pumping Plants - 21.0% and Real estate - 43%; Mark-ups: PED - 12% and S&A - 8% are appli

VALUE ENGINEERING TEAM STUDY
APPENDIX F

REVISED FINAL COST ESTIMATE WORKSHEET

C-2 PROPOSAL DESCRIPTION: Optimize number of pump stations and pumping capacity

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
North FPDA 3-200 CFS, 2-75 CFS	CFS	750	$26,050.00	$19,537,500
South FPDA 2-200 CFS, 2-50 CFS	CFS	500	$29,500.00	$14,750,000
CWBS Index FY2009 to FY2010	LS	0.02	$34,287,500.00	$716,198
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$35,003,698

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
North FPDA 225 CFS	CFS	225	$46,990.43	$10,572,846
South FPDA 225 CFS	CFS	225	$30,954.92	$6,964,858
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$17,537,704

	Net Cost Decrease/Increase		$17,465,994
*	Mark-ups	20.96%	$3,660,872
	Total Cost Decrease/Increase		$21,126,866
	Total Life Cycle Cost Decrease/Increase		$9,877,500

* Included in Unit Price: Gen. Contractor Mark-up - Included in Unit Prices (Overhead Field Office/Home Office/Sales Tax/Profit/Bond) and Contingencies also applied for Pumping Plants - 21.0%; Mark-ups: PED - 12% and S&A - 8% are applied for Total Decrease/

Annual O&M for 2 Pump Stations (750 to 250 CFS and 500 to 250 CFS) = $450,000. Life Cycle Cost: [($450,000) X (21.95, P/A, 4.5%, 100 Yrs)] = $9,877,500.

VALUE ENGINEERING TEAM STUDY
APPENDIX F

REVISED FINAL COST ESTIMATE WORKSHEET

C-3 PROPOSAL DESCRIPTION: Reduce inflow design flood to less than the Probable Maximum Flood

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
800' Emergency Overflow Weir -				$0
Grade Beams (2' X 2' X 1,600')	CY	475	$2,735.70	$1,299,458
Concrete Slab (0.33' X 10' X 800')	CY	98	$1,703.10	$166,904
Auger-cast Pile (16" X 7.5' @ 20' o.c.)	LF	600	$69.64	$41,782
CWBS Index FY2009 to FY2010	LS	0.02	$1,508,142.66	$31,481
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$1,539,624

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Emergency Overflow Weirs 1-300' & 2-400'	LS	1	$2,642,468.00	$2,642,468
Articulated Concrete Mat				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$2,642,468

	Net Cost Decrease/Increase		-$1,102,844
*	Mark-ups	20.96%	-$231,156
	Total Cost Decrease/Increase		-$1,334,000

* Included in Unit Price: Gen. Contractor Mark-up - Included in Unit Prices (Overhead Field Office/Home Office/Sales Tax/Profit/Bond) and Contingencies also applied for Channels/Canals - 27.0%; Mark-ups: PED - 12% and S&A - 8% are applied for Total Decrease

VALUE ENGINEERING TEAM STUDY
APPENDIX F

REVISED FINAL COST ESTIMATE WORKSHEET

C-7 PROPOSAL DESCRIPTION: Build one 3,000 CFS plug structures and add second on Phase 2 if needed

DELETIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
Canal Plug - Control Structure	Ea	1	$1,579,740.00	$1,579,740
Includes CWBS Index FY2009 to FY2010	LS	0.00	$1,579,740.00	$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Deletions		$1,579,740

ADDITIONS

ITEM	UNITS	QUANTITY	UNIT COST	TOTAL
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
				$0
		Total Additions		$0

	Net Cost Decrease/Increase		$1,579,740
*	Mark-ups	20.96%	$331,114
	Total Cost Decrease/Increase		$1,910,854
	Total Life Cycle Cost Decrease/Increase		$263,400

* Included in Unit Price: Gen. Contractor Mark-up - Included in Unit Prices (Overhead Field Office/Home Office/Sales Tax/Profit/Bond) and Contingencies also applied forcontrol structure - 24.0%; Mark-ups: PED - 12% and S&A - 8% are applied for Total Decreas

Annual O&M for 1 Control Structure (3,000 CFS) = $12,000. Life Cycle Cost: [($12,000) X (21.95, P/A, 4.5%, 100 Yrs)] = $263,400.

US Army Corps of Engineers®

Jacksonville District

South Florida Water Management District

CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN
C-111 SPREADER CANAL WESTERN PROJECT

FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

Volume 4 – Appendix A, Part II

January 2011

US Army Corps of Engineers®

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

This Report Contains [5] Volumes
You Are Here

Volume 1 – Main Report

- Executive Summary
- Section 1 – Introduction
- Section 2 – Existing Conditions/Affected Environment
- Section 3 – Future "Without Project" Condition
- Section 4 – Identification of Problems and Opportunities
- Section 5 – Formulation and Evaluation of Alternatives
- Section 6 – The Recommended Plan
- Section 7 – Environmental Effects
- Section 8 – Plan Implementation
- Section 9 – Coordination, Public Views, and Comments
- Section 10 – Recommendations
- Section 11 – List of Preparers
- Section 12 – Index
- Section 13 – Glossary of Terms
- Section 14 – Acronym List
- Section 15 – References

Volume 2 – Annex A-B

- Annex A – FWCA and Endangered Species Act Compliance
- Annex B – NEPA Information

Volume 3 – Annex C-F

- Annex C – Analyses Required by WRDA 2000 and State Law
- Annex D – Draft Project Operating Manual
- Annex E – Project Monitoring Plan
- Annex F – Reports Provided by RECOVER to Support the PIR

Volume 4 – Appendix A

- Appendix A – Engineering Part I
- Appendix A – Engineering Part II, HTRW Reports

Volume 5 – Appendix B-H

- Appendix B – Cost Estimates
- Appendix C – Environmental Information
- Appendix D – Real Estate
- Appendix E – Agency / Public Coordination
- Appendix F – Plan Formulation and Evaluation
- Appendix G – Economic and Social Considerations
- Appendix H – Recreation Plan

CENTRAL AND SOUTHERN FLORIDA PROJECT
C-111 SPREADER CANAL WESTERN PROJECT

FINAL PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

US Army Corps of Engineers

U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

SOUTH FLORIDA WATER
MANAGEMENT DISTRICT

January 2011

APPENDIX A
ENGINEERING

APPENDIX A
ENGINEERING
PART II

TABLE OF CONTENTS

A.0 ENGINEERING PART II A-1
A.1 Hazardous, Toxic and Radioactive Waste Reports A-1
A.1.1 Correspondence A-3
A.1.1.1 Aerojet Feature A-5
A.1.1.2 Frog Pond Feature A-13
A.1.1.3 Protocol A-35
A.1.2 Protocol A-41
A.1.3 Site Hazardous, Toxic and Radioactive Waste Studies A-95
A.1.4 Soil Management A-581
A.1.5 Water Quality Certification Permit A-673

A.0 ENGINEERING PART II

A.1 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE REPORTS

A.1.1 Correspondence

A.1.1.1 **Aerojet Feature**

38617-407

Florida Department of Environmental Protection

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

Jack Long, Director
Southeast District Office

Southeast District Office
400 N. Congress Avenue, Suite 200
West Palm Beach, FL 33401
(561) 681-6600

July 9, 2009

Mr. Robert J. Taylor, Sr. Environmental Engineer
Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road, Bldg. B-1
West Palm Beach, FL 33416-4680

WCU – Miami_Dade County
C-111 Spreader Canal

Re: Phase I & Limited Phase II Environmental Site Assessment Report for
C-111 Spreader Canal Phase I Component
Miami-Dade County, Florida

Dear Mr. Taylor:

Staff of the Waste Cleanup Section has reviewed the document entitled, Phase I & Limited Phase II Environmental Site Assessment Report for the C-111 Spreader Canal Phase I Component, Miami-Dade County, Florida, prepared by URS Corporation (URS), for the South Florida Water Management District, dated June 5, 2009 (received on June 8, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Based on the information supplied, it appears that the Western Component of the study area, not including the former and current cultivated areas, is suitable for the proposed project. The former and current cultivated areas are currently being assessed for agricultural contaminants of concern. Please forward the assessment addendum when it becomes available.

2. The Former Agricultural Areas in the Central Component still need to be sampled and assessed for organochlorine pesticides and metals that may have been applied as agricultural amendments.

3. The results of the samples taken from the stockpiled soils excavated from the C-110 Canal indicate that the area may be suitable for inundation. All assessed analyte concentrations were below their respective Sediment Quality Assessment Guidelines (SQAGs).

4. The Department concurs that additional follow-up assessments and closures will be required should the District acquire the Everglades Youth Development Center and the former Navy listening facility.

5. With the exception of the former Navy listening facility, there appear to be no other areas of concern that would render the Eastern Component unsuitable for inundation as proposed for this project.

Should you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

Sincerely,

Paul Alan Wierzbicki

Paul Alan Wierzbicki, P.G.
Waste Cleanup Supervisor

cc: Brian Dougherty, FDEP, Tallahassee (Brian.Dougherty@dep.state.fl.us)
Joe Lurix, FDEP, WPB (Joe.Lurix@dep.state.fl.us)
Chad Kennedy, FDEP, WPB (William.C.Kennedy@dep.state.fl.us)
Wilbur Mayorga, Miami-Dade Department of Environmental Resource Management (mayorw@miamidade.gov)

090544

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

August 5, 2009

Robert Taylor
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the documents entitled, "Phase I and Limited Phase II Environmental Site Assessment Report, C-111 Canal Phase I Component, Miami-Dade County, Florida" and "Supplemental Soil Assessment Addendum, C-111 Spreader Canal Phase I Component, 700 Acres at Aerojet Canal Extension and Northern C-110 Canal, Florida City, Miami-Dade County, Florida," submitted to the South Florida Water Management District (District) by URS Corporation (URS). These reports summarize the results from additional soil sampling conducted in the C-111 Spreader Canal Phase I Component project area.

The C-111 Spreader Canal Phase I Component is designed to provide ecosystem restoration of freshwater wetlands, tidal wetlands, and near-shore habitat, and maintenance of flood protection in the Southern Glades wetlands area. The western section of the project includes the Aerojet Canal extension into 100 acres of former and currently cultivated agricultural lands. The central component of the project involves using former agricultural soils for plug material in the C-110 Canal. Approximately 600 acres of former agricultural lands could potentially be inundated as a result of the proposed C-110 Canal plugs.

To evaluate the potential ecological risk associated with using these areas in the C-111 Spreader Canal Phase I Component, soil and sediment samples were collected. Three discrete sediment samples were collected from the Aerojet Canal adjacent to the northernmost Aerojet facility, and two composite samples were collected from the 100 acres of former and current agricultural land in the area of the proposed Aerojet Canal extension. In the central component, two, 5-point composite soil samples were collected at plug locations. Twelve, 50-acre composite soil samples were collected from the 600-acre former agricultural area. Analytical results were compared to Florida Department of Environmental Protection Sediment Quality Assessment Guidelines (SQAG) and the Florida Administrative Code Soil Cleanup Target Levels (SCTL).

Results

The three sediment samples from the Aerojet Canal detected concentrations of methylene chloride (mean of 7.9 μg/kg) below its SCTL (20 μg/kg). Arsenic (mean of 6.4 mg/kg) was detected above the SCTL (2.1 mg/kg) in all sediment samples. One of the 50-acre grid composite samples (grid 99) collected from the current agricultural area at the site of the

TAKE PRIDE IN AMERICA

proposed Aerojet Canal extension detected a concentration of copper (84 mg/kg) in exceedance of its SQAG threshold effect concentration (32 mg/kg). The duplicate sample from this location detected 144 mg/kg copper, which is above the interim screening level for the protection of the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (85 mg/kg). The soil samples from C-110 Canal plug locations detected arsenic at concentrations above the SCTL (2.1 mg/kg), but below the (TEC) (9.8 mg/kg). The approximately 600-acre former agricultural area north of the C-110 canal also detected arsenic in excess of the SCTL at 9 of 50-acre grids.

URS concluded that copper impacted soils north of the Aerojet Canal (50-acre grid 99) pose an unacceptable ecological risk. They recommended further assessment or corrective actions for this area.

Service Comments

To insure no risk from copper exposure to the snail kite, the Service concurs with the recommendation for further sampling or corrective actions for 50-acre grid 99, located in the proposed area of the Aerojet Canal extension. The detected levels of arsenic and methylene chloride are unlikely to pose risk to Service trust resources. Pending successful remediation, verified through confirmatory sampling for copper impacted soils at grid 99, we concur that this site is suitable for its intended use in the C-111 Spreader Canal Phase I Component.

Thank you for the opportunity to review these additional sampling investigations for the C-111 Spreader Canal Phase I Component. If you have any questions regarding these comments, please contact Emily Bauer at 772-562-3909, extension 335.

Sincerely yours,

Robert Trahan

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc: electronic copy only
Corps, West Palm Beach, Florida (Tori White)
DEP, West Palm Beach, Florida (Joe Lurix)
URS, Boca Raton, Florida (Ed Leding)

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Inger Hansen, Engineer IV, Watershed Management & Planning**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: SEP 18 2009
SUBJECT: **Supplemental Soil Assessment Addendum for the C-111 Spreader Canal Site**

As requested, I have reviewed the Supplemental Soil Assessment Addendum for the C-111 Spreader Canal Site, dated July 16, 2009, (received July 17, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. The Department concurs with the consultant's recommendation for additional assessment and possible corrective actions within Grid 99, due to copper impacts.

2. The recommendation to conduct quarterly groundwater monitoring is also accepted.

3. Based on the information supplied, I cannot concur that No Further Action is warranted in Grids 44, 53 and 82. It appears that there is an assessment report for these areas that has not yet been forwarded and reviewed. Comments for that document will be sent separately.

4. The recommendation to prepare a human health risk assessment, if the public is granted access to the project area, is also acceptable.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Joe Lurix, Waste Program Administrator

090675

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Joe Lurix, Waste Program Administrator**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: DEC 03 2009
SUBJECT: **Soil Management Plan for the Unlined Aerojet Canal Extension at the C-111 Spreader Canal, Miami-Dade County, Florida**

I have reviewed the Soil Management Plan for the Unlined Aerojet Canal Extension at the C-111 Spreader Canal, dated November 2, 2009, (received November 5, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Based on the information supplied, it appears that the Soil Management Plan is protective of Human Health and the Environment.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Robert Taylor, South Florida Water Management District
Ed Leding, P.G., URS Corporation
Brian Dougherty, Bureau of Waste Cleanup (Brian.Dougherty@dep.state.fl.us)

091031

A.1.1.2 **Frog Pond Feature**

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: Joe Lurix, Waste Program Administrator
THROUGH: Paul Wierzbicki, Waste Cleanup Supervisor
FROM: Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section
DATE: APR 28 2009
SUBJECT: Additional Soil Investigations Frog Pond - C-111 Spreader Canal, Leaky Reservoir

As requested, I have reviewed the Additional Soil Investigations Frog Pond for the Leaky Reservoir area of the C-111 Spreader Canal Project, dated March 30, 2009, (received April 1, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Based on the information supplied, it would seem prudent to proceed to scrape the soils in grids 31, and 33. The copper results for the composite sample in grid 31 are very close to the interim screening level value, and grid 33 has a chromium concentration that exceeds the TEC as well.

2. While it is under stood that this current project does not call for the use of grids 5 and 6, please ensure that should the soils in those grids be disturbed, they are handled in such a way that they do not come in contact with surface waters.

3. Please furnish the Department with confirmatory soil samples after the excavation is finished.

4. What is the rationale for not conducting sampling and analysis in the NW corner of the parcel, outside the grid?

5. It is noted on page 8 that a "Soil Management Plan" is being developed. Please ensure that excavated soils are managed so that they do not pose a leachability threat to surface or groundwater.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Inger Hansen, Engineer IV, Watershed Management & Planning

090331

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 27, 2009

Robert Taylor
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the Ecological Risk Assessment (ERA) and the Additional Soil Investigation for the Frog Pond, prepared by Newfields and URS Corporation (URS), respectively. These documents report contaminant concentrations and the predicted risk associated with using the Frog Pond for the construction of a 570-acre water detention area in the C-111 Spreader Canal Project. The proposed detention area is intended to act as a 'leaky' reservoir, allowing water to infiltrate to groundwater. The infiltration is expected to create a hydrologic buffer that will force groundwater flows into Taylor Slough to the west and keep regional groundwater from flowing into the C-111 canal to the east.

A 2006 Phase II Environmental Site Assessment on 1,380 acres at the Frog Pond identified soil concentrations of copper, zinc, and 4,4′-DDE that predicted risk to Service trust resources (Service comment letter dated May 1, 2007). Since this Phase I/II assessment, the footprint of the water detention area shifted to the west, resulting in an area of approximately 350 acres that had not undergone sampling. In the Additional Soil Investigation, composite soil samples were collected from seven, 50-acre grids throughout this 350-acre area within the new Frog Pond Detention Area footprint. Analytical results were compared to Florida Department of Environmental Protection Sediment Quality Assessment Guidelines (SQAG) and the Florida Administrative Code Soil Cleanup Target Levels.

A low concentration, below the SQAG, of the organochlorine pesticide 4,4′-DDE was detected in one of the seven composite samples. Endosulfan, which has no SQAG, was detected in four of the composite samples at concentrations below the calculated site-specific SQAG (9.14 µg/kg). All other pesticides were below their respective laboratory detection limits. Four of the composite samples detected copper at a concentration above the interim screening level for the protection of the endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (85 mg/kg), ranging from 136 to 224 mg/kg. Zinc concentrations slightly exceeded the SQAG threshold effect concentration (TEC) (120 mg/kg) in two of the composite samples.

In 2007, a pilot scraping study was conducted in a 5-acre portion of the 350-acre Frog Pond area to determine if contaminated soils (mean of 202 mg/kg copper and 172 mg/kg zinc) could be effectively removed from the solution riddled limestone. Results from this study found that copper and zinc concentrations in the scraped area remained above the interim screening level (85 mg/kg) and the TEC (120 mg/kg), respectively.

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The Frog Pond detention area will likely be subject to frequent wetting/drying cycles. Standing water is likely to persist in solution areas, where soils were shown to remain after scraping. The length of time water would persist is hard to predict, but if these areas persist long enough, an aquatic community could become established and attract aquatic feeding avian fauna. To further evaluate the risk associated with flooding Frog Pond soils, an Ecological Risk Assessment was performed with soils from the Frog Pond. Bulk soil samples were collected from three locations at the Frog Pond: two samples (CS-8 [copper = 140 mg/kg] and CS-10 [copper = 97 mg/kg]) were collected from the scraped pilot study area and one sample (grid 6) was collected from an area identified as having the highest observed copper concentration (365 mg/kg). Bioaccumulation tests (28 day) were conducted using the worm, *Lumbriculus variegatus*, and the Florida apple snail, *Pomacea paludosa*. Toxicity tests (10-day acute) were performed using *Chironomus dilutus* and *Hyalella azteca*. A survey was also conducted in the 5-acre pilot study area to determine the depth and aerial extent of soil remaining after scraping. Soil samples were collected from the survey area at both shallow (soil < 1 inch deep) and deep (soil > 1 inch deep) locations.

In an attempt to mimic the repeated wetting cycles detention areas undergo, soils were acclimated six times through static-renewal with synthetic freshwater (renewals at days 7, 12, 17, 27, 37, and 48). Results from the acclimation phase of the study found a general decrease in the concentration of copper in the soil/sediments, with the greatest rate of decline between day 1 and 7. At the end of the acclimation period, copper in sediments exceeded the TEC (32 mg/kg) in CS-8 (79 mg/kg) and CS-10 (63 mg/kg) and the SQAG probable effect concentration (PEC) (150 mg/kg) in grid 6 (225 mg/kg). Soils with higher copper concentrations resulted in higher dissolved copper in the water. Copper (dissolved) in surface water in the acclimation phase increased from day 1 to day 7 and then sharply decreased to day 17 and remained relatively constant throughout the end of the acclimation phase at day 48. There was relatively little difference in the concentrations of dissolved copper at day 1 and day 48, especially for CS-10 and grid 6. Concentrations of copper in water were at or above the Florida Administrative Code Surface Water Quality Criteria throughout 6 of the 7 sampling events for grid 6 and in one sampling event with soils from CS-8. Endosulfan sulfate (0.02 to 0.04 μg/L) also exceeded the surface water quality critera (≤ 0.056 μg/L) at three of the sampling events.

The 28-day bioaccumulation test run with *L. variegatus* in acclimated grid 6 soils (365 mg/kg copper) detected an average of 282 mg/kg dw copper in worms, compared to 23 mg/kg dw in worms from control soils. Apple snails bioaccumulated copper at an average of 121 mg/kg dw with CS-8 soils, 70.2 mg/kg dw with CS-10 soils, and 325 mg/kg dw with grid 6 soils, compared to only 19.8 mg/kg dw from control soil.

Survival and growth for *H. azteca* and *C. dilutus* in CS-8 and CS-10 soils (acclimated and unacclimated) were not significantly different from the control. *H. azteca* in grid 6 soils (acclimated and unacclimated) had significantly lower survival and biomass as compared to the control. Mean growth and survival for *C. dilutus* in grid 6 (unacclimated) soils was significantly lower than the control.

Five samples collected from the pilot study area showed considerably higher levels of copper (mean of 140 mg/kg) in the shallow soil samples (0 to 1 inch deep) than those collected from deep soils (0 to a minimum of 6 inches deep) within solution cavities (mean of 14 mg/kg). The survey to determine the percent of soil remaining after scraping found approximately 39 percent of the area with no soil, 50 percent with thin soils (<1 inch), and 11 percent with thick soils (>1 inch). Vertical delineation sampling at eight locations found that copper concentrations greatly decline with depth. None of the samples collected at depths greater than 1 inch exceeded 85 mg/kg.

To reduce the risk from elevated copper concentrations, URS recommended that the proposed 570-acre Frog Pond detention area undergo soil scraping, with the exception of grids G-31, G-32, and G-33, which did not exceed the interim screening value for copper. Excavated soils are planned for use in construction of detention area berms or will be placed east of the project towards the C-111 Canal. In addition, confirmatory sampling is recommended to document the effectiveness of soil scraping.

Summary and Comments

The detected levels of copper in the proposed Frog Pond detention area present a concern for Service trust resources, specifically the endangered Everglade snail kite. Average (148 mg/kg) and 95 percent upper confidence level (UCL) (177 mg/kg) copper concentrations in the proposed Frog Pond detention area exceed the interim screening value (85 mg/kg) for the protection of the snail kite. The copper bioaccumulation study with apple snails found considerably lower biota-sediment accumulation factors (BSAF) (0.9) than a study by Frakes et al. (2008) (7 to 37). This is likely due to the lack of exposure through diet, which has been shown by Hoang et al. (2008) to be a more important route of uptake as compared to sediment exposure. Because no dietary route of uptake was considered, the bioaccumulation study did not represent the potential bioaccumulation upon inundation of Frog Pond soils. Even without accounting for dietary exposure to copper, the maximum concentrations observed using grid 6 soils (426 mg/kg dw) approached the critical snail body burden (estimated at 450 mg/kg dw). Using the snail tissue concentrations from the bioaccumulation study in place of the default BSAF in the food-web model, highly underestimates the exposure to snail kites.

The Service does not concur with the ERA conclusion that bioavailable copper concentrations are expected to be reduced with repeated flooding. The soil acclimation phase of the ERA detected water concentrations that exceeded the surface water quality criteria. There was little difference between the copper concentrations in overlying water from the initial flooding and the seventh flooding during the acclimation phase. A study by Hoang et al. (2008) showed that while there may be a slight decrease in dissolved copper concentration in water with repeated flooding events, the concentration of free copper (Cu^{+2}), which is highly bioavailable, increased with the number of flooding events due to a decrease in dissolved organic carbon (DOC).

Detected concentrations of other metals and pesticides were noticeably lower than previously sampled areas outside of the project footprint. The site-wide 95 percent UCL for endosulfan (20.37 μg/kg) exceeded its calculated site-specific SQAG (9.14 μg/kg). The maximum observed

concentration of endosulfan (66.3 μg/kg) predicted no risk to avian fauna using the food-web model (hazard quotients [HQ] < 0); however, impacts to the aquatic community and fish are possible. Mean concentrations for 4,4′-DDE (1.2 μg/kg), chlordane (1.1 μg/kg), and zinc (102 mg/kg) were below SQAG. The mean (45.3 mg/kg) and 95 percent UCL (49.8 mg/kg) for chromium were just above the TEC (43 mg/kg), but have a low potential of posing risk to the benthic community.

Confirmatory sampling conducted as part of the pilot scraping study found an average residual copper concentration of 145 mg/kg with a 95 percent UCL of 173 mg/kg. Further sampling conducted in the ERA to determine the vertical distribution of copper at the scraped grid found an average copper concentration of 93 mg/kg with a 95 percent UCL of 106 mg/kg. Newfields used this 95 percent UCL for copper (106 mg/kg) to calculate the area-weighted concentration expected after soil scraping. An estimated 65 mg/kg of copper was calculated for the area-weighted concentration, which is below the 85 mg/kg interim screening value. There is no mention of the pilot study confirmatory sampling results in the ERA. If the 95 percent UCL from the confirmatory sampling is used in place of the 95 percent UCL from the vertical delineation, then the area-weighted copper concentration estimated for scraped soils (106 mg/kg) exceeds the interim screening value for copper. Unless there is a valid reason to discount confirmatory sampling results, the Service recommends that all available data should be used to estimate the area-weighted average copper concentration. Using the Service calculated 95 percent UCL from both the ERA and the draft pilot study report resulted in an estimated area-weighted average of 80 mg/kg copper. Regardless of the 95 percent UCL that is used in the area-weighted calculation, we feel that five acres is an insufficient area to calculate a 95 percent UCL for a 570-acre site.

The Service concurs with the recommendation for soil scraping, provided that post-scraping confirmatory sampling be conducted on a representative percentage of the project site. Confirmatory sampling should include a measure of the relative percent of soil remaining and the concentration of copper within these soils. These data should be used to calculate an estimated area-weighted average for the entire Frog Pond detention area. Once these confirmatory samples are collected, determination about the need for monitoring or further remediation can be made. We recommend that if Frog Pond soils are to be reused in the construction of berms, they pass all leachability testing criteria.

Thank you for the opportunity to provide comments regarding the Frog Pond Property. If you have any questions, please contact Emily Bauer at 772-562-3909, extension 335.

Sincerely yours,

Robert Fraker

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc: electronic only
DEP, West Palm Beach, Florida (Joe Lurix)
Corps, West Palm Beach, Florida (Tori White)
Newfields, Boulder, Colorado (Joe Allen)
URS, Boca Raton, Florida (Edward Leding)

LITERATURE CITED

Frakes, R.A., T.A. Bargar, E.A. Bauer. 2008. Sediment copper bioavailability to freshwater snails in south Florida: risk implications for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*). Ecotoxicology 17:598-604.

Hoang, T.C., E.C. Rogevich, G.M. Rand, R.A. Frakes. 2008. Copper uptake and depuration by juvenile and adult Florida apple snails (*Pomacea paludosa*). Ecotoxicology 17:605-615.

Hoang, T.C., L.J. Schuler, E.C. Rogevich, P.M. Bachman, G.M. Rand, R.A. Frakes. 2008. Copper release, speciation, and toxicity following multiple flooding of copper enriched agriculture soils: Implications in Everglades restoration. Water Air Soil Pollut. 199:79-93.

URS

September 10, 2009

Robert A. Frakes, Ph.D.
U.S. Fish & Wildlife Service
South Florida Ecological Services Field Office
1339 20th Street
Vero Beach, FL 32960

RE: **Soil Management Plan Addendum – Detention Area / Response to U.S. Fish and Wildlife Service Comments**
C-111 Spreader Canal Northern Storage Area
Frog Pond
Florida City, FL
Job # 38617-408

Dear Dr. Frakes:

On behalf of the South Florida Water Management District (District), URS Corporation (URS) is pleased to present to following responses to the U.S. Fish and Wildlife Service's (Service) on the Soil Management Plan (SMP) referenced above. URS submitted this plan to the Service on July 28, 2009.

On August 17, 2009, the Service contacted URS in regards to SMP. The Service requested that estimates be made for the amount of residual copper impacted soils remaining in place in the low lying areas after scraping and relocating surficial soils inside the footprint of the Detention Area. The Service also requested that additional confirmation soil samples be collected and to describe a more specific sampling methodology.

On August 19, 2009, URS submitted a memorandum, via electronic mail, to the Service detailing a proposed survey for estimating the amount of residual soils remaining within the Detention Area footprint after the soils has been scraped. A detailed soil sampling methodology was also provided. A copy of the memorandum is attached.

After reviewing the memorandum, on August 21, 2009, the Service provided comments on the memorandum via electronic mail. On August 27, 2009, URS contacted the Service and discussed the comments. Based on the conversation with the Service, URS formulated responses and submitted them to the Service on August 27, 2009 via electronic mail. Given below are the August 21, 2009 Service comments and URS' August 27, 2009 responses.

Robert A. Frakes, Ph.D.
U.S. Fish and Wildlife Service
September 10, 2009

Service Comment - *Step two in the post-scraping activities states that within each 125-acre cell, solution cavities >100 ft^2 will be identified and recorded with GPS. I just want to verify that all depressional areas >100 ft^2 will be measured, not just the 10 that are actually sampled.*

URS Response: All solution cavities / depressional areas greater than 100 square feet will be identified in each of the 125-acre cells. Ten of these areas in each 125-acre cell will be selected for soil sampling and analysis of copper.

Service Comment - *If there are numerous small solution cavities (<100 ft^2), then we need to account for their contribution to the average Cu concentration for the site. Maybe there is an easy way to estimate the area that small cavities represent and simply add that to the total area of Cu impacted soil. We could assume that the small solution holes have the same copper concentration as the average calculated from the larger holes. If there is no easy way to accurately estimate the total area of the small cavities, then I would suggest performing a survey on a small, representative portion of the property and actually measuring the total area the small cavities represent and extrapolating that to the whole site. Of course this might all be irrelevant if there are relatively few small solution cavities. We just won't know until it's scraped.*

URS Response: Smaller solution cavities / depressional areas that are less than 100 square feet but greater than 25 square feet will be measured in one, representative 125-acre cell. This data will be extrapolated for the entire Detention Area. In addition, at least two, 1-acre areas will be selected in each of the five, 125-acre cells, and all solution / depressional areas less than 25 square feet will be measured.

Service Comment - *Regarding step three in the post-scraping activities, I think that the largest solution cavities should be targeted for sampling, since they represent the greatest area and source of exposure.*

URS Response: The larger solution cavities / depressional areas within each of the 125-acre cells will be targeted for sampling.

Service Comment - *I recommend that the discrete samples be composed of a 5-point close proximity composite. This might be what was intended, but I just wanted to verify.*

URS Response: As noted, all soil samples collected will be composed of a 5-point, close proximity composite.

Also, as recommended by Newfields, an additional set of 5-point close proximity composite soil samples will be collected from the 0 to 2-inch interval and analyzed for copper. These samples will be collected at 50 % of the solution cavities / depressional

areas that are targeted to be sampled (25 locations). Soil samples collected as part of the pilot study indicated that copper was mostly confined to the top 2 inches. The 0 to 2-inch data will augment the mass balance work conducted to date.

URS appreciates providing this addendum / responses to the Service's comments on the SMP and memorandum. If you have any questions concerning these responses or this project please contact URS at your convenience.

Respectfully Submitted

URS Corporation

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Projects Director

Attachment 1 - URS Memorandum to U.S. Fish and Wildlife Service dated August 19, 2009

C: Robert Taylor, District
Joe Lurix, FDEP – Southeast District
Ligia Mora-Applegate, FDEP – Tallahassee, FL

MEMORANDUM

TO: Emily Bauer, U.S. Fish and Wildlife Service

FROM: URS Corporation

DATE: August 19, 2009

SUBJECT: **Soil Management Plan**
Detention Area – Frog Pond
C-111 Spreader Canal Northern Storage Reservoir
Copper and Zinc Impacted Soil
Florida City, Miami-Dade County, Florida

This memorandum is intended to summarize the activities for estimating the amount of residual copper impacted soil following scraping of the surficial soil within the Frog Pond Detention Area footprint located west of Florida City in Miami-Dade County, Florida. The Frog Pond property is located in Sections 30 and 31, Township 57 South, Range 38 East and Sections 6 and 7, Township 58 East, Range 38 East and consists of approximately 5,216 acres, of which 1,380 acres are currently used for agricultural production. The Detention Area footprint will be constructed on approximately 600 acres in the western portion of the 1,380 acres of the property.

The Frog Pond Detention Area is located within the C-111 Spreader Canal Project. One aspect of the C-111 Spreader Canal Project consists of constructing a Detention Area with a total capacity of approximately 293.7 acre-feet. The C-111 canal to the east of the subject property has disrupted the natural groundwater flow away from the Everglades National Park and Taylor Slough that are located to the south and west of the property. The groundwater flow is currently to the southeast on the property. The construction of the Detention Area will re-establish the natural groundwater flow patterns to flow toward the Taylor Slough and ultimately into Florida Bay. The design for the Detention Area involves water infiltrating through the bottom of the reservoir to the groundwater in order to create a groundwater mound that will force groundwater on the property to flow towards the south and west. The anticipated high water mark in the Detention Area is three feet above the cap-rock floor surface.

URS Corporation (URS) developed a Soil Management Plan (SMP) that provides the procedures required for the excavation and relocation of soils with concentrations above the U.S Fish and Wildlife Service's (Service) Soil Quality Assessment Guidelines (SQAGs) values for copper and zinc at the Frog Pond property. Since these impacted soils are located within the footprint of the Detention Area, the soils need to be excavated and relocated, prior to flooding, to

minimize the risk to benthic macroinvertebrates as well as to fish and wildlife resources, and endangered and threatened species of concern.

Following excavation activities, a survey will be conducted on a representative proportion of the Frog Pond Detention Area to determine the area-weighted average of the residual copper concentrations. Below are the soil survey activities following scraping of the surficial soil within the footprint of the Detention Area:

1) Divide the 600-acre Detention Area into five, 125-acre cells from south to north.

2) Within each 125-acre cell, representative low lying areas greater than 100 square feet (ft^2) will be identified and recorded with a global positioning unit (GPS).

3) Based on the initial survey select at least 10 representative low lying areas greater the 100 ft^2 for copper analysis.

4) Measure soil depths within the representative low lying areas.

5) Collect discrete soil samples from each of the 10 representative low lying areas in each of the 125-acre cells.

    a. 0 up to 6-inches (n = 50).
    b. 6 inches to base (n = 25).

6) Analyze samples for copper.

The 10 locations within each of the 125-acre cells will be considered representative of the 125-acre cells. Ten discrete shallow soil samples and five discrete vertical soil samples will be collected from each of the 5, 125-acre cells. The discrete shallow sample will be collected from approximately 0 to 6-inches below land surface (bls). The second sample will be collected from 6-inches to the bottom of the VUGs. All samples will be analyzed for copper. The soil analytical data will then be utilized to calculate the area-weighted average for residual copper across the Frog Pond Detention Area.

Once all excavation, relocation, surveying, and sampling activities have been conducted, a summary report will be developed documenting the field activities and summarize the analytical results.

If you have any questions or require additional information, please contact me at (561) 994-6500, extension 1061.

Fred Schuknecht

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Joe Lurix, Waste Program Administrator**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: SEP 11 2009
SUBJECT: **Soil Management Plan for the Frog Pond area at the C-111 Spreader Canal**

As requested, I have reviewed the Soil Management Plan for the Frog Pond section of the C-111 Spreader Canal Project, dated July 29, 2009, (received July 31, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. It is stated on p. 6, paragraph 3, of the Soil Management Plan, that the groundwater flow direction at the site is southeast, towards the C-111 Canal, yet all of the proposed monitoring wells are directly west of the feature in question. It would seem prudent to place the monitoring wells for both the stock pile locations and the levee sections constructed with a blend of impacted soils and fill, down gradient of the monitored feature.

2. The Department concurs with the consultant's recommendation to conduct post-scraping confirmatory sampling within the footprint of the detention area.

3. Due to the possibility that copper will desorb from the sediments at levels above the Surface Water Quality Criteria, it is suggested that monitoring for copper concentrations in the post-inundation surface water be a condition of the permit.

4. Please be reminded that co-located contaminants necessitate apportionment, in order to account for the additive effects of multiple contaminants of concern at the same site.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Inger Hansen, Engineer IV, Watershed Management & Planning

090726

URS

September 17, 2009

Mr. Paul Wierzbicki, P.G.
Waste Cleanup Supervisor
Florida Department of Environmental Protection, Southeast District
400 North Congress Avenue
West Palm Beach, Florida 333401

RE: **Response to FDEP Comments**
Soil Management Plan for the Frog Pond
Miami-Dade County, Florida
Job # 38617-355/408

Dear Mr. Wierzbicki:

URS Corporation (URS) has reviewed the Florida Department of Environmental Protection (FDEP) Southeast District comments in the September 11, 2009 memorandum on URS' "*Soil Management Plan for the Frog Pond section of the C-111 Spreader Canal Project.*" The report was submitted to the FDEP on July 29, 2009.

We appreciate your timely review, comment, and assistance on this important restoration project. URS and the South Florida Water Management District (District) agree with the comments issued by the FDEP and will incorporate the modifications into the *Soil Management Plan*. Below are the FDEP comments and URS' responses. A copy of the FDEP memorandum dated September 11, 2009 is included as **Attachment A**.

FDEP Comment # 1 *- It is stated on p. 6, paragraph 3, of the Soil Management Plan, that the groundwater flow direction at the site is southeast, towards the C-111 Canal, yet all of the proposed monitoring wells are directly west of the feature in question. It would seem prudent to place the monitoring wells for both the stock pile locations and the levee sections constructed with a blend of impacted soils and fill, down gradient of the monitored feature.*

URS Response #1: All monitor well locations were initially proposed immediately south of the monitored feature. The monitor wells will be installed southeast of the three proposed stock pile locations. However the monitor well located at the southern terminus of the Detention Area will remain in the proposed location. Figure 6 from the *Soil Management Plan* illustrating the updated monitor well locations is given in **Attachment B**.

FDEP Comment # 2 *- The Department concurs with the consultant's recommendation to conduct post-scraping confirmatory sampling within the footprint of the detention area.*

URS Response #2: Noted. The District has recently agreed with the U.S. Fish and Wildlife Service (Service) and the FDEP to modify the *Soil Management Plan*. The modification includes the collection of additional samples as well as analysis of the organochlorine pesticide 4,4-DDT and its metabolites. This additional confirmation sampling should provide the necessary confidence concerning site wide soil contaminate concentrations post scrapping. The *Soil Management Plan Addendum* which includes the soil sampling modification was submitted on September 10, 2009.

FDEP Comment # 3 *- Due to the possibility that copper will desorb from the sediments at levels above the Surface Water Quality Criteria, it is suggested that monitoring for copper concentrations in the post-inundation surface water be a condition of the permit.*

URS Response #3: The *Soil Management Plan* does not specifically address surface water sampling; however it is URS' understanding that the District plans to conduct startup sampling of the surface water within the Detention Area which includes copper.

FDEP Comment # 4 *- Please be reminded that co-located contaminants necessitate apportionment, in order to account for the additive effects of multiple contaminants of concern at the same site.*

URS Response #4: Noted. In the event that elevated concentrations of multiple chemicals of concern are exhibited in the confirmation soil samples, URS will evaluate the effects of the multiple contaminates.

We appreciate your timely review, comments, and assistance on this important restoration project. Please note that the above comments and responses have and/or will be incorporated into the *Soil Management Plan*. If you have any questions concerning the above responses or require additional information concerning this project please contact URS at your convenience.

Respectfully Submitted,

URS CORPORATION

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Vice President

URS

Attachments

Attachment A FDEP Memorandum dated September 11, 2009
Attachment B Updated Monitor Well Locations

C: Robert Taylor, District
Robert Frakes, Ph.D., U.S. Fish and Wildlife Service – Vero Beach, FL
Ligia Mora Applegate – FDEP Tallahassee
Joe Allen, NewFields

Attachment A

FDEP Memorandum dated September 11, 2009

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Joe Lurix, Waste Program Administrator**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: SEP 11 2009
SUBJECT: **Soil Management Plan for the Frog Pond area at the C-111 Spreader Canal**

As requested, I have reviewed the Soil Management Plan for the Frog Pond section of the C-111 Spreader Canal Project, dated July 29, 2009, (received July 31, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. It is stated on p. 6, paragraph 3, of the Soil Management Plan, that the groundwater flow direction at the site is southeast, towards the C-111 Canal, yet all of the proposed monitoring wells are directly west of the feature in question. It would seem prudent to place the monitoring wells for both the stock pile locations and the levee sections constructed with a blend of impacted soils and fill, down gradient of the monitored feature.

2. The Department concurs with the consultant's recommendation to conduct post-scraping confirmatory sampling within the footprint of the detention area.

3. Due to the possibility that copper will desorb from the sediments at levels above the Surface Water Quality Criteria, it is suggested that monitoring for copper concentrations in the post-inundation surface water be a condition of the permit.

4. Please be reminded that co-located contaminants necessitate apportionment, in order to account for the additive effects of multiple contaminants of concern at the same site.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Inger Hansen, Engineer IV, Watershed Management & Planning

090726

Attachment B

Updated Monitor Well Locations

DRAWN: R.A.C.	REVISIONS	BY	DATE
CHECKED: E.L.			
DATE: JULY 09			

URS

7800 CONGRESS AVENUE, SUITE 202
BOCA RATON, FLORIDA 33487
PHONE: (561) 904-6300
FAX: (561) 904-6301

FROG POND
SOIL MANAGEMENT PLAN
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-408 DATE: JULY 2009

LOCATION OF PROPOSED GROUNDWATER MONITOR WELLS

FIGURE: 6

R:\Environmental\Labs\Shared\FrogPond\Soil Management Plan\Figures\FIG.proj, mxd 9.00.dwg, 09/14/09

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Robert Taylor, South Florida Water Management District**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: SEP 25 2009
SUBJECT: **Response to Comments on the Soil Management Plan for the Frog Pond Area of the C-111Spreader Canal, Miami-Dade County, Florida**

I have reviewed the Response to Comments on the Soil Management Plan for the Frog Pond Area of the C-111 Spreader Canal, dated September 17, 2009, (received September 21, 2009) and have the following comment within the scope of the Waste Cleanup Section.

1. The responses to comments 1 through 4 are accepted as presented, as long as the District performs copper sampling in appropriate areas, using appropriate test methods.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Joe Lurix, Waste Program Administrator (Joe.Lurix@dep.state.fl.us)
Inger Hanson, Engineer IV, Watershed Management & Planning
Ed Leding, P.G., URS Corporation

090883

A.1.1.3 Protocol

Agenda
Meeting to Discuss FDEP Comments on
CERP Environmental Site Assessment process
November 3, 2006

1. Introductions (15 min)
2. Presentation-Overview of the CERP ESA process (1 hour)
3. Break (identify comments to be discussed in more detail)
4. Detailed discussion of key comments

MEETING ATTENDANCE

DATE: 11/3/06 PROGRAM: SFWMD / DEP

MEETING SUBJECT: CERP

MEETING ROOM: 2ND Floor NO. OF PARTICIPANTS: TELEPHONE: VOICE POINT:

NAME	REPRESENTING	TELEPHONE #	FAX #	E-MAIL ADDRESS
Paul Wierzbicki	FDEP/Waste	561/681-6677	561/681-6770	paul.wierzbicki@dep.state.fl.us
Chad Kennedy	" WRE	6706		William.C.Kennedy@DEP
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Mtattend 2/02

Florida Department of
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Michael W. Sole
Secretary

April 4, 2008

Mr. Robert Kukleski
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Re: Protocol For Assessment, Remediation And Post-Remediation Monitoring For Environmental Contaminants On Everglades Restoration Projects

Dear Mr. Kukleski:

The Florida Department of Environmental Protection (Department) has reviewed the "Whitepaper to Address Florida DEP Remaining Concerns about the Ecological Risk Assessment (ERA) Protocol" prepared by Newfields and dated October 15, 2007. As we have discussed, this white paper satisfactorily addresses the Department's remaining comments regarding the "Protocol For Assessment, Remediation And Post-Remediation Monitoring For Environmental Contaminants On Everglades Restoration Projects" (protocol).

We appreciate the South Florida Water Management District's (SFWMD's) continued efforts to address our concerns regarding sampling density and the use of composite samples for agricultural field assessments. The SFWMD has provided modifications to the procedures that serve to reduce the chance of false negatives in this protocol. Although the protocol does not reduce the chance of false negatives to the level that the Department would normally seek on a "typical" contaminated site with a known discharge location, that level of assurance is not practically achievable given the nature and magnitude of the Everglades restoration effort.

The Department also agrees with deferring any fish tissue analysis to the post-construction phase of the projects. The construction process will radically alter the existing environment and it is the post-construction environment about which we are most concerned. Future decisions about whether to conduct fish tissue analysis should be made on a project by project basis.

The Department acknowledges that no serious, large scale risks from agricultural residuals are likely to be missed by using the protocol and we have no further proposals on how to efficiently and cost-effectively identify any potential remaining risks at this time. However, the protocol only pertains to these agricultural residuals. "Point source" contamination must still be assessed and remediated in accordance with all applicable Department statutes and rules, including but not limited to Rules 62-770 and 62-780, F.A.C.

The Department believes it is appropriate to periodically review and revise the protocol as needed and recommends that the parties undertake this review over intervals of no longer than five years. I appreciate the SFWMD's diligence and resourcefulness throughout the development of this protocol and look forward to working with you on upcoming projects.

Sincerely,

Brian J. Dougherty, Administrator
Program & Technical Support Section
Bureau of Waste Cleanup

cc: Joe Lurix, DEP Southeast District Office
Greg Knecht, Ecosystem Projects Coordination

DEPARTMENT OF THE ARMY
SOUTH ATLANTIC DIVISION, CORPS OF ENGINEERS
ROOM 10M15, 60 FORSYTH ST, S.W.
ATLANTA, GEORGIA 30303-3490

REPLY TO
ATTENTION OF:

CESAD-PDS-P

30 June 2010

MEMORANDUM FOR MR. JAMES DALTON, CECW-CE, HQUSACE

SUBJECT: Agrochemical Contaminants and Soil Management Plans Associated With the Indian River Lagoon South and C-111 Spreader Canal Projects

1. References

a. Memorandum, CECW-PC, 11 June 2010, Subject: Policy Compliance Review for the CERP, C-111 Spreader Canal Western Project Final Integrated Project Implementation Report and Environmental Impact Statement, dated November 2009.

b. ASA (CW) letter, 4 June 2010, addressed to Carol Ann Wehle, Executive Director, South Florida Water Management District (SFWMD).

2. Policy guidance included with the referenced documents contains direction to coordinate with regulatory agencies on proposed treatment. Reference 1a included specific direction to coordinate with EPA Region IV. Upon further investigation it has been determined that EPA Region IV has delegated this regulatory program responsibility to Florida Department of Environmental Protection (FDEP) for these agriculture chemicals. EPA Region IV is not exercising regulatory authority in this matter. Coordination for the proposed soil management with FDEP and Fish and Wildlife Service (FWS) are or will soon be complete. Consequently, further coordination with EPA Region IV in this instance would provide no additional value. Accordingly, as FDEP has the EPA-delegated regulatory authority for this soil management plan, we intend to provide evidence of their concurrence in response to reference 1a.

3. I coordinated with Stan Meiburg, Regional Administrator, today on this issue and he confirmed that he does not want to review individual soil management plans for each project and prefers that clean up measures for agrochemicals be coordinated with FDEP. As a result, I have directed Jacksonville District to complete any remaining coordination required on these and other affected CERP projects with FDEP and FWS to ensure compliance with the intent of the policy guidance.

4. My staff point of contact on this issue is Mike Magley, (404) 562-5206.

TODD T. SEMONITE
Major General, USA
Commanding

A.2 PROTOCOL

Whitepaper to Address Florida DEP Remaining Concerns about the Ecological Risk Assessment (ERA) Protocol

Prepared by
Joseph Allen, Mark Lewis, Ph.D., and Shahrokh Rouhani, Ph.D., P.E.
NewFields Companies, LLC

Prepared for
South Florida Water Management District

October 15, 2007

NEWFIELDS

1.0 INTRODUCTION

The South Florida Water Management District (SFWMD) routinely acquires large agricultural tracts for incorporation into water storage and water quality improvement projects. Many of these tracts have residual chemicals present in the soil associated with routine agrochemical application during the period of agricultural use. In order to characterize the level of chemical impacts on these tracts, SFWMD and its land acquisition contractors have utilized a protocol for sampling and subsequent risk assessment ("the protocol") of these properties which was developed by the United States Fish and Wildlife Service (USFWS) in cooperation with SFWMD. This protocol has been in use for a number of years and has been revised occasionally to reflect lessons learned through the assessment process. The intent of the protocol is to ensure that the sampling density and methodology is consistent between project objectives and is sufficient to adequately characterize these properties with regard to chemical impacts and potential future use. As the protocol states (USFWS, 2004, page 1):

"Many of these lands proposed for acquisition will support functioning water reservoirs (storm water treatment areas, Aquifer Storage and Recovery detention reservoirs, and storage reservoirs) designed to impound a wide range of water capacities and depths over long periods of time. Additionally, many of these reservoirs will cover large expanses of several thousand acres, establishing local and regional aquatic ecosystems as well as providing foraging habitat for waterfowl and other aquatic wildlife. Without appropriate risk management and attention to design alternatives, the subsequent release of these pesticides and trace metals into CERP [the Comprehensive Everglades Restoration Plan] *wetlands, reservoirs, and conveyances will provide exposure pathways to the regional fish and wildlife communities in south Florida."*

Ultimately, the data collected using the USFWS protocol are utilized in performing ecological risk assessments (ERA) and in the decision making process as to whether the land is suitable for the proposed water quality projects, or whether remedial actions are required to protect the receptors that may utilize the habitat created by the proposed water quality improvement project.

This document has been prepared in response to concerns raised by the Florida Department of Environmental Protection (FDEP) regarding the ERA guidance. In recent months, FDEP has provided comments on environmental reports for tracts within the BBCW and C-111 projects, and other SFWMD projects. On October 20, 2006 FDEP provided SFWMD with a list of comments and concerns related to the ERA guidance. A meeting to discuss these comments was held on November 3, 2006 with technical experts representing FDEP, USFWS and SFWMD with the primary goal of addressing FDEPs concerns regarding the ERA guidance and associated sampling protocols. These comments, including the SFWMD responses to the comments were provided at the November 3, 2006

meeting. A round of comments based on the SFWMD responses was provided to SFWMD on February 26, 2007 by FDEP.

To address the above FDEP comments, a draft version of this document was submitted to FDEP on July 9, 2007, which was followed by a joint FDEP/SFWMD meeting on July 12, 2007. Discussions during this meeting indicated that the submitted draft document satisfactorily addressed most of the concerns raised by FDEP. A final round of comments, highlighting the remaining concerns, was provided to SFWMD on September 9, 2007 by FDEP. This document has been revised to address these comments.

2.0 OUTLINE OF THE ECOLOGICAL RISK ASSESSMENT GUIDANCE

The ERA guidance outlines a multi-phased approach toward determining the presence or absence of hazardous materials and the potential for ecological risk associated with their presence. The assessment steps provided in the ERA guidance are as follows:

- An initial Phase I Environmental Site Assessment ("ESA") is performed according to American Society of Testing and Materials ("ASTM") Standard Practice E1527-00 with the goal of identifying the presence or likely presence of any hazardous substance of petroleum products on the property.
    - The Phase I ESA includes a thorough site inspection, review of historical aerial photographs, land use records, and review of pertinent environmental databases, as well as onsite personnel interviews. Information acquired via the Phase I ESA is used to determine the necessity for a Phase II ESA.
    - If the Phase I ESA indicates the presence of contamination or that the potential for contamination exists, a Phase II ESA is initiated that includes coordination with the USFWS.
- A Phase II ESA is used to identify sources and locations of contamination, specifically contaminants of potential concern (both human health and ecological), and provide recommendations for additional sampling, testing or risk assessment; and corresponding corrective actions.
    - The Phase II ESA is focused on potential point sources at the property along with additional limited sampling within canals or agricultural fields.
    - Data are used to conduct a screening-level ERA (SLERA) using available benchmarks, such as the Florida Sediment Quality Assessment Guidelines (SQAGs) and/or surface water quality standards and assessment of risk to USFWS trust species.

- The ERA guidance recommends risk assessment protocols for further risk-based evaluation should the results of the SLERA indicate that risks may be elevated at the site.

3.0 OUTLINE OF THE PHASE II SAMPLING PROTOCOL

The sampling protocol for Phase II ESAs provides data for risk assessment purposes in both potential point source areas and within current or former agricultural areas. The media sampled may include soils, sediments, groundwater and/or surface water (if present).

- Phase II ESA sampling is generally focused on facilities (current and/or former) and potential point sources on the property.
  - Discrete samples are collected from all potential source areas identified during the site inspection or historical review conducted as part of the Phase I ESA and may include: pesticide mixing and loading areas, storage sheds, vehicle turn-arounds, airstrips, cattle dip tanks, pumping stations and burn areas.
  - Sediment and surface water data are collected from canals at the site.

- Phase II sampling also includes the collection of data from the current or former agricultural areas at the property following a standard protocol. The collected data in the former agricultural areas are intended to provide representative average concentrations over the specified grids for risk assessment purposes. The proposed sampling protocol does not recommend the use of grid-wide values, especially grid composite data, to delineate and/or evaluate extents or magnitudes of potential hot spots.

  - On small properties (< 500 acres), discrete samples are collected at regular intervals across the property with a density of at least one sample per 10 to 20 acres with a minimum of 10 samples.
  - On large properties (> 500 acres), a composite sampling protocol is instituted based on 50-acre grid cells.
    - On very large properties, a previously determined number of grids are randomly selected for sampling.
    - On smaller properties (e.g. < 1000 acres) an attempt is made to sample all grids.
      - 50-acre grids are stratified by agricultural use.
      - Grids are divided into ten 5-acre plots.
      - A discrete random sample is collected from each 5-acre plot.
      - Samples are composited from all discrete samples within the 50-acre grid.
      - A second aliquot from each 5-acre grid sample is typically archived for future analysis.
      - Copper is analyzed in all 5-acre discrete samples.

4.0 RISK MANAGEMENT GOALS AND GUIDING PRINCIPLES FOR THE CERP LAND ACQUISITION AND ASSESSMENT.

Risk Management Goals (RMGs) are an important part of assessing risk (EPA 1998). The RMGs for an ERA form the basis of the sampling design and process by which risks are assessed. The RMGs implicit in CERP guiding documents and ERA risk assessment and management process are as follows:

- The overall purpose of CERP is to manage ecosystem nutrient loading and hydrology.
- The CERP process recognizes that agricultural chemicals, and the risk of adverse effects from them cannot be completely removed (i.e., cannot manage to NO Risk).
- The benefits realized from reclamation of wetland and hydrologic function through CERP outweighs risk of adverse effects from residual agricultural chemicals.
- Risks to USFWS trust species are managed to avoid unacceptable adverse effects on "individual" basis rather than on a population basis.
- Ecological function from other aquatic receptors (benthos and fish) is protected on populations and community basis, some effect is tolerated if ecosystem function is protected.
- Risks and ecological function are assessed and managed on a landscape scale rather than on the smaller scale typically encountered on a regulated industrial or commercial cleanup site.
- The ability to assess ecotoxic risk is limited by available resources (time and money).

The ERA process design is based on the primary RMGs of protecting Trust wildlife species, and ecological function on a landscape scale. The process for assessing benthic effects is based on this underlying principle in that:

- The Assessment Endpoint for the benthic community is based on function of the community as a whole ecosystem occupying the landscape. Functions of benthos include nutrient cycling (including organic carbon) and to provide important prey base for the aquatic food web. These functions are generally scaled over large, landscape levels rather than at small scales and can tolerate small-scale disturbances provided that the majority of the community

remains viable. The overall impact on function should be related to the degree to which the system is affected.

- The system level effects from direct sediment toxicity to benthos (or anything else), if they occur, do not extend beyond the boundaries of the affected portion of the site (whereas bioaccumulation effects can affect area and resources beyond contaminated spot).
  - As a result, a relatively small portion of an area may be severely affected, without affecting function in the system.
  - Conversely, a large area with relatively small level of effects can have significant system effects because a proportionately larger fraction of the system is affected.

- The RMGs relate to restoring ecosystem function and protecting Trust wildlife species. For benthos and other ecological functions, this typically applies to landscape scales of the project areas. As a result, the ERA assessment goal for benthos is geared toward detecting large areas of even small effects, possibly sacrificing resolution of proportionately small areas of higher impact. This is consistent with the goals cited in the USFWS/SFWMD Guidance. This is driven, in part, by limited resources (time and money) to investigate such large tracts.

5.0 ADDRESSING FDEP KEY CONCERNS AND RECOMMENDATIONS

As noted, FDEP provided a series of comments about various aspects of the sampling protocol. Some of these comments were satisfactorily addressed by SFWMD. The remaining FDEP comments can be grouped into the following key concerns:

- Reliability of composite samples proposed in large property investigations;
- Random selection of grids for composite sampling and analysis in very large properties;
- Analysis of resulting composite data in ERA decisions;
- Sufficiency of collected data in agricultural areas of the investigated properties;
- The use of copper Threshold Effect Concentrations (TECs), Probable Effect Concentrations (PECs) and the interim benchmark for the protection of the Everglades snail kite.
- The overall protectiveness of the process for benthic receptors (i.e. the aquatic community).
- The use of bioaccumulation and toxicity testing studies.
- Additional analysis for heavy metals.
- Canal sediment sampling.
- Fish tissue sampling.

The following sections address the above concerns and provide recommendations where appropriate.

5.1 Discrete Sample Compositing

In large properties, discrete sampling at short intervals would be at best cost prohibitive, if not impracticable. Reducing the sample density, however, can lead to under-representation of large portions of the property, as well as elevated likelihood of missing hotspots. Composite sampling is a compromise, under which large numbers of discrete samples are collected, but composited prior to laboratory analyses. As early as the 1980s, the United States Environmental Protection Agency (EPA) recognized the utility of composite sampling in large site investigations (e.g. EPA, 1989, Section 6.6).

The main advantage of composite sampling is its expanded spatial coverage, which is achieved without the ensuing increase in analytical costs. The proposed composite samples, which are unbiased and representative samples of their constituent aliquots, have the following characteristics:

- Composite samples yield unbiased and representative estimates of average concentrations over exposure areas that have ecologically relevant scales for large properties. For example, comparison of an individual composite sample to appropriate ecological benchmarks allows an appropriate remedial decision concerning the entire 50-acre grid.

- For the aquatic community endpoint, site-wide averages are an appropriate scale. Composite samples directly provide estimates of exposure and potential risk to the entire aquatic community that may colonize the site.

- For the USFWS trust species, risks to individuals are more important than risks to the population due to their threatened or endangered status. This sampling protocol allows for average concentrations to be measured directly over areas that may encompass the entire foraging range or only a portion of the foraging range depending on the species being evaluated.

The primary disadvantage of composite samples is the likelihood of masking hotspots by diluting the elevated discrete samples with cleaner aliquots. This masking can be viewed as a form of a "*false negative*," i.e., the probability of yielding clean composite results, while certain portions of the grid may exceed ecological benchmarks.

The protocol attempts to minimize the above disadvantage by including rules according to which all discrete aliquot samples associated with an exceeding composite sample should be analyzed individually. As noted, recent adjustments to the protocol have also called for the analysis of the archived discrete aliquot samples from adjacent grids.

The above protocol rule addresses the false negative problem associated with elevated composite samples. The question that remains is the problem of false negatives among non-exceeding composites. For this purpose, available data can be used to quantify such likelihoods. For example, consider the discrete and composite copper concentrations from 37 50-acre grids from various sites that have been sampled under the Phase II ESA protocol, as listed in Table 1. Figure 1 shows the range of variability of discrete aliquot samples associated with each composite. The issue is whether these exceeding discrete values are ecologically significant.

The probability of an aliquot exceeding a benchmark in a given grid can be computed as the ratio of the number of exceeding discrete aliquots in that grid over its total number of aliquots. Using the above copper data, Table 2 lists the aliquot exceedance rates in individual grids based on the three copper benchmark levels routinely used in the SLERAs of 85 ppm (USFWS Interim Benchmark for the Everglades Snail Kite), 31.6 ppm (TEC), and 150 ppm (PEC). On average, the aliquot exceedance in individual grids increases with decreasing ecological benchmarks and increasing composite values.

To address FDEP's concern about false negatives associated with non-exceeding composite samples, a supplementary step can be added to the protocol. For this purpose, a subset of non-exceeding grids is randomly selected, in which all discrete aliquots are laboratory analyzed. These discrete results are then added to discrete aliquot data produced for exceeding grids. When selecting the subset of non-exceeding grids, the following should be considered: (1) the non-exceeding grids targeted for discrete sampling shall not be clustered; and (2) the number of non-exceeding grids targeted for discrete sampling shall be at least 20% of the total number of non-exceeding grids but not greater than 10.

For each grid, the aliquot exceedance rate is computed based on the appropriate ecological benchmarks. The resulting rates are then listed according to the ascending order of their corresponding composite values, as listed in Table 2. Using these results, then the average aliquot exceedance rates are computed in the ascending grids (i.e., all grids having a composite value equal or less than the given grid). Such results allows the analyst to identify the composite concentration beyond which ascending average aliquot exceedance rates is greater than a pre-determined level, *e.g.* 5%. This composite threshold value is then considered as the area-specific trigger level. The trigger values for the example copper dataset based on the above three ecological benchmarks are listed in Table 2.

Consistent with the FDEP's recommendation, the final area-specific trigger levels must meet the following criteria: (1) trigger levels shall be determined on a chemical- and area-specific basis; and 2) if the empirically derived trigger level

exceeds the chemical-specific PEC (or PEC equivalent) benchmark then the benchmark shall be used as the trigger level.

Upon the above determination, all grids associated with composite concentrations in excess of the trigger level either will be remediated in their entirety, or their discrete samples will be laboratory analyzed for all contaminants of concern and investigated in a manner similar to other previously analyzed discrete samples. This supplementary step: (a) enhances the conservative basis of the protocol, (b) reduces the chances of false negatives consistent with area-specific results, and (c) avoids reliance of arbitrary trigger levels, such as 1/10 of a benchmark.

As the final comments of FDEP indicate, although the above approach reduces the likelihood of false negatives, it does not eliminate the chances of such occurrences. The question that immediately arises is whether the proposed approach leaves unreasonable data gaps regarding undetected hot spots. For this purpose, the following must be considered:

- The majority of hot spots are likely to occur within grids associated with composite concentrations in excess of trigger values. Therefore, although such hot spots may go undetected individually, they will be addressed collectively through proposed grid-wide remediations or further investigation.

- Under the proposed approach, the chances of missing isolated hot spots in non-exceeding grids, *i.e.* grids with composite concentrations less than trigger values, will be maintained below a pre-determined level, *e.g.* 5%. Given the fact that non-exceeding grids cover only parts of the area, the cumulative extent of undetected, isolated hot spots on an area-wide basis will always remain below the pre-determined level.

- The cumulative extent of undetected, isolated hotspots is further reduced by the fact that in the revised approach, based on the FDEP's recommendation, trigger values are ensured to remain at or below their corresponding benchmark criteria, i.e. the final chances of missing isolated hot spots in non-exceeding grids will always be at or below the pre-determined level.

- Regardless of sampling density, any field measurement entails the likelihood of a false negative. As EPA guidance (1989, page 2-1) states the question is: "*How can you balance the two sets of possibilities: the chance that the site is contaminated even when the sampling shows attainment of the cleanup standard, and the chance of contamination when the majority of samples taken show the site to be clean? The answer is to evaluate the potential magnitude of these two errors and balance them using the statistical strategies described in* [EPA (1989)]." This is exactly how SFWMD approached the problem and addressed it in accordance with EPA Guidance (EPA, 1989).

Considering the above, SFWMD concludes that the proposed sampling protocol provides a balanced approach, which maintains the chances of false negatives at a reasonable level. Language addressing FDEP's concerns regarding the accumulation of risk based on unidentified, small hot spots will be included as an uncertainty in all future risk assessments.

5.2 Random Selection of Grids

As noted, the protocol prescribes random selection of a pre-determined number of 50-acre grids for composite sampling and analysis in very large properties (>1000 acres). FDEP raised concerns about the fact that such random selections may lead to data gaps and uneven sampling of the property resulting in under-representation of large portions of the property.

Theoretically, the homogeneity of the delineated properties mitigates concerns about potential gaps and under-representations. In fact, the ERA Phase I investigation is primarily focused on ensuring the homogeneity of the investigated properties by excluding potential hotspots and point sources. The chance, however, exists that random selection of grids may leave certain zones of a property under-represented.

To address the above concern SFWMD proposes to divide very large properties into super-grids, each consisting of about 25 50-acre grids, and then randomly select a pre-determined number of grids from each super-grid. This stratified random sampling, which is consistent with EPA Guidance (EPA, 1989, Section 6.5.2.2), addresses the coverage issue, while preserving the unbiased nature of the sampling process, without undue increases in the overall cost of the sampling or analysis effort.

5.3 Analysis of Composite Data

FDEP has raised a number of comments concerning the use of composite data in remedial computations and decisions, specifically with regards to maximum and the upper confidence level of the mean (UCL) computations. Comments indicate that the main concerns stem from the apparent treatment of composite values, which are physical averages of a finite number of aliquots, as discrete values.

Any sample is representative of a given volume. The use of discrete and composite data is predicated on the following fundamental requirements that are already imbedded in the protocol, including:

- Samples representative of different volumes shall not be mixed in any statistical computations. For example, the UCL of the mean concentration

over an area cannot be calculated based on a mixture of composite and discrete samples.

- Estimates, such as mean or maximum concentration, computed based on composite or discrete samples, shall be considered as representative of the volumetric base of their constituent sample data.

- ERA decisions must be made based on sample data that have volumetric bases consistent with the given decision.

The computational procedures in the protocol are based on strict separation of composite and discrete samples. These procedures fully recognize the fact that composite data generally have lower standard deviations when compared to discrete datasets. However, many statistical procedures have self correcting mechanism to account for such differences. For example, discrete data are usually more numerous than composite data, *e.g.* Table 1. However, when calculating the UCL, the higher standard deviation of the discrete aliquot copper data is compensated by their larger sample size. As a result, UCLs of the mean based on both discrete and composite data would yield nearly similar results. As listed in Table 3, in the example dataset, although discrete aliquots have a higher standard deviation, due to their much larger number, yield a lower UCL when compared to the one calculated based on composite data.

Such self correcting mechanism does not exist for composite sample statistics. For example, on average, the maximum composite concentration in a given property is bound to be less than the maximum discrete concentrations. For example, see Table 3. Use of such sample statistics in an ERA decision is appropriate, if only the volumetric base of the composite data are considered as consistent with the underlying assumptions of the given decision.

5.4 Sufficiency of Composite Data

FDEP has raised concerns about the potential insufficiency of composite datasets for characterizing large properties. In statistical terms, large sample sizes are required for characterization of highly variable contaminants (see EPA, 1989, Box 6.10, page 6-14). The protocol pursues procedures to ensure the homogeneity of the delineated properties. Implicit in this approach is the low level of variability among the contaminants of concern within the delineated area. However, definitive confirmation of the data adequacy occurs upon the completion of the sampling effort when UCL of the mean over the entire area is computed.

Given the unbiased and representative nature of composite samples, if the computed UCL is less than ecological benchmarks, then consistent with EPA guidance (EPA, 1989, Section 6.4.3), the property as a whole can be considered as clean and the sample size can be viewed as adequate. In contrast, if the

resulting composite data display high variability, then the computed UCL may exceed ecological benchmarks, even when the computed mean is low. Under such a condition, the sample size can be viewed as inadequate for determining the clean status of the property.

If data inadequacy is determined, specific alternative can be pursued, including: (a) additional grid sampling; or (b) segregating grids that cause elevated standard deviations and repeat the process for each part separately. The segregation of composite data into statistically homogeneous subsets can be accomplished using techniques, such as the probability plot analysis (DON, 2002).

The above post-sampling analyses not only provide appropriate data for ERA decisions, but also confirm the sufficiency of the data to reach the appropriate decision.

5.5 The Use of Copper Benchmarks

Comments from FDEP have indicated concern over the application of the TEC and PEC copper benchmarks along with the interim benchmark for the protection of the Everglades snail kite. The comments have suggested that the snail kite benchmark appears to supersede all other values in risk assessment conclusions and risk management decisions.

Current SFWMD practice is to analyze all discrete 5-acre grid subcells from sampled 50-acre grid cells for copper. As a result, copper is evaluated in all current SLERAs conducted at citrus farms on a discrete sample basis only. This is an example of a protocol change made in response to agency (USFWS) comments.

In practice, all copper data are screened against the TEC. If the maximum concentration (grid composite or discrete sample) exceeds the TEC, the copper distribution is further evaluated by identifying the (discrete) grid cells in which the TEC or the PEC is exceeded. The results are presented in reports. Copper concentrations in all samples are also compared to the 85-ppm snail kite benchmark and the locations exceeding this value are identified.

Based on the results of the SLERA, risk managers at SFWMD make decisions on corrective actions and/or decisions to do more extensive ecological risk analysis, including toxicity testing, bioaccumulation testing, and elutriate testing as appropriate to the chemicals and receptors identified in the Phase II analysis.

Remediation for copper is usually based on exceedance of the snail kite screening value (85 ppm). Toxicity test results used for development of the SQAGs indicate that the 85-ppm value is protective of benthos. The snail kite value is approximately 57% of the copper PEC (150 mg/Kg). Although specific

data for copper are not available for review, FDEP (2003) indicates that an average PEC-quotient (PEC-Q) less than 0.5 (50%) for all chemicals combined corresponds to less than 20% toxicity in laboratory tests (See Attachment A, Table 4.10). This also applies to PEC-Q for combined metals (see Table 2 in USEPA 2000). This percentage is within the range corresponding to identification of TECs (See Attachment A, Table 4.8). Therefore, site management decisions made to protect snail kites based on this value appear to be protective of benthic invertebrates.

5.6 Overall Protectiveness of the ERA Process for the Aquatic Community

Comments received from FDEP have indicated that the use of the PEC value for screening purposes is not acceptable and have suggested the use of the PEC divided by a safety factor (i.e., 1/10 of the PEC) for use in the SLERA. FDEP comments also suggest that risk from combinations of chemicals (i.e., cumulative risks) are not adequately represented, and that sediment toxicity testing should be used to assess this aspect of risk to benthos.

SFWMD disagrees that 1/10 PEC should be used as a screening value. In response to past comments from FDEP and USFWS, the ERA screening process that is implemented is more conservative than described in the guidance and essentially equivalent to what FDEP has suggested. The process described above for copper is also applied to all other chemicals detected at each site. All chemical results are first screened against the TEC. For properties smaller than 500 acres this means that each 5-acre parcel is screened. For larger properties, this includes 50-acre grid composite samples. All screening results are presented in the ERA reports.

FDEP (2003) recommends using a TEC as a screening level, below which adverse effects on benthics is considered unlikely. For most organic chemicals, the TEC is less than 20% of the PEC, and for many important insecticides, less than 10% (Table 4). For metals, the ratio is higher, but still protective based on the RMGs described in previous sections. Therefore, the level of conservatism implied by screening against the TEC is near that requested for composite samples in FDEP's comment.

To address the issue of a cumulative risk to benthos from multiple chemicals, SFWMD proposes adding the PEC-quotient (PEC-Q) method to the screening process (FDEP 2003). Based on data presented by FDEP (2003), the SFWMD proposes to use a mean PEC-Q of 0.5 as a screening level. Samples from the Southeastern US with mean PEC-Q values less than 0.5 exhibited detectable toxicity in less than 20% of samples (See Attachment A, Table 4.10). FDEP guidance relies upon TECs as screening levels, and TECs typically represent concentrations at which 15-30% of toxicity tests show positive results (See

Attachment A, Table 4.8). Therefore, a PEC-Q corresponding to equivalent toxicity would offer similar protection.

Results could be used to determine whether corrective actions can be used to reach acceptable conditions. If corrective action decisions cannot be made on the basis of the above, then an expanded ERA will be performed for the site. The scope for the expanded ERAs is dependent upon results of the SLERA, and on site-specific conditions and data needs. In the past, the expanded risk assessments have included toxicity testing to varying degrees. Use of toxicity testing as part of an expanded ERA may be considered. SFWMD proposes that standard testing procedures be used to maintain consistency.

5.7 Bioaccumulation and Toxicity Testing Studies

In cases where expanded ERAs are necessary, additional data are required that allow the ERA to move beyond the typical SLERA stage. The USFWS/SFWMD guidance document provides some examples of the types of testing that could be done as part of an expanded ERA. Comments received from FDEP have provided additional suggestions.

In current practice, the use of expanded ERAs has been minimal. The Phase I/Phase II ESA process associated with the acquisition process requires relatively quick turn-around in the initial 'screening' stages. On a project-specific basis, long-term investigations (*e.g.*, long-term bioaccumulation testing) are not feasible in the initial stages. SFWMD practice has been to make conservative decisions on corrective actions to expedite process.

Expanded ERAs have been conducted under USFWS oversight in cases where decisions on corrective actions are not possible based on screening assessments. Such assessments have included bioaccumulation and toxicity testing. Study designs have been based on EPA and ASTM standard methods.

SFWMD is willing to combine data from past bioaccumulation and toxicity testing exercises to glean trends in bioaccumulation rates, and to support the development of South Florida benchmarks based on toxicity test results. Results can be used to help guide use of toxicity tests and bioaccumulation testing in the future.

SFWMD is also willing to consider research, or use of non-standard methods on a separate path. However, schedule and budget constraints in the Phase I/II process must be considered. The SFWMD agrees that additional types of data may be valuable as part of an expanded ERA and that consultation with FDEP can be beneficial to the successful completion of an expanded ERA.

5.8 Additional Analysis for Heavy Metals

The FDEP has requested that the SFWMD consider routinely analyzing soil, sediment, and groundwater samples for metals such as cadmium, chromium, boron, vanadium, nickel, and zinc because these heavy metals may be present in pesticides.

The SFWMD already routinely analyzes samples for cadmium and chromium, as part of the eight Resource Conservation and Recovery Act (RCRA) metals suite. However, these metals have not typically been detected at concentrations to raise any human health or ecological concerns.

A detailed evaluation of agrochemical application is typically conducted as part of the Phase I environmental site assessment (ESA) portion of the CERP ERA process. This evaluation includes interviews with the property manager regarding the type, quantity, timing, and method of application of agrochemicals. The evaluation also typically includes a review of material safety data sheets (MSDS) for chemicals which are handled by the property manager. Based on the SFWMD's experience, the chemicals cited by FDEP as potential components of pesticides have not been noted on any reviewed MSDS. In the event that any of these metals were noted in the MSDS, the analytical suite for the Phase II ESA would be expanded to include these chemicals. The SFWMD does not believe that routine analyses for these metals are warranted. Therefore, the SFWMD proposes to conduct these analyses on a case by case basis, as warranted by the Phase I ESA results.

5.9 Canal Sediment Sampling

The FDEP has suggested expanding the sampling of sediments in site canals as a potential screening tool for the CERP ERA protocol. While limited canal sediment sampling is typically performed as a component of the ERA protocol, the SFWMD's experience indicates that expanded canal sediment sampling is not likely to be an effective screening tool. Currently, canal sediment sampling is typically limited to potential point source areas where run-off of agrochemicals into the canals appears likely. A limited number of canal sediment samples are also typically collected in areas where canals converge or in other areas which the sampler believes would most likely be impacted.

One of the major concerns with using canal sediment sampling as a screening tool is the high potential for false negatives due to the fact that most agricultural canals are dredged on a routine basis. In many cases, the SFWMD has found a complete lack of sediments for sampling, or the chemicals of concern in the site soils have been banned for many years (e.g., DDT) and the canals have been dredged multiple times since the last application.

Additionally, since very few canals originate and terminate on the same property, it is very difficult to conclude whether the sediments in the canal originated on-site or off-site. The presence of absence of a chemical in the canal sediments appears to be a poor predictor of whether the chemical will be detected in the site soils.

Lastly, the presence of contaminants in canal sediments would probably be a minor contributor to ecological risk on agricultural properties after they are converted to water storage or treatment areas. The relatively low contribution to the overall ecological risk is also associated with several factors related to the typical construction characteristics of these projects.

(1) Most of the canals within the areas proposed for flooding are backfilled during construction to promote sheet flow across the storage areas. The backfilling of the canals would eliminate the exposure pathway to contaminated canal for ecological risk.
(2) The canals generally represent a very small percentage of the overall footprint of the eventual project areas, so they do not represent a significant portion of total habitat area when compared to the project scale.
(3) Existing conditions in many remaining canals would typically not be preferred habitat for wading birds and other sensitive receptors due to steep banks that prevent shallow water areas needed for emergent vegetation and that are preferred by wading birds.

If canal segments are to be included in project plans as part of the deepwater refugia, then samples will be collected from segments that are to remain. However, these segments cannot be identified during the Phase I/II process because detailed designs are not available.

5.10 Fish Tissue Sampling

The FDEP has suggested the collection of fish tissue samples from existing canals on agricultural properties as a screening mechanism for evaluating cumulative ecological risk. The SFWMD acknowledges that fish tissue analysis may be an appropriate tool in post-construction monitoring and adaptive management of the CERP projects. However, pre-construction sampling of fish within existing canals would not be an effective tool in making decisions about corrective actions or evaluating post construction conditions.

Foremost, it must be acknowledged that most of the canals on these agricultural properties cross many properties. Both the surface water and fish in these canals move freely between sites. While the home range of smaller fish may be solely within the subject property boundaries, the fish are exposed to water,

sediment, and possibly food sources that enter the subject property from upgradient areas. As a result, it would not be possible to infer that any accumulation of agrochemicals in fish tissue is associated with the subject property.

The construction of the CERP projects typically involves significant alteration of the surface water hydrology and habitat on these agricultural sites. Therefore, post-construction conditions are likely to be vastly different from pre-construction conditions. It is likely that most of the existing fauna on these properties would be excluded from the proposed water storage areas due to significant alteration of the habitat during and after the construction stage. For example, most existing fish in the site canals would move off-site during the draining and filling of on-site canals and other disruptive construction activities.

The SFWMD has limited experience that indicates that fish tissue may not be a reliable indicator of sources of contamination in sediments. On one particular site, no significant concentrations of toxaphene were detected in fish tissue samples collected from existing canals where high toxaphene concentrations were present in the soils of the adjacent property. Additionally, the interpretation of the data is likely to require iterative sampling and negotiating access to off-site properties in order to determine whether the source of any identified fish tissue burdens are related to on-site or off-site sources. Such a process is not likely to fit into schedule available during the property acquisition process.

Fish tissue samples collected on a project-wide basis may be good indicators of contaminants that may have the potential to cause risk following construction of the project. Such information could be used to focus on the contaminant types (and associated land uses) that are important to manage or control through design and management of the reservoirs and STAs. However, such samples do not appear to be a useful tool in the relatively narrowly focused decisions associated with the property acquisition Phase I/II process.

6.0 SUMMARY

The ecological risk assessment protocol designed and utilized by SFWMD and USFWS represents a defensible and adequate approach to making informed risk management decisions regarding the purchase of property to be utilized in various SFWMD projects.

This document was prepared in order to address several concerns regarding the protocol that have been raised by FDEP. These concerns have been grouped into ten (10) categories and the conclusions reached in each for each of these topics following discussions with FDEP are as follows:

- Reliability of composite samples proposed in large property investigations.

- An area and chemical-specific trigger value that is equal or less than the PEC benchmark (or PEC equivalent benchmark) will be calculated and used to indicate grids requiring discrete sample analysis.

- Random selection of grids for composite sampling and analysis in very large properties.
  - On very large properties, using a 'super-grid' system, blocks of 50-acre grid cells will be created and a random subset of those grids will be sampled in a stratified random sampling design to ensure more uniform sample coverage.

- Analysis of resulting composite data in ERA decisions.
  - Statistical calculations will not mix composite and discreet data and estimates of the mean will be noted as being calculated on a volumetric basis.

- Sufficiency of collected data in agricultural areas of the investigated properties.
  - Additional data may be collected if the non-point source dataset is deemed to be statistically inadequate.
  - Discrete samples will continue to be collected at all known point-source locations

- The use of copper Threshold Effect Concentrations (TECs), Probable Effect Concentrations (PECs) and the interim benchmark for the protection of the Everglades snail kite.
  - A review of the toxicological data used to calculate the TEC and PEC indicates that the interim benchmark for the Everglades snail kite is expected to approximate the benthic toxicity predicted by the TEC and is adequately protective of the aquatic community.

- The overall protectiveness of the process for benthic receptors (i.e. the aquatic community).
  - The PEC-Q approach recommended in the FDEP sediment benchmark guidance document will be utilized as another line-of-evidence in assessing risk to the aquatic community.

- The use of bioaccumulation and toxicity testing studies.
  - Where expanded ERAs are required, SFWMD will consider the use of bioaccumulation studies using both standard and non-standard protocols on a project-specific basis.

- Additional analysis for heavy metals.
  - SFWMD will consider the analysis of heavy metals not included in the standard Phase II investigation on a case-by-case basis if the Phase I investigation indicates their potential presence.

- Canal sediment sampling.
  - If canal segments are to be included in project plans as part of the deepwater refugia, then samples will be collected from segments that are to remain but not as part of the property acquisition Phase I/II process.

- Fish tissue sampling.
  - Fish tissue samples do not appear to be a useful tool in the relatively narrowly focused decisions associated with the property acquisition Phase I/II process; however, their collection will be considered on a project-wide basis.

7.0 REFERENCES

Department of Navy (DON), *"Guidance for Environmental Background Analysis, Volume I: Soil, NFESC User's Guide,"* UG-2049-ENV, April 2002.

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United States Environmental Protection Agency (EPA). *"Prediction of sediment toxicity using consensus-based freshwater sediment quality guidelines."* Prepared by USGS for USEPA. EPA 905/R-00/007. 2000.

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Tables

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
AG Property	A1	1	A1-1	79	mg/Kg dw		95	mg/Kg dw
AG Property	A1	1	A1-2	200	mg/Kg dw	*	95	mg/Kg dw
AG Property	A1	1	A1-3	50	mg/Kg dw		95	mg/Kg dw
AG Property	A1	1	A1-4	120	mg/Kg dw	*	95	mg/Kg dw
AG Property	A1	1	A1-5	56	mg/Kg dw		95	mg/Kg dw
AG Property	A1	1	A1-6	84	mg/Kg dw		95	mg/Kg dw
AG Property	A1	1	A1-7	74	mg/Kg dw		95	mg/Kg dw
AG Property	A1	1	A1-8	230	mg/Kg dw	*	95	mg/Kg dw
AG Property	A1	1	A1-9	43	mg/Kg dw		95	mg/Kg dw
AG Property	A1	1	A1-10	52	mg/Kg dw		95	mg/Kg dw
AG Property	A2	2	A2-1	37	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-2	55	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-3	71	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-4	85	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-5	37	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-6	17	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-7	2	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-8	81	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-9	22	mg/Kg dw		86	mg/Kg dw
AG Property	A2	2	A2-10	36	mg/Kg dw		86	mg/Kg dw
AG Property	A3	3	A3-1	100	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-2	9	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-3	73	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-4	13	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-5	180	mg/Kg dw	*	90	mg/Kg dw
AG Property	A3	3	A3-6	48	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-7	5.5	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-8	53	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-9	23	mg/Kg dw		90	mg/Kg dw
AG Property	A3	3	A3-10	37	mg/Kg dw		90	mg/Kg dw
AG Property	A4	4	A4-1	120	mg/Kg dw	*	97	mg/Kg dw
AG Property	A4	4	A4-2	190	mg/Kg dw	*	97	mg/Kg dw
AG Property	A4	4	A4-3	25	mg/Kg dw		97	mg/Kg dw
AG Property	A4	4	A4-4	130	mg/Kg dw	*	97	mg/Kg dw
AG Property	A4	4	A4-5	77	mg/Kg dw		97	mg/Kg dw
AG Property	A4	4	A4-6	28	mg/Kg dw		97	mg/Kg dw
AG Property	A4	4	A4-7	50	mg/Kg dw		97	mg/Kg dw
AG Property	A4	4	A4-8	91	mg/Kg dw		97	mg/Kg dw
AG Property	A4	4	A4-9	32	mg/Kg dw		97	mg/Kg dw
AG Property	A4	4	A4-10	45	mg/Kg dw		97	mg/Kg dw
AG Property	A5	5	A5-1	99	mg/Kg dw		120	mg/Kg dw
AG Property	A5	5	A5-2	30	mg/Kg dw		120	mg/Kg dw
AG Property	A5	5	A5-3	150	mg/Kg dw	*	120	mg/Kg dw
AG Property	A5	5	A5-4	26	mg/Kg dw		120	mg/Kg dw
AG Property	A5	5	A5-5	180	mg/Kg dw	*	120	mg/Kg dw
AG Property	A5	5	A5-6	63	mg/Kg dw		120	mg/Kg dw
AG Property	A5	5	A5-7	370	mg/Kg dw	*	120	mg/Kg dw
AG Property	A5	5	A5-8	50	mg/Kg dw		120	mg/Kg dw

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
AG Property	A5	5	A5-9	19	mg/Kg dw		120	mg/Kg dw
AG Property	A5	5	A5-10	45	mg/Kg dw		120	mg/Kg dw
Biscayne Bay CW	S1	6	S1-A	45.1	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-B	8.13	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-C	12.3	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-D	9.07	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-E	5.97	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-F	5.88	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-G	20.8	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-H	2.9	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-I	13.7	mg/kg		20.9	mg/kg
Biscayne Bay CW	S1	6	S1-J	11.8	mg/kg		20.9	mg/kg
Biscayne Bay CW	S2	7	S2-A	6.66	mg/kg		7.35	mg/kg
Biscayne Bay CW	S2	7	S2-B	12	mg/kg		7.35	mg/kg
Biscayne Bay CW	S2	7	S2-C	7.42	mg/kg		7.35	mg/kg
Biscayne Bay CW	S2	7	S2-D	6.13	mg/kg		7.35	mg/kg
Biscayne Bay CW	S2	7	S2-E	4.36	mg/kg		7.35	mg/kg
Biscayne Bay CW	S2	7	S2-F	17	mg/kg		7.35	mg/kg
Biscayne Bay CW	S2	7	S2-G	11.3	mg/kg		7.35	mg/kg
Biscayne Bay CW	S3	8	S3-A	9.6	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-B	7.33	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-C	15.5	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-D	12.9	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-E	5.81	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-F	3.45	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-G	6.21	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-H	19.3	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-I	18.2	mg/kg		6.68	mg/kg
Biscayne Bay CW	S3	8	S3-J	16	mg/kg		6.68	mg/kg
Biscayne Bay CW	S4	9	S4-A	6.08	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-B	5.64	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-C	4.97	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-D	3.15	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-E	3.12	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-F	2.99	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-G	4.24	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-H	13.1	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-I	13.6	mg/kg		4.18	mg/kg
Biscayne Bay CW	S4	9	S4-J	13.5	mg/kg		4.18	mg/kg
Biscayne Bay CW	S5	10	S5-A	15.6	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-B	21.8	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-C	12.8	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-D	6.63	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-E	2.76	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-F	6.12	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-G	4.2	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-H	2.49	mg/kg		4.1	mg/kg
Biscayne Bay CW	S5	10	S5-I	2.24	mg/kg		4.1	mg/kg

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
Biscayne Bay CW	S5	10	S5-J	2.66	mg/kg		4.1	mg/kg
Biscayne Bay CW	S6	11	S6-A	9.78	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-B	9.81	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-C	8.26	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-D	16.2	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-E	2.51	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-F	22.3	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-G	3.02	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-H	6.01	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-I	2.16	mg/kg		5.29	mg/kg
Biscayne Bay CW	S6	11	S6-J	2.45	mg/kg		5.29	mg/kg
Biscayne Bay CW	S7	12	S7-A	27	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-B	29.4	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-C	25.3	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-D	18.8	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-E	26.1	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-F	24.3	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-G	23	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-H	23.2	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-I	20.7	mg/kg		21.8	mg/kg
Biscayne Bay CW	S7	12	S7-J	29.2	mg/kg		21.8	mg/kg
Biscayne Bay CW	S8	13	S8-A	27.2	mg/kg		17.6	mg/kg
Biscayne Bay CW	S8	13	S8-B	35	mg/kg		17.6	mg/kg
Biscayne Bay CW	S8	13	S8-C	3.46	mg/kg		17.6	mg/kg
Biscayne Bay CW	S8	13	S8-D	17	mg/kg		17.6	mg/kg
Biscayne Bay CW	S8	13	S8-E	15.5	mg/kg		17.6	mg/kg
Biscayne Bay CW	S8	13	S8-F	14.6	mg/kg		17.6	mg/kg
Biscayne Bay CW	S8	13	S8-G	15	mg/kg		17.6	mg/kg
Biscayne Bay CW	S9	14	S9-A	53.6	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-B	36.6	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-C	30	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-D	23.6	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-E	29.3	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-F	21.8	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-G	42.1	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-H	28.2	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-I	57.4	mg/kg		28.3	mg/kg
Biscayne Bay CW	S9	14	S9-J	57.1	mg/kg		28.3	mg/kg
Biscayne Bay CW	S10	15	S10-A	82.7	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-B	4.57	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-C	10.4	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-D	2.83	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-E	3.81	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-F	6.61	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-G	15.4	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-H	5.92	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-I	5.34	mg/kg		7.6	mg/kg
Biscayne Bay CW	S10	15	S10-J	7.33	mg/kg		7.6	mg/kg

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
Biscayne Bay CW	S11	16	S11-A	14	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-B	9.32	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-C	8.71	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-D	8.62	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-E	7.69	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-F	9.01	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-G	12	mg/kg		10.5	mg/kg
Biscayne Bay CW	S11	16	S11-H	6.9	mg/kg		10.5	mg/kg
Biscayne Bay CW	S12	17	S12-A	4.75	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-B	4.1	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-C	19.5	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-D	5.36	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-E	5.02	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-F	4.38	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-G	6.35	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-H	3.24	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-I	11.3	mg/kg		4.95	mg/kg
Biscayne Bay CW	S12	17	S12-J	9.65	mg/kg		4.95	mg/kg
Biscayne Bay CW	S13	18	S13-A	4.1	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-B	4.33	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-C	6.2	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-D	3.82	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-E	6.42	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-F	6.81	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-G	4.72	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-H	3.23	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-I	5.4	mg/kg		4.89	mg/kg
Biscayne Bay CW	S13	18	S13-J	26	mg/kg		4.89	mg/kg
Biscayne Bay CW	S14	19	S14-A	3.46	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-B	4.71	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-C	4.65	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-D	4.23	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-E	4	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-F	4.43	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-G	3.96	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-H	4.32	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-I	3.69	mg/kg		4.71	mg/kg
Biscayne Bay CW	S14	19	S14-J	4.59	mg/kg		4.71	mg/kg
Biscayne Bay CW	S15	20	S15-A	4.06	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-B	4.4	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-C	4.69	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-D	4.59	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-E	4.6	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-F	4.24	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-G	4.12	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-H	3.85	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-I	4.39	mg/kg		4.36	mg/kg
Biscayne Bay CW	S15	20	S15-J	4.02	mg/kg		4.36	mg/kg

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
Biscayne Bay CW	S16	21	S16-A	3.41	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-B	3.8	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-C	3.64	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-D	4.01	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-E	3.08	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-F	4.1	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-G	2.58	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-H	2.54	mg/kg	U	3.16	mg/kg
Biscayne Bay CW	S16	21	S16-I	10.1	mg/kg		3.16	mg/kg
Biscayne Bay CW	S16	21	S16-J	2.82	mg/kg		3.16	mg/kg
Biscayne Bay CW	S17	22	S17-A	2.5	mg/kg	U	4.36	mg/kg
Biscayne Bay CW	S17	22	S17-B	2.62	mg/kg	U	4.36	mg/kg
Biscayne Bay CW	S17	22	S17-C	3.44	mg/kg		4.36	mg/kg
Biscayne Bay CW	S17	22	S17-D	2.23	mg/kg	U	4.36	mg/kg
Biscayne Bay CW	S17	22	S17-E	3.53	mg/kg		4.36	mg/kg
Biscayne Bay CW	S17	22	S17-F	3.5	mg/kg		4.36	mg/kg
Biscayne Bay CW	S17	22	S17-G	5.12	mg/kg		4.36	mg/kg
Biscayne Bay CW	S17	22	S17-H	5.5	mg/kg		4.36	mg/kg
Biscayne Bay CW	S17	22	S17-I	5.11	mg/kg		4.36	mg/kg
Biscayne Bay CW	S17	22	S17-J	4.59	mg/kg		4.36	mg/kg
Biscayne Bay CW	S18	23	S18-A	3.72	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-B	4.31	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-C	5.2	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-D	4.61	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-E	4.75	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-F	4.7	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-G	4.46	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-H	4.88	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-I	4.48	mg/kg		4.27	mg/kg
Biscayne Bay CW	S18	23	S18-J	4.42	mg/kg		4.27	mg/kg
Biscayne Bay CW	S19	24	S19-A	4.61	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-B	5.08	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-C	5	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-D	4.72	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-E	5.21	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-F	5.03	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-G	5.36	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-H	5.55	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-I	5	mg/kg		4.41	mg/kg
Biscayne Bay CW	S19	24	S19-J	4.33	mg/kg		4.41	mg/kg
Conley	C2	25	C2-1	120	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-2	11	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-3	78	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-4	220	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-5	110	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-6	180	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-7	64	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-8	180	mg/Kg dw	V	96	mg/Kg dw

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
Conley	C2	25	C2-9	57	mg/Kg dw	V	96	mg/Kg dw
Conley	C2	25	C2-10	52	mg/Kg dw	V	96	mg/Kg dw
Conley	C4	26	C4-1	93	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-2	81	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-3	90	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-4	75	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-5	69	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-6	48	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-7	40	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-8	31	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-9	75	mg/Kg dw	V	87	mg/Kg dw
Conley	C4	26	C4-10	51	mg/Kg dw	V	87	mg/Kg dw
Graves	25GC	27	36G	98	mg/kg		110	mg/kg
Graves	25GC	27	32G	68	mg/kg		110	mg/kg
Graves	25GC	27	28G	270	mg/kg		110	mg/kg
Graves	25GC	27	33G	89	mg/kg		110	mg/kg
Graves	25GC	27	29G	98	mg/kg		110	mg/kg
Graves	25GC	27	25G	160	mg/kg		110	mg/kg
Graves	25GC	27	26G	190	mg/kg		110	mg/kg
Graves	25GC	27	30G	120	mg/kg		110	mg/kg
Graves	25GC	27	34G	98	mg/kg		110	mg/kg
Graves	25GC	27	35G	55	mg/kg		110	mg/kg
Graves	25GC	27	31G	83	mg/kg		110	mg/kg
Graves	25GC	27	27G	190	mg/kg		110	mg/kg
L31 N	046	28	046-A	100	mg/kg		160	mg/kg
L31 N	046	28	046-B	190	mg/kg		160	mg/kg
L31 N	046	28	046-C	500	mg/kg		160	mg/kg
L31 N	046	28	046-D	420	mg/kg		160	mg/kg
L31 N	046	28	046-E	180	mg/kg		160	mg/kg
L31 N	046	28	046-F	130	mg/kg		160	mg/kg
L31 N	046	28	046-G	210	mg/kg		160	mg/kg
L31 N	046	28	046-H	130	mg/kg		160	mg/kg
L31 N	046	28	046-I	130	mg/kg		160	mg/kg
L31 N	046	28	046-J	87	mg/kg		160	mg/kg
MacArthur	M22	29	13M	39	mg/kg		100	mg/kg
MacArthur	M22	29	14M	83	mg/kg		100	mg/kg
MacArthur	M22	29	15M	39	mg/kg		100	mg/kg
MacArthur	M22	29	16M	84	mg/kg		100	mg/kg
MacArthur	M22	29	17M	99	mg/kg		100	mg/kg
MacArthur	M22	29	18M	56	mg/kg		100	mg/kg
MacArthur	M22	29	19M	48	mg/kg		100	mg/kg
MacArthur	M22	29	20M	49	mg/kg		100	mg/kg
MacArthur	M22	29	21M	52	mg/kg		100	mg/kg
MacArthur	M22	29	22M	37	mg/kg		100	mg/kg
MacArthur	M23	30	23M	120	mg/kg		120	mg/kg
MacArthur	M23	30	24M	130	mg/kg		120	mg/kg
MacArthur	M23	30	25M	130	mg/kg		120	mg/kg
MacArthur	M23	30	26M	51	mg/kg		120	mg/kg

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
MacArthur	M23	30	27M	130	mg/kg		120	mg/kg
MacArthur	M23	30	28M	74	mg/kg		120	mg/kg
MacArthur	M23	30	29M	83	mg/kg		120	mg/kg
MacArthur	M23	30	30M	52	mg/kg		120	mg/kg
MacArthur	M23	30	31M	73	mg/kg		120	mg/kg
MacArthur	M23	30	32M	180	mg/kg		120	mg/kg
MacArthur	M55	31	53M	42	mg/kg		60	mg/kg
MacArthur	M55	31	54M	29	mg/kg		60	mg/kg
MacArthur	M55	31	55M	55	mg/kg		60	mg/kg
MacArthur	M55	31	56M	49	mg/kg		60	mg/kg
MacArthur	M55	31	57M	58	mg/kg		60	mg/kg
MacArthur	M55	31	58M	47	mg/kg		60	mg/kg
MacArthur	M55	31	59M	36	mg/kg		60	mg/kg
MacArthur	M55	31	60M	30	mg/kg		60	mg/kg
MacArthur	M55	31	61M	13	mg/kg		60	mg/kg
MacArthur	M55	31	62M	35	mg/kg		60	mg/kg
MacArthur	M117	32	113M	31	mg/kg		100	mg/kg
MacArthur	M117	32	114M	57	mg/kg		100	mg/kg
MacArthur	M117	32	115M	320	mg/kg		100	mg/kg
MacArthur	M117	32	116M	53	mg/kg		100	mg/kg
MacArthur	M117	32	117M	18	mg/kg		100	mg/kg
MacArthur	M117	32	118M	31	mg/kg		100	mg/kg
MacArthur	M117	32	119M	75	mg/kg		100	mg/kg
MacArthur	M117	32	120M	140	mg/kg		100	mg/kg
MacArthur	M117	32	121M	100	mg/kg		100	mg/kg
MacArthur	M117	32	122M	34	mg/kg		100	mg/kg
Marcott	M1	33	M1-1	15	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-2	100	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-3	99	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-4	130	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-5	150	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-6	25	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-7	51	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-8	46	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-9	57	mg/Kg dw	V	120	mg/Kg dw
Marcott	M1	33	M1-10	65	mg/Kg dw		120	mg/Kg dw
Marcott	M2	34	M2-1	45	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-2	33	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-3	66	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-4	56	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-5	45	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-6	15	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-7	14	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-8	48	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-9	16	mg/Kg dw		89	mg/Kg dw
Marcott	M2	34	M2-10	29	mg/Kg dw		89	mg/Kg dw
Marcott	M3	35	M3-1	57	mg/Kg dw		86	mg/Kg dw
Marcott	M3	35	M3-2	88	mg/Kg dw		86	mg/Kg dw

Table 1. Examples of Aliquot and Composite Copper Data

Area	Grid ID	Grid Number	Aliquot ID	Copper (Aliquot)	Unit	Qualifier	Copper (Composite)	Unit
Marcott	M3	35	M3-3	33	mg/Kg dw		86	mg/Kg dw
Marcott	M3	35	M3-4	60	mg/Kg dw		86	mg/Kg dw
Marcott	M3	35	M3-5	21	mg/Kg dw		86	mg/Kg dw
Marcott	M3	35	M3-6	51	mg/Kg dw		86	mg/Kg dw
Marcott	M3	35	M3-7	43	mg/Kg dw	V	86	mg/Kg dw
Marcott	M3	35	M3-8	98	mg/Kg dw	V	86	mg/Kg dw
Marcott	M3	35	M3-9	45	mg/Kg dw	V	86	mg/Kg dw
Marcott	M3	35	M3-10	24	mg/Kg dw	V	86	mg/Kg dw
Marcott	M4	36	M4-1	59	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-2	1.2	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-3	96	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-4	4	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-5	22	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-6	19	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-7	18	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-8	80	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-9	23	mg/Kg dw	V	210	mg/Kg dw
Marcott	M4	36	M4-10	31	mg/Kg dw	V	210	mg/Kg dw
Tetley	TC	37	1T	36	mg/kg		40	mg/kg
Tetley	TC	37	3T	54	mg/kg		40	mg/kg
Tetley	TC	37	5T	24	mg/kg		40	mg/kg
Tetley	TC	37	7T	21	mg/kg		40	mg/kg
Tetley	TC	37	9T	23	mg/kg		40	mg/kg
Tetley	TC	37	10T	85	mg/kg		40	mg/kg
Tetley	TC	37	11T	24	mg/kg		40	mg/kg
Tetley	TC	37	12T	42	mg/kg		40	mg/kg

Table 2. Determination of Copper Trigger Levels Using Different Ecological Benchmarks

Benchmark	Rate of Aliquots Exceeding Benchmark					
	85 ppm		TEC (31.6 ppm)		PEC (149 ppm)	
Copper (Composite in ppm)	Individual Grid Rate	Ascending Grid Average	Individual Grid Rate	Ascending Grid Average	Individual Grid Rate	Ascending Grid Average
3.16	0%	0%	0%	0%	0%	0%
4.1	0%	0%	0%	0%	0%	0%
4.18	0%	0%	0%	0%	0%	0%
4.27	0%	0%	0%	0%	0%	0%
4.36	0%	0%	0%	0%	0%	0%
4.36	0%	0%	0%	0%	0%	0%
4.41	0%	0%	0%	0%	0%	0%
4.71	0%	0%	0%	0%	0%	0%
4.89	0%	0%	0%	0%	0%	0%
4.95	0%	0%	0%	0%	0%	0%
5.29	0%	0%	0%	0%	0%	0%
6.68	0%	0%	0%	0%	0%	0%
7.35	0%	0%	0%	0%	0%	0%
7.6	0%	0%	10%	1%	0%	0%
10.5	0%	0%	0%	1%	0%	0%
17.6	0%	0%	14%	2%	0%	0%
20.9	0%	0%	10%	2%	0%	0%
21.8	0%	0%	0%	2%	0%	0%
28.3	0%	0%	50%	4%	0%	0%
40	0%	0%	50%	7%	0%	0%
60	0%	0%	70%	10%	0%	0%
86	0%	0%	70%	12%	0%	0%
86	20%	1%	80%	15%	0%	0%
87	20%	2%	90%	19%	0%	0%
89	0%	2%	60%	20%	0%	0%
90	20%	2%	60%	22%	10%	0%
95	30%	3%	100%	25%	20%	1%
96	50%	5%	90%	27%	30%	2%
97	40%	6%	80%	29%	10%	2%
100	30%	7%	70%	30%	10%	3%
100	10%	7%	100%	32%	0%	3%
110	75%	9%	100%	35%	33%	4%
120	40%	10%	70%	36%	30%	4%
120	40%	11%	80%	37%	10%	5%
120	50%	12%	100%	39%	10%	5%
160	100%	15%	100%	40%	50%	6%
210	10%	14%	30%	40%	0%	6%
Lower Bound of Trigger Level	**95**		**28.3**		**120**	

Note: Composite values corresponding to the highlighted cells define the bounds of the trigger value for the given benchmark based on a cutoff exceedance rate of 5%

Table 3. Descriptive Statistics of Aliquot and Composite Copper Data

Parameters	Aliquot	Composite
Count	362	37
Minimum	1.2	3.2
Maximum	500.0	210.0
Mean	44.7	55.0
Std. Deviation	61.6	54.5
Std. Error	3.2	9.0
95%UCL of Mean	50.0	70.1

Table 4
Florida SQAGs and TEC/PEC Ratio

from: Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. FDEP 2003

Chemical	TEC	PEC	TEC/PEC
Arsenic	9.8	33	0.3
Barium	20	60	0.33
Beryllium	NG	NG	--
Boron	NG	NG	--
Cadmium	1	5	0.2
Chromium	43	110	0.39
Cobalt	50	NG	--
Copper	32	150	0.21
Lead	36	130	0.28
Mercury	0.18	1.1	0.16
Nickel	23	49	0.47
Silver	1	2.2	0.45
Strontium	NG	NG	--
Titanium	NG	NG	--
Zinc	120	460	0.26
Zircon	NG	NG	--
Acenaphthene	6.7	89	0.08
Acenaphthylene	5.9	130	0.05
Anthracene	57	850	0.07
Fluorene	77	540	0.14
Naphthalene	180	560	0.32
Phenanthrene	200	1200	0.17
Benz[a]anthracene	110	1100	0.1
Benzo(a)pyrene	150	1500	0.1
Chrysene	170	1300	0.13
Dibenz[a,h]anthracene	33	140	0.24
Fluoranthene	420	2200	0.19
Pyrene	200	1500	0.13
Total PAHs	1600	23000	0.07
Total PCBs	60	680	0.09
Hexachlorobenzene (HCB)	20	240	0.08
Hexachlorobutadiene (HCBD)	55	550	0.1
Bis(2-ethylhexyl)phthalate	180	2600	0.07
Dimethyl Phthalate	NG	NG	--
Diethyl Phthalate	630	NG	--
Di-n-butyl Phthalate	NG	43	--
Chlordane	3.2	18	0.18
Dieldrin	1.9	62	0.03
Sum DDD	4.9	28	0.18
Sum DDE	3.2	31	0.1
Sum DDT	4.2	63	0.07
Total DDTs	5.3	570	0.01
Endrin	2.2	210	0.01

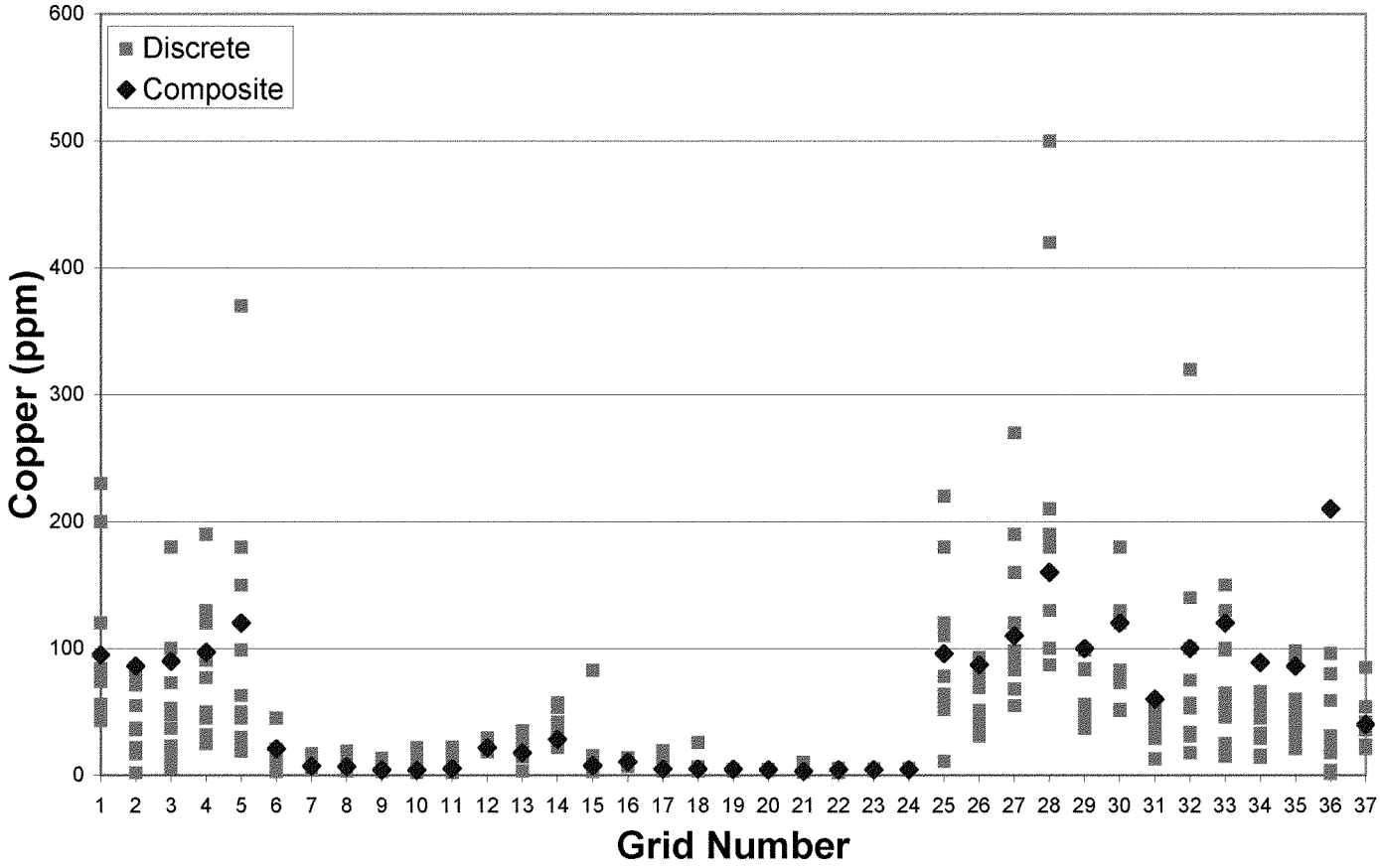
Table 4
Florida SQAGs and TEC/PEC Ratio

from: Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. FDEP 2003

Chemical	TEC	PEC	TEC/PEC
Heptachlor Epoxide	2.5	16	0.16
Lindane	2.4	5	0.48
Azinphos-ethyl	0.018	NG	--
Azinphos-methyl	0.062	NG	--
Diazinon	0.38	NG	--
Ethion	NG	NG	--
Malathion	0.67	NG	--
Methidathion	NG	NG	--
Phosmet	NG	NG	--
Phosphamidon	NG	NG	--
Phoxim	0.06	NG	--
Pyrazophos	0.015	NG	--

Figures

Figure 1. Examples of Composite and Discrete Aliquot Copper Data



Attachment A
Exerpted Tables from:

Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. (FDEP 2003)

Table 4.8. Incidence of toxicity within ranges of contaminant concentrations defined by the sediment quality guidelines (SQGs; from MacDonald *et al.* 2000a)

Substance	Number of Samples Evaluated	Incidence of Toxicity (number of samples in parenthesis)		
		≤TEC	TEC-PEC	>PEC
Metals				
Arsenic	150	25.9% (15 of 58)	57.6% (38 of 66)	76.9% (20 of 26)
Cadmium	347	19.6% (20 of 102)	44.6% (29 of 65)	93.7% (118 of 126)
Chromium	347	28% (37 of 132)	64.4% (38 of 59)	91.7% (100 of 109)
Copper	347	17.7% (28 of 158)	64.0% (48 of 75)	91.8% (101 of 110)
Lead	347	18.4% (28 of 152)	53.6% (37 of 69)	89.6% (112 of 125)
Mercury	79	65.7% (23 of 35)	70.0% (28 of 40)	100% (4 of 4)
Nickel	347	27.7% (51 of 184)	62.7% (32 of 51)	90.6% (87 of 96)
Zinc	347	18.4% (30 of 163)	60.9% (39 of 64)	90.0% (108 of 120)
Polycyclic Aromatic Hydrocarbons (PAHs)				
Anthracene	129	17.3% (13 of 75)	92.9% (26 of 28)	100% (13 of 13)
Fluorene	129	29% (27 of 93)	85.7% (12 of 14)	100% (13 of 13)
Naphthalene	139	24.7% (21 of 85)	94.1% (16 of 17)	92.3% (24 of 26)
Phenanthrene	139	17.7% (14 of 79)	88.2% (30 of 34)	100% (25 of 25)
Benz[a]anthracene	139	17.1% (13 of 76)	70% (14 of 20)	100% (20 of 20)
Benzo(a)pyrene	139	18.5% (15 of 81)	75.7% (28 of 37)	100% (24 of 24)
Chrysene	139	20% (16 of 80)	68.1% (32 of 47)	95.8% (23 of 24)
Fluoranthene	139	25% (24 of 96)	82.5% (33 of 40)	100% (15 of 15)
Pyrene	139	20.5% (16 of 78)	63.0% (29 of 46)	96.4% (27 of 28)
Total PAHs	167	18.5% (15 of 81)	65.1% (43 of 66)	100% (20 of 20)
Polychlorinated Biphenyls (PCBs)				
Total PCBs	120	11.1% (3 of 27)	31.0% (9 of 29)	82.3% (42 of 51)
Organochlorine Pesticides				
Chlordane	193	14.9% (15 of 101)	75.0% (15 of 20)	73.0% (27 of 37)
Dieldrin	180	16.5% (18 of 109)	95.2% (20 of 21)	100% (10 of 10)
Sum DDD	168	19.8% (20 of 101)	33.3% (1 of 3)	83.3% (5 of 6)
Sum DDE	180	18.1% (19 of 105)	33.3% (1 of 3)	96.7% (29 of 30)
Sum DDT	96	23% (23 of 100)	0.0% (0 of 1)	91.7% (11 of 12)
Total DDT	110	17.4% (16 of 92)	100% (23 of 23)	100% (10 of 10)
Endrin	170	29.4% (37 of 126)	40.0% (4 of 10)	NA% (0 of 0)
Heptachlor Epoxide	138	17.8% (16 of 90)	85.0% (17 of 20)	37.5% (3 of 8)
Lindane	180	28.1% (34 of 121)	65.9% (29 of 44)	82.4% (14 of 17)

NA = not applicable; TEC = threshold effect concentration; PEC = probable effect concentration.

Table 4.10. Incidence of sediment toxicity within ranges of mean PEC-Qs for sediments from Florida and elsewhere in the southeastern portion of the United States.

Toxicity Test - Endpoint	n	Avg mean Q	Incidence of Toxicity (number of samples in parentheses)					
			<0.1	0.1 to <0.5	0.5 to <1.0	1.0 to <5.0	≥1.0	≥5.0
10-d *Hyalella azteca* survival	522	0.379	13% (15 of 116)	15% (51 of 339)	30% (14 of 46)	33% (6 of 18)	38% (8 of 21)	67% (2 of 3)
10-d *Hyalella azteca* survival or growth	522	0.379	13% (15 of 116)	16% (54 of 339)	37% (17 of 46)	39% (7 of 18)	48% (10 of 21)	100% (3 of 3)
28-42-d *Hyalella azteca* survival	174	0.549	8% (4 of 53)	13% (11 of 87)	43% (10 of 23)	38% (3 of 8)	45% (5 of 11)	67% (2 of 3)
28-42-d *Hyalella azteca* survival or growth	174	0.549	13% (7 of 53)	24% (21 of 87)	52% (12 of 23)	38% (3 of 8)	45% (5 of 11)	67% (2 of 3)
10-d *Chironomus tentans* survival	133	0.391	19% (5 of 26)	7% (7 of 94)	0% (0 of 9)	0% (0 of 3)	0% (0 of 4)	0% (0 of 1)
10-d *Chironomus tentans* survival or growth	133	0.391	23% (6 of 26)	9% (8 of 94)	33% (3 of 9)	67% (2 of 3)	75% (3 of 4)	100% (1 of 1)
Overall Toxicity	643	0.381	18% (27 of 150)	18% (73 of 406)	43% (26 of 61)	36% (8 of 22)	42% (11 of 26)	75% (3 of 4)

n = number of samples; PEC-Q = probable effects concentration quotient.

3/14/08 FINAL VERSION

ATTACHMENT 1

PROTOCOL FOR ASSESSMENT, REMEDIATION AND POST-REMEDIATION MONITORING FOR ENVIRONMENTAL CONTAMINANTS ON EVERGLADES RESTORATION PROJECTS

A. Contamination Assessment

1. *Phase I Environmental Site Assessment*

The Phase I Environmental Site Assessment (Phase I) is performed in accordance with the American Society of Testing and Materials (ASTM) Standard Practice E1527-00, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." The purpose of the Phase I is to identify the presence or likely presence of any hazardous substance or petroleum product on the property. Phase I should provide all available information on current and past land use, and consists of the following elements:

a. Site Inspection

The site inspection usually consists of walking, driving, and/or flying over the property to visually ascertain the presence of features or indicators of past land uses and possible environmental contaminants. A checklist of such indicators includes, but is not limited to, dumps, drums, construction debris, fills, unusual chemical odors, above ground and underground storage tanks, chemical storage buildings, asbestos evidence, "stressed" vegetation or bare ground, "sterile" water bodies, oiled roads, stained or discolored ground or stream banks, oil slicks, air strips, maintenance areas, pipelines, transformers or other electrical equipment, oil and gas drilling, and mining activities.

b. Historical Considerations

The historical review should include interviews with current owners, previous owners, and neighbors to obtain an accurate history of past land uses, farming practices, pesticide usage, etc. Aerial photographs should be reviewed for evidence of row crops and other agricultural, commercial or industrial activities. At a minimum, the historical review should include reliable information on (1) farming practices (e.g., row crops, sugarcane, citrus, sod farm, ornamentals, grazing), (2) exact location of these practices on the property, and (3) farming chronology. For example, row cropping on a portion of the property during the period from the 1940s to the mid-1980s is strong suggestive evidence for the presence of organochlorine (OC) pesticides at that location.

c. Review of Environmental Databases

An extensive review of environmental databases (Comprehensive Environmental Response, Compensation, and Liability Information System; Resource Conservation and Recovery Information System; National Priorities List; Emergency Response Notification System;

state Above Ground and Underground Storage Tank records; Solid Waste Facility and Landfill Report; Florida State Hazardous Waste Site list; Facility Index System/Identification Initiative Program Summary Report; Formerly Used Defense Sites; and local mosquito control districts) should be conducted.

Information gleaned from the Phase I assessment is used to determine the necessity of a Phase II assessment.

2. *Phase II Environmental Site Assessment*

Should information from the Phase I or other credible sources (i.e., previous investigations) indicate the presence of contamination or that the potential for contamination exists, a Phase II Environmental Site Assessment (Phase II) should be initiated. Coordination between FWS and the agency performing the assessment is important starting at this point and throughout the rest of the process. Coordination will be facilitated by providing FWS with a Phase II Scope of Work (SOW) or proposal for review. The proposal should describe in detail the sampling plan (number, media, and location of samples), sample collection methods, analytical parameters, quality control/quality assurance (QA/QC) plan, standards and/or ecological screening criteria to be used for comparison, contingency for expanded sampling, and screening level risk assessment procedures, if applicable. The environmental laboratory to perform chemical analyses should be EPA certified, maintain a rigorous QA/QC program, and achieve laboratory detection limits consistent with state and federally approved ecological screening values and water/soil quality standards. More detail on sampling procedures and analytical requirements is provided in the following section. The selection of a credible laboratory is one of the highest priorities in the site assessment process.

The purpose of the Phase II is to identify sources and locations of contamination, specify contaminants of potential concern (both human health and ecological), and provide recommendations for additional sampling, testing, or risk assessment; and corresponding corrective actions. The focus of the Phase II is generally on facilities and potential point sources on the property, which includes: mixing/loading areas, storage sheds, vehicle turn-around areas, airstrips, cattle dip tanks, pumping stations, and burn areas.

In addition, sampling may be conducted in other areas, such as canals and agricultural fields, in order to identify contaminants that have a more widespread distribution or to establish background levels of contaminants. Media sampled may include soils, sediments, groundwater and occasionally surface water. The most commonly encountered types of contaminants at agricultural sites include pesticides, petroleum hydrocarbons, and various metals.

Chemical concentrations in the various sampled media should be compared with the appropriate ecological screening values to determine if remediation and/or additional sampling or assessment is required. Ecological screening values to be used include the following: (1) Florida Department of Environmental Protection (FDEP) Sediment Quality Assessment Guidelines (SQAGs); (2) Florida Surface Water Quality Standards; or (3) USEPA Ambient Water Quality Criteria, among others. Ecological screening values are discussed in more detail in the next section.

Generally, any point sources identified can be remediated based on the results of the Phase II, with some additional delineation work. If remediation of the point source(s) removes all ecological concerns (i.e., all contaminant concentrations are reduced below screening values), no further assessment work is required on the site. However, if the results of the Phase I and/or Phase II indicate that widespread contamination at levels of ecological concern may be present, then more extensive sampling in the agricultural fields may be required (see next section).

3. *Agricultural Field Sampling and Screening Level Ecological Risk Assessment (SLERA)*

Generally, contaminant information obtained during a standard Phase I/Phase II Environmental Site Assessment (Phase I/II) is not detailed or comprehensive enough to be suitable for use in an ecological risk assessment (ERA). The methods described in this section are designed to provide detailed information on the distribution and concentrations of contaminants of concern (COCs) identified in the Phase I/II, for use in food chain models to predict risks to FWS's trust resources. A major purpose of this section is to determine whether concentrations of contaminants in the farmed areas are uniformly distributed in the fields, or are present as "hot spots[1]" that can be remediated. The method allows for sampling coverage of a large area while keeping assessment costs at manageable levels. If there is sufficient evidence to expect that pesticide contamination is likely at a site, it may be advantageous to conduct this sampling protocol concurrently with the Phase II assessment.

Sample site selection should be biased to maximize detection of agrochemicals in cultivated soils by sampling the entire cultivated area when possible. Random sampling on properties characterized by mixed land use is not likely to provide the greatest degree of representation regarding contamination commonly associated with agricultural production (i.e., insecticides, herbicides, fungicides, fertilizers, etc.). Prior to developing a sampling strategy, each property's land use should be reviewed in terms of spatial and temporal variables, placing the greatest sampling priority on those areas which were intensively managed for agricultural production (e.g., cultivated fields). Conversely, a lesser priority should be given to rangelands and abandoned or vacant lots which have limited or no historical agricultural land uses. Some exceptions to this rationale would include commercial and industrial land uses which are sparsely distributed within the geographic areas currently under consideration for incorporation into CERP projects. In most cases, the use of random sampling is limited to those properties demonstrating homogeneous land use across the majority of the property.

a. Sample Collection

Soil samples will be collected using a stainless steel spoon or hand auger from 0-6 inches below land surface. This interval represents the biologically relevant depth for interaction with surface water and biological receptors. It is important that care is taken not to include sample material from more than 6 inches deep, as this may result in dilution and underestimation of contaminant concentrations. Between samples, sampling equipment should be decontaminated using standard procedures to prevent cross-contamination between samples. (Decontamination between subsamples (see below) will not be necessary

[1] Hot spots are referred to isolated areas of elevated contaminant concentrations.

because subsamples will be mixed together to form a composite.) Immediately following collection, samples should be placed on ice and submitted as soon as possible to the laboratory for analysis.

At all properties except citrus groves, discrete soil samples and subsamples for compositing (see below) should be composed of five aliquots of equal volumes collected from the center point located at the nominal sampling location, and from four additional points located 5 feet from the center point in each of the cardinal directions. The sample should be thoroughly homogenized in a stainless steel mixing bowl. These "close proximity composite samples" are intended to reduce the effects of small scale soil heterogeneity.

At properties used for citrus farming, discrete soil samples should be composed of three equal-volume subsamples; one subsample each from (1) the drip line of the tree nearest to the nominal sampling point; (2) the nearest drainage swale to the tree; and (3) the nearest crown of the road between rows of the trees. The sample is, therefore, expected to be representative of the average concentration of the areas most likely to be affected by the application of agricultural chemicals used in citrus farming. The sample should be thoroughly homogenized in a stainless steel mixing bowl.

Before being placed in the sample jar, all soil samples (discrete and composites) should be thoroughly homogenized until they appear completely uniform in texture and color. Analytical laboratories should be instructed that samples received from the field should be thoroughly homogenized again in the jar before an aliquot is removed for extraction.

b. Analytical Parameters

If it has been determined during the Phase I/II that a property has a history of agricultural activity prior to 1985, then each soil analysis should include, at a minimum, organochlorine pesticides (EPA Method 8081), metals (including mercury and copper), and total organic carbon (TOC). If the history of the property or more recent use suggests that other contaminants may be present, then the list of analytes should be expanded as appropriate. The best available detection limits should be requested of the analytical laboratory, but at a minimum, detection limits (practical quantitation limits) for each chemical should be as low as the corresponding screening value (see below). That is not possible in all cases; however, since some screening benchmarks are lower than quantitation limits defined by the Florida Department of Environmental Protection. As a general rule, TOC analysis should be done for all soil and sediment samples. TOC is essential for food chain modeling and interpretation of individual sample results, bioassay results, etc.

c. Discrete Sampling for Small Properties (<500 acres)

Discrete sampling will be required for agricultural areas less than 500 acres in size. Discrete sample sites should be established at regular intervals across the property, at a density of at least one sample per 10-20 acres. The actual sampling density will depend on the size of the property, analytical cost per sample, likelihood of contamination, and other factors, and will

be specified in the proposed sampling plan and agreed to by consensus between the SFWMD and FWS. A minimum of 10 samples will be necessary for most properties. Some exceptions to this minimum sample size will occur where parcels are small (<100 acres) or demonstrate a combination of land uses (i.e., residential "ranchettes," small scale livestock/garden/nursery properties, rock mining pits, etc.) where only a small percentage of the overall area was cultivated. Careful consideration should be given prior to using a sample size smaller than 10. As sample size decreases, statistical variation tends to increase, thereby increasing the size of confidence intervals used to determine the 95 percent UCL of the mean for any given analyte. Higher UCL values may increase the probability that samples will exceed ecological screening values, thereby necessitating expanded sampling, risk assessment, and subsequent clean up. Also, higher UCL values will generate correspondingly higher Hazard Quotients (HQ) in food chain modeling exercises associated with Ecological Risk Assessments (ERA).

Within this framework, actual sample location is at the discretion of the project manager. This agricultural field sampling is in addition to, and separate from, Phase II sampling that may be focusing on facilities with a high likelihood of contamination, such as pump stations, storage sheds, mixing/loading areas, airstrips, vehicle turn-arounds, cattle dip tanks, etc. The exact location of each sample should be recorded using GPS.

d. Composite Sampling for Large Properties (>500 acres-1000 acres)

In large properties, discrete sampling at short intervals would be at best cost prohibitive, if not impracticable. Reducing the sample density, however, can lead to under-representation of large portions of the property, as well as elevated likelihood of missing hot spots. In order to address this problem, composite sampling is used. Composite sampling is a compromise, under which large numbers of discrete samples are collected, but composited prior to laboratory analyses. The following composite sampling strategy has been developed jointly by FWS and SFWMD.

Using aerial photographs, a 50-acre grid pattern will be established on each property or agricultural area greater than 500 acres in size. The grids should be located and confirmed in the field using GPS. For properties between 500 acres and 1,000 acres, all of the 50 acre grids will be sampled. For example, for a 1000-acre parcel, all 20 of the 50-acre grids would be sampled.

Each of the 50-acre grids will be subdivided into ten 5-acre subgrids. One close proximity composite soil sample will be collected from each of the 5-acre subgrids in the 50-acre grid. The location of each subsample should be exactly determined using GPS. The ten sub-samples are then composited into one sample and thoroughly mixed. This composite sample, representing the entire 50-acre grid, is then submitted to the laboratory for analysis and/or testing. (For copper, discrete samples will be maintained separate (i.e., not composited) and analyzed individually.)

e. Composite Sampling for Very Large Properties (>1000 acres)

For very large properties, where complete composite sample coverage is not possible due to budget constraints, a pre-arranged fraction of the 50-acre grids should be selected. For example, a 5000-acre parcel would be divided into 100, 50-acre grids. Perhaps half (50) of these grids would be selected for sampling. The number of grids to be selected will be pre-determined for each site by consensus between the SFWMD and FWS, based on site-specific factors. Grids will be selected for sampling using a stratified random approach.

For stratified random sampling, the agricultural area will be divided into a number of equally-sized supergrids, each consisting of group of adjacent 50-acre grids. From each supergrid, the pre-arranged fraction of grids will be selected randomly for sampling. For this purpose, a random number generator will be used to select 50-acre grids from each supergrid for sampling. The stratified random approach is recommended over a purely random approach. In random sampling there is always a chance of clustering, as well as over- and under-representation of segments of the agricultural area. The stratified random approach will assure that all segments of the agricultural area are equally represented.

f. Screening-Level Ecological Risk Assessment

Following the collection of Phase II data and sampling of the cultivated areas, each site will be evaluated using a SLERA. The SLERA is intended to identify contaminants of potential ecological concern (COPECs) and provide screening-level conclusions regarding the potential for risk to the ecological receptors at the site. The conclusions of the SLERA will primarily indicate which COPECs are likely to show a low potential for elevated risk and those that may require further evaluation either through the collection of additional data for use in an expanded ecological risk assessment or through remediation.

Screening is conducted for two general sets of ecological receptors and the screening values are used to identify areas that may require further attention for each receptor. For the aquatic community receptor, the FDEP's Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters (MacDonald et al. 2003) should be used as screening values whenever possible. The SQAGs were developed for assessing sediment quality in Florida waters, based on the probability of effects on sediment-dwelling organisms. For each contaminant there are two SQAGs: Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC). TECs were formulated to define concentrations of contaminants below which adverse effects on sediment-dwelling organisms are unlikely to occur. PECs were developed to define ranges of concentrations above which adverse effects are likely to occur.

In most cases the TEC will serve as the initial screening value, especially when using a composite sampling design. Use of PECs as screening values may be justified under some circumstances for certain contaminants. For some contaminants, SQAGs have not yet been developed. The U.S. Environmental Protection Agency's Ecotox Thresholds, the National Oceanic and Atmospheric Administration's Effects Range Low and Effects Range Median, or other ecologically-based guidelines should be used when SQAGs are not available. For

some chemicals such as metals, information on natural background levels may have to be considered. Human health-based guidelines for cleanup of contaminated sites, such as FDEP's Soil Cleanup Target Levels, should not be used for this purpose. Chemicals exceeding either the TEC or the PEC, or their equivalent benchmark where SQAGs are not available, will be identified as COPECs and will be further discussed in the SLERA.

When more than one chemical is present in the sediments, the risk associated with exposure of the aquatic community to the mixture may be greater than to a single chemical. Risks associated with exposure to multiple chemicals in any one chemical group (e.g., metals, organochlorine pesticides, etc.) are generally considered to be additive. In order to account for the potential effects of multiple chemicals, a PEC-quotient (PEC-q) approach will be utilized, when more than one chemical in a group is detected on a site. The PEC-q for each chemical is calculated by dividing the chemical concentration by the PEC for that chemical. The mean of the PEC-q's for all of the chemicals in the group will then be calculated. If the mean PEC-q is greater than 0.5, the combined effects of the multiple chemicals in the sediment may be toxic and should be further evaluated. Specific tests and methods to be used for further risk-based evaluation are discussed in the following sections.

Since TECs/PECs are specific to benthic macroinvertebrates, screening is also conducted for aquatic-feeding wildlife (birds and mammals) that are FWS trust wildlife species (i.e. MBTA and ESA species). Generally, the bald eagle (*Haliaeetus leucocephalus*), white pelican (*Pelecanus erythrorhynchos*), snail kite (Rostrhamus sociabilis), osprey (*Pandion haliaetus*), clapper rail (*Rallus longirostris*), great blue heron (*Ardea herodias*), and wood stork (*Mycteria americana*) are federal trust species that have been used as representative target species in exposure and risk calculations.

For wildlife, the screening-level risk is expressed by calculating a screening-level hazard quotient (HQ), which is simply the ratio of the modeled exposure (numerator) and TRV (denominator). Screening-level HQs for wildlife species are calculated using the site-specific reasonable maximum exposure (numerator) compared to a TRV based on the No Observed Adverse Effects Level (NOAEL)(denominator). Exposures are generally calculated using the fugacity-based foodweb exposure model that was developed jointly by FWS and SFWMD (Goodrich 2002 and NewFields 2006), but other exposure models can be used if needed and approved by FWS. A screening-level HQ greater than one indicates that the chemical should be retained as a COPEC for further risk analysis in the SLERA and potentially as a basis for risk management actions.

g. Sites Which Exceed the PEC and/or with Wildlife HQs Greater than 1.0

Sediments with concentrations of contaminants above the PEC potentially represent significant and immediate hazards to exposed aquatic life. If any of the 50-acre composite samples, described above, exceeds the PEC or other appropriate probable effect-level screening value, it will be necessary to return to that 50-acre grid and obtain individual samples from each of the ten aliquot locations. These samples should be taken as close as possible to the original sample locations. These discrete samples should then be submitted to the laboratory for analysis.

The purpose of this follow-up sampling is to determine the spatial distribution of contaminants within the 50-acre grid; i.e., do the data indicate the presence of one or more isolated hot spots, or widespread contamination above the PEC? If only one or a few of the individual (5-acre) samples are elevated, SFWMD may choose to attempt to remediate these areas in order to reduce the average contaminant levels of the 50-acre grid to below PEC. This will require additional sampling in order to confirm that the sub-grids in question were indeed responsible for the PEC exceedance, and to delineate the extent of the hotspot(s). Due to possible small scale variability in contaminant concentrations, one sample is not sufficient as a basis for remediation decisions. As discussed in Section C (Remediation), the SFWMD may chose to conduct a more detailed analysis, including geostatistical analyses, to attempt to identify areas in need of remediation.

Conversely, follow-up sampling may indicate that large portions of the site contain elevated levels of contaminants. Remediation of widespread contamination over such a large area may not be practical. In such a case, further testing and completion of an ecological risk assessment (ERA) will be necessary in order to refine our understanding of the hazards to federal trust resources associated with contaminants on the site. These tests and assessments should include: (1) desorption studies, (2) sediment bioassays, and (3) ERA with food chain modeling. In addition, if any of the contaminants have a tendency to accumulate in aquatic organisms or biomagnify in the food chain, such as organochlorine pesticides, PCBs, PCDDs/PCDFs, and some metals, bioaccumulation studies are recommended. Specific tests and methods to be used are discussed in the following sections.

As stated above, follow-up sampling of discrete locations within a 50-acre grid is intended to determine the spatial distribution of contaminants within the grid, and should not constitute an attempt to confirm or refute the original composite result. If widely disparate results are obtained upon follow-up (discrete) sampling compared with the original composite, this suggests either small-scale variability in the COPEC concentrations or that some error has occurred in sampling, homogenization, or laboratory analysis. In these cases, the original composite result will represent the 50-acre grid in question, barring some evidence to the contrary suggesting that the follow-up result is actually more representative of contaminant concentrations in the grid.

In order to avoid the above situation, consideration will be given on a project-by-project basis, that discrete samples collected in the field, following homogenization, be split into two jars. One sample jar will be used for producing the composite by mixing with the other samples representing a particular 50-acre grid; the other jar of each pair would be stored at 4 degrees centigrade for possible future analyses. If screening levels for any analytes of interest are exceeded in the composite sample analyses, then all 10 of the subsample aliquots used to make that sample will be reanalyzed for the observed compounds to identify more precisely the location of the observed contaminants. Use of this methodology may be problematic for very large properties due to limited storage space.

h. Sites Which Exceed Only the TEC

In general, a few scattered exceedances of a TEC by an individual contaminant at a site, when there are no PECs exceeded, is not considered to be a significant cause for concern. However, if enough samples exceed the TEC, such that the mean (estimated by the 95 percent upper confidence limit (UCL) of the mean) for the entire site (i.e., the mean of all discrete samples for a small site, or the mean of all 50-acre composites for a large site) is above the TEC, widespread ecological effects are possible. To evaluate this, the mean and the 95 percent UCL of the mean should be calculated for each COPEC. In most cases, if the 95 percent UCL for all contaminants is below the TEC, the SLERA will indicate that the potential for unacceptable risk is low and no further action will be necessary. However, if the 95 percent UCL for any contaminant exceeds the TEC, then the additional testing and an ERA (as described above for PEC exceedances) or remedial activities may be necessary. These tests and assessments should include: (1) desorption studies, (2) sediment bioassays, (3) ERA with food chain modeling, and (4) bioaccumulation studies for lipophilic contaminants. In addition, if TECs are exceeded by more than one contaminant in the same grid(s), further evaluation will be necessary to address possible synergistic or additive effects of these co-contaminants. Bioassays may be useful in this case to identify potential toxicity from multiple contaminants that would not be predicted by using individual screening values.

i. Evaluation of False Negatives where Composite Samples are Used

[Note: The following procedure for the evaluation of potential false negatives has been added to this MOA at the request of the Florida Department of Environmental Protection (FDEP) and is not required by FWS. This procedure is included in this MOA in order to provide a complete documentation of the sampling and assessment protocol followed by SFWMD.]

The primary disadvantage of composite samples is the possibility of masking hot spots by diluting the elevated discrete samples with cleaner aliquots. This masking can be viewed as a form of a "false negative," i.e., the probability of yielding clean composite results, while certain portions of the grid may exceed ecological benchmarks. In order to minimize the above disadvantage, the following procedure is included.

A representative percentage of "clean" grids (i.e., COPEC concentrations within the grid are all below the SQAG-TEC values) will be selected for further evaluation. The percentage of grids selected for further evaluation will depend upon the variability of the data and the total number of composite samples which were analyzed. When selecting the subset of non-exceeding grids, the following should be considered: (1) the non-exceeding grids targeted for discrete sampling shall not be clustered; and (2) the number of non-exceeding grids targeted for discrete sampling shall be at least 20% of the total number of "clean" grids but not greater than 10.

All of the individual discrete aliquots making up the ten-point composite samples within the selected grids will subsequently be analyzed for the COPECs only. The results for the

discrete samples for selected clean grids will be tabulated, along with the results for individual discrete samples that are analyzed for exceeding grids (per the procedure outlined in section h. below). Both the composite sample and discrete sample values for each grid should be tabulated.

For each grid, the percentage of discrete samples exceeding the ecological benchmark will be calculated. The grids will then be sorted based on ascending COPEC composite concentration. The average aliquot exceedence rate for each grid is then computed by obtaining the average percentage of aliquots exceeding the benchmark in that grid and in all grids with lower composite concentrations.

The average aliquot exceedance rates are then used to determine the composite sample concentration above which the individual sample results exceed the composite value by a pre-determined percentage (e.g., 5%). The largest composite value corresponding to the pre-determined exceedence rate will be defined as the trigger level. If the trigger level is less than the PEC for the given chemical, it shall be used in all subsequent analyses as the substitute for the PEC.

Using this approach, the probability of missing hot spots in clean grids can be maintained below a pre-determined level (e.g. 5%). Trigger levels for individual chemicals that have already been established in certain types of agricultural areas may be used in other similar agricultural areas. In such instances, supplementary area-specific false negative sampling and analyses are not required.

4. Expanded Ecological Risk Assessment

In cases where clear decisions regarding the potential for risk cannot be reached or where remediation to remove potential risks based on screening-level results is impractical, further testing and completion of an ERA will be necessary in order to refine our understanding of the hazards to federal trust resources associated with contaminants on the site. These tests and assessments should include: (1) desorption studies, (2) sediment toxicity tests, and (3) ERA with food chain modeling. In addition, if any of the contaminants have a tendency to accumulate in aquatic organisms or biomagnify in the food chain, such as organochlorine pesticides, PCBs, PCDDs/PCDFs, and some metals, bioaccumulation studies are recommended. The details of the ERA should be agreed upon by SFWMD and FWS prior to the initiation of work.

a. Desorption Studies

Contaminated soils inundated during the process of wetland restoration may release soil bound pollutants into the pore and surface waters. Soil or sediment characteristics governing pollutant desorption (e.g., total organic carbon, grain size, pH) will vary among locations. In addition, weathering or aging of some contaminants may alter their bioavailability from that predicted in the published literature. This necessitates site-specific desorption studies to accurately assess pollutant availability to aquatic organisms. Pollutant desorption is assessed on soils from the location using ASTM method E-1195-01, "Method for Determining a

Sorption Constant (Koc) for an Organic Chemical in Soil and Sediments." This method simulates flooding of site soils and measures release of contaminants from the soil over time. Filtered pore water samples are collected and analyzed for COCs after 3, 7, 14, and 21 days contact time. These results are used to determine a site-specific organic carbon partitioning coefficient (Koc), an estimate of pollutant partitioning between sediments and water. This value can be used in food chain models for predicting aquatic and terrestrial organism exposure to pollutants.

Soils used in the desorption study should represent, as near as possible, the maximum detected concentration of the contaminant on the site, in order to ensure that measurable levels of the particular COC are released into the water. Bulk soil samples collected for this purpose must be thoroughly mixed. To ensure uniform contaminant concentrations, samples should be collected and analyzed from several locations within the bulk soil sample (e.g., top, middle, and bottom of the container). In order to be useful, the water analysis results must show evidence that steady-state concentrations have been reached within the 21-day duration of the test. Contaminant concentrations in water obtained during the desorption study may be compared with Florida Surface Water Quality Standards.

b. Sediment Toxicity Testing

Toxicity testing with representative aquatic invertebrates and vertebrates allows prediction of soil bound pollutant toxicity to aquatic organisms if the location is converted to a wetland. For properties requiring an ecological risk assessment, the following sediment toxicity tests should be conducted: 10-day flow through sediment bioassay with two invertebrate species (e.g., *Hyalella azteca* and *Chironomus tentans*), and 7-day flow through sediment bioassay with one fish species such as the fathead minnow (*Pimephales promelas*) or other suitable species.

"Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates (ASTM E-1706-95)," "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (USEPA/600-R-99/064)," and "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (USEPA/600/4-91/002)" provide standard methods to assess soil-associated pollutant effects upon aquatic organisms.

Endpoints measured in these tests are survival and growth. Any statistically significant impacts upon these endpoints in any test are considered direct evidence of potential impairment of the prospective benthic/aquatic community in the restored wetland.

As with the other sediment studies, bulk soil samples collected for this purpose must be thoroughly mixed, and uniformity of contaminant concentrations should be confirmed by sampling from several locations within the bulk soil simple. Soils used in the sediment toxicity tests should represent, as near as possible, the maximum detected concentration of the contaminant on the site.

c. Bioaccumulation Studies

Factors affecting pollutant accumulation by aquatic organisms can vary among locations. Accurate prediction of pollutant bioaccumulation at a location requires site-specific bioaccumulation studies, using species representative of those that may exist on the location once flooded. For properties requiring an ecological risk assessment, 28-day bioaccumulation studies should be performed with a representative benthic macro invertebrate (e.g., *Lumbriculus variegatus*) and fish (e.g., *Pimephales promelas*).

Methods described in "Great Lakes Dredged Material Testing and Evaluation Manual (USEPA and Army Corps of Engineers, 1998)" and "Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (ASTM E-1688)" should be used to determine the bioaccumulation potential of soil-associated pollutants. These results are considered as site-specific measures of the degree to which sediment-associated chemicals may accumulate in biota. Results can be used to generate input variables for food-chain modeling.

Soils used in the bioaccumulation studies should represent, as near as possible, the maximum detected concentration of the contaminant on the site, in order to ensure that measurable levels of the particular COC are released into the water and taken up by the organisms. Bulk soil samples collected for this purpose must be thoroughly mixed. To ensure uniform contaminant concentrations, samples should be collected and analyzed from several locations within the bulk soil sample (e.g., top, middle, and bottom of the container). In order to be useful, the concentration of contaminant(s) in the test organisms must show evidence that steady-state conditions have been reached within the 28-day duration of the test.

d. Exposure and Risk Analysis Using Aquatic Food Chain Models

In the absence of direct measures of effects, it is necessary to estimate or predict the risk of adverse effects upon FWS's trust resources and other organisms that may utilize the created wetland, reservoir, or STA. Food chain models allow prediction of effects on higher level organisms by combining data from the site-specific desorption and bioaccumulation studies with information on dietary composition, consumption rates, body weights, etc. and literature toxicity data. The FWS and SFWMD have jointly developed a food web model for this purpose (Goodrich 2002 and NewFields 2006), and this model is the preferred tool for risk analysis. However, alternative approaches for modeling exposure may be used if they are more applicable to site conditions. FWS must approve the use alternative models, and reports should present details of the model components and input variables.

FWS's trust resources include migratory birds and federally listed threatened or endangered species. Typically, representative Trust species such as the bald eagle (*Haliaeetus leucocephalus*), white pelican (*Pelecanus erythrorhynchos*), snail kite (*Rostrhamus sociabilis*), osprey (*Pandion haliaetus*), clapper rail (*Rallus longirostris*), and wood stork (*Mycteria americana*) have been used in the analysis. Where bioaccumulating pollutants are present, a maximally exposed piscivorous bird must always be included. Generic fish

species (omnivorous and higher level predatory fish) may be used as aquatic focal species. At a minimum, the food chain model should assess risk to the following groups (trophic levels) of target organisms: benthic invertebrates (detritivores), omnivorous fish, first order carnivorous fish (trophic level 3), second order carnivorous fish (trophic level 4), omnivorous bird, first order carnivorous bird, second order carnivorous bird, and all threatened or endangered species that may utilize the site after flooding. The following potential routes of exposure should be included in the model: direct exposure to contaminated water/sediments, sediment ingestion, water ingestion, and food ingestion. The following transfer mechanisms and processes should be included; desorption from sediment to water, bioconcentration from water, bioaccumulation through ingestion of contaminated prey, and biomagnification.

Once the target species exposure to pollutants has been modeled, the potential risk to the species should be assessed by comparing the modeled exposure to a toxicity reference value (TRV). For purposes of this program, the most relevant endpoints for assessing risk are effects upon (1) survival and (2) reproduction. In the absence of toxicity tests performed with the specific target species, TRVs for the pollutant(s) of interest must be obtained from the literature. Where possible, the ideal TRV will have been generated using a similar exposure route for a taxonomically related species. Uncertainties arising from the use of TRVs based on different exposure routes or unrelated species should be discussed in the risk assessment. In general, the most sensitive TRV should be utilized to assess risk to the target species.

As discussed in previous sections, risk is expressed by calculating an HQ, which is simply the ratio of the modeled exposure (numerator) and TRV (denominator). HQs above one indicate a potential for adverse effects to occur in a species under a given exposure scenario. The higher the HQ above one, the greater the risk that adverse effects will occur. HQs below one generally indicate that adverse effects are unlikely. HQs that are greatly different from one provide the greatest level of certainty in their interpretation.

Where appropriate, a probabilistic risk analysis may also be used as a tool for assessing risk at sites where the food chain model is also used in an expanded risk analysis. The details of any probabilistic risk assessment should be discussed and agreed upon by SFWMD and FWS on a site-specific basis prior to initiating any such analysis.

5. *Final Reports*

a. Phase I/II Environmental Site Assessment and SLERA Report

Upon completion of all sampling, chemical analyses, and screening-level food chain modeling, a Phase I/II and SLERA report should be prepared which identifies all potential hazards to ecological receptors and provides recommendations for additional risk-based data collection and assessment. The Phase I/II/SLERA will also provide all analytical data and corresponding global positioning system (GPS) coordinates for all collected samples in the report. These data and coordinates will also be provided to FWS in an electronic

spreadsheet form (Excel). Finally, the Phase I/II/SLERA may also provide general recommendations for corrective actions and/or management of the project that will reduce the hazards to acceptable levels.

Given the spatial resolution of the data collected for the Phase I/II and the sometimes limited timeframe available for completion of the Phase I/II, SFWMD recognizes that accurate delineation of areas that may require remediation may not possible without further investigation. The Phase I/II will be used to provide a general estimation of the amount of remediation necessary to reduce the potential for risk at a site. More detailed delineation of areas of elevated COPEC concentrations that may occur subsequent to the Phase I/II will be presented in separate reports.

FWS will review the report and provide concurrence or make recommendations for changes or additions. Any recommendations for changes or additions will be handled as addenda to the report.

b. Ecological Risk Assessment Report

If additional risk assessment activities are required, an Ecological Risk Assessment (ERA) report will be provided as a separate document. Following the completion of the expanded ERA, SFWMD will provide FWS with a draft of the ERA report for review. The draft ERA report will include the complete results of all desorption studies, sediment toxicity testing, bioaccumulation studies, and food chain modeling. In addition, it should include a complete and clear description of all methods, assumptions, and inputs used in the laboratory studies and food chain modeling. The report should provide detailed conclusions regarding risks to all trophic groups and species of concern for the entire site or any portion thereof. FWS will review the draft report and make recommendations for changes or additions. Following the resolution of any FWS concerns, a final ERA report will be provided to FWS.

A.3 SITE HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

LIMITED PHASE I/II ENVIRONMENTAL SITE ASSESSMENT REPORT STUDY AREA - C-111 SPREADER CANAL MIAMI-DADE COUNTY, FLORIDA

Prepared For:
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Prepared By:
URS Corporation
7800 Congress Avenue, Suite 200
Boca Raton, FL 33487

Job # 38615-881

August 31, 2006

URS

August 31, 2006

Mr. Robert J. Taylor
Lead Environmental Engineer
Land Acquisition Support Group
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Re: Limited Phase I/II Environmental Site Assessment Report
C-111 Spreader Canal
Miami-Dade County, Florida
Job No. 38615-881

Dear Mr. Taylor:

URS Corporation (URS) is pleased to present three copies of the Limited Phase I/II Environmental Site Assessment of the C-111 Spreader Canal, approximately 6,770 acres of land, referred to as the "Study Area", located south of Florida City in unincorporated Miami-Dade County, Florida. This report has been prepared in accordance with URS' proposal to the South Florida Water Management District (District) and Work Order No. 2 and No. 4.

URS appreciates the opportunity to support the District on this important project. If you have any questions with the information contained in this report, please contact URS at your convenience.

Respectfully Submitted,

URS CORPORATION

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EXECUTIVE SUMMARY

URS Corporation (URS) was retained by the South Florida Water Management District (District) to conduct a Limited Phase I/Phase II Environmental Site Assessment (ESA) of an estimated 6,770 acres of land on the C-111 Spreader Canal project, which is located in southern Miami-Dade County, Florida and herein referred to as the "Study Area." The Study Area consists of a one-mile wide corridor situated between the C-111 and C-L-31E District canals. This one-mile corridor represents the southern boundary, the ½ mile middle boundary and the northern boundary of the proposed C-111 Spreader Canal. It is URS' understanding that the District has developed a conceptual plan for the restoration of the natural hydrologic flow on the Study Area. This project was conducted in accordance with URS' Work Plan dated April 3, 2006; presented to Dr. Robert A. Frakes, Environmental Contaminants Coordinator of the U.S. Fish and Wildlife Service, and Mr. Robert J. Taylor, Lead Environmental Engineer of the South Florida Water Management District.

The Phase I ESA was performed in general accordance with the ASTM "Standard Practice for Site Assessments: Phase I Environmental Site Assessment Process" (ASTM E 1527-00 as currently amended). The purpose of the Phase I ESA was to evaluate whether current or historical activities on or near the Study Area may have resulted in contamination by hazardous substance or wastes, also known as a "Recognized Environmental Condition." The Phase II ESA was conducted concurrent with the Phase I ESA to evaluate impacts to the soil resulting from a release of hazardous substances or materials through handling and use. Soil analytical results from the Phase II ESA investigations were reviewed to evaluate the necessity for and estimated costs of further testing, evaluations or corrective actions.

Five former agricultural areas, approximately 4,186 acres were identified as areas of potential concern by the Phase I ESA. With the exception of 81 acres, no former agricultural areas were identified south of the Southern Boundary. The former agricultural areas were active in the 1930s and 1940s up to the mid 1950s. Historically, vegetable row crops, consisting of tomatoes, corn, squash, and other vegetables were grown in the former cultivated areas during the winter season.

No evidence of buildings, storage/staging areas, process operations, or other farm support structures were observed on the former agricultural areas or within the Study Area. The Everglades Youth Development Center and a former US Navy listening station for the Department of Defense are located within the Study Area. The Everglades Youth Development Center has a small arms shooting range, an aboveground storage tank used to store diesel fuel for a diesel generator, a maintenance building and a waste water treatment plant.

The Phase II ESA consisted of an extensive soil quality evaluation of the 4,186 acres of former agricultural area. As discussed with the Service, the former agricultural areas were divided into 82, 50-acre grids of which a total of 68 grids were selected to be sampled using aerial photographs and a random number generator. One composite soil sample was collected from each of the 68 grids and discrete and composite samples were collected from the smaller former agricultural areas.

Discreet soil samples were also collected from the small former agricultural areas. The 70-acre former agricultural area was divided into seven, approximate 10-acre sub-grids and one discrete soil sample was collected from each 10-acre sub-grid. Three composite soil samples were made from the seven discrete

soil samples collected. On the small 11-acre former agricultural area, three discrete soil samples and one composite soil sample were collected.

The soil analytical data collected from the Study Area was reviewed with respect to the District's placement of the C-111 Spreader Canal and restoration of the hydroflow within the 1-Mile Corridor. Ideally, the further north the C-111 Spreader Canal can be positioned, the more area that will be re-hydrated. The Study Area was defined by three boundaries: Northern, Middle and Southern. The Northern Boundary of the Study Area represents the northern-most position of the C-111 Spreader Canal, while the Southern Boundary represents the southern-most position of the C-111 Spreader Canal. The Middle Boundary is the midway point, ½- miles between the northernmost and southern-most position.

Considering this, the soil analytical results were reviewed with respect to SQAG PECs and TECs, focusing on the samples collected from the grids located between the Northern Boundary and the Middle Boundary, located ½-mile to the south to evaluate if the upper ½-mile portion of the Study Area would be suitable for the District to re-hydrate. Soil analytical results were also reviewed for samples collected from the grids located between the Middle Boundary and the Southern Boundary to evaluate if the lower ½-mile portion of the Study Area would be suitable for the District to re-hydrate.

Northern to Middle Boundary

The composite soil samples collected from between the Middle and the Northern Boundary indicates that copper, lead, and cadmium were detected in Grids No. 44 and No. 53 above their respective SQAG PECs. Barium was also detected at these two grids above its respective SQAG TEC.

The organochlorine pesticides; 4,4-DDE and total chlordane, were detected between the Middle and Northern Boundary in Grids No. 35 and No. 65 above their SQAG TEC.

Middle to Southern Boundary

Total chlordane was detected in Grid No. 82 in the area located between the Middle and the Southern Boundary exceeding the chlordane SQAG PEC. Total chlordane exceeded the SQAG TEC at Grid No. 10 and 4,4-DDE exceeded its respective SQAG TEC at six grids.

Selenium was detected in the composite samples collected from Grids No. 12, No. 16, No. 22, and No. 24, exceeding the Service's interim value of 1 mg/kg.

No organochlorine pesticides were detected above laboratory detection limits in the four composite soil samples and 10 discrete soil samples collected from the former agricultural areas south of the Southern Boundary. The metals detected in these soil samples were either below SQAG TECs or below laboratory detection limits.

The 95% UCL and a Screening Level Ecological Risk Assessment (SLERA) was conducted on the entire 1-mile corridor. All the composite soil analytical data collected from the 68 grids composite soil samples were used in calculating the 95% UCL for the COPECs to evaluate if the C-111 Spreader Canal positioned along the Northern Boundary, when the hydroflow is restored, the Study Area would be suitable to be inundated. The 95 % UCL for detected COPECs utilizing the data from soil samples collected only between the Middle and Southern Boundaries, and the four grids south of the Southern Boundary was calculated and a SLERA for this area conducted.

95% Upper Confidence Limit

Northern to Southern Boundary

- Both the mean and 95% UCL concentrations for cadmium, copper, lead and selenium exceeding their respective SQAG TEC levels.

Middle to Southern Boundary

- The mean and 95% UCL concentrations for selenium are 2.44 µg/kg and 4.02 µg/kg, respectively. Both the mean and the 95% UCL exceed the selenium SQAG TEC. The 95% UCL concentrations for Total Chlordane and 4,4-DDE are 5.19 µg/kg and 4.91 ug/kg, respectively exceeding the SQAG TECs of 3.2 µg/kg and 3.2 ug/kg, respectively.

Screening Level Ecological Risk Assessment

Northern to Southern Boundary

No unacceptable risks were indicated for the fish and benthic community, in the event that rehydration occurs in the entire Study Area, although some potential risks may occur to the benthic community in the form of exposure to cadmium, copper and lead due to elevated concentrations in Grids 44 and 53.

The hazard quotient (HQ) for copper slightly exceeded 1 indicating a low potential risk, specifically for the snail kite. This risk is mainly associated with preferential feeding in one of the two Grids 44 and 53 with high copper concentrations.

All other HQs for the Trustee bird species were less than one, indicating that there would be no unacceptable risks to higher-trophic level, avian receptors.

However, it must also be considered that some Trustee species could forage within areas smaller than the exposure unit defined by the entire area, and as a result may be exposed to maximum concentrations, (i.e. grids 44 and 53 which have elevated cadmium, lead, and copper above SQAG PECs), unacceptable risk may be present.

Middle and Southern Boundary

Under the event that rehydration occurs in the area between the middle and southern boundaries, no unacceptable risks were predicted to either the fish and water column community or Trustee bird species.

The Service's interim value of 1 mg/kg for selenium was slightly exceeded in composite soil samples collected grids 12, 16, 22, and 24 and discrete samples collected from grids D3 and D4, the District's fugacity-based food web model indicated no significant risks to avian receptors using site-specific exposure assumptions.

Recommendations

URS recommends that the disposition of the Everglades Youth Development Center and the former U.S. Navy facility be determined with respect to the C-111 Spreader Canal project since access during the Phase I ESA was not obtained. A site inspection would include a Limited Phase II ESA consisting of soil and groundwater sampling and analysis as well as an asbestos survey of the buildings. The estimate cost to conduct the site inspections and sampling is $ 18,000.

The Phase II ESA has identified 100 acres in the Northern to Middle Boundaries where soil samples collected have exhibited cadmium, lead, and copper concentrations greater than the corresponding SQAG PEC and the Service's interim value. Based on the SLERA, these 100 acres of barium, lead, and copper impacted soils pose a potential risk to the Service's trustee species. **In order to evaluate if "hot spots" exist, URS recommends that additional soil sampling be conducted in Grids No. 44 and 53 and collecting individual discrete samples from each of the ten 5-acre sub-grid sample locations and collect discrete soil samples. In accordance with the Service's recent correspondence in which the Service has requested additional sampling in grids in close proximity to impacted areas and which had not been evaluated during this Phase II ESA, URS recommends collecting composite samples from grids 42, 50, and 51 located diagonally and adjacent to Grids No. 44 and 53. The composite soil samples should be analyzed for cadmium, copper and lead in order to further determine the extent of the contamination.**

In the Middle to Southern Boundaries, 50 acres at Grid No. 82 have been identified with total chlordane concentrations above the SQAG PEC. Selenium has also been identified in 215 acres also located in the Middle to Southern Boundaries at concentrations above the Service's interim value of 1 mg/kg. **Based on the SLERA, the 215 acres of selenium impacted soils do not appear to pose undo risk to the Service's trustee species.** The 50 acres of chlordane impacted soils pose a potential risk to the Service's trustee species. **In order to evaluate whether a "hot spot" exists in Grid No. 82 due to the elevated total chlordane exhibited, URS recommends collecting individual discrete samples from each of the ten 5-acre sub-grid sample locations and analyzing for total chlordane to further determine the extent of the contamination.**

The estimated costs for the collection and analysis of the additional samples is $ 12,400

Additionally, since the soils at Grids No. 12, 16, 22, and 24, located in the area south of the middle boundary exceeded the Service's interim value of 1 mg/kg for Selenium, URS recommends submitting the data collected to date to the Service for review.

In the event that the Service does not concur with the findings of the SLERA with respect to selenium, additional sampling may be warranted. The additional sampling may consist of collecting individual discrete samples from each of the ten 5-acre sub-grids which together formed the original composite soil samples and laboratory analysis to determine the distribution of the contaminant selenium in order to verify that no "hot spots are present in Grids No. 12, 16, 22, and 24. Additionally, the Service may recommend that composite samples be collected from Grids No. 11, 14, 15, 17, 18, 23, 25, and 30, located adjacent and diagonally, an analyzed for selenium. These grids were not assessed within this Phase II ESA.

The SLERA has indicated that, with the exception of the 150 acres at Grids No. 44, 53 and 82, the Northern Boundary is suitable for the placement of the C-111 Spreader Canal, and the 1-mile corridor can be inundated without causing undo risk to the Service's trustee species.

The soil analytical data will be reviewed and areas of elevated chlordane, cadmium, lead, and/or copper identified. Based on the size of these "hot spots" a remedial strategy will be developed to abate the

potential risks the impacted soils in these "hot spots" pose to the Service's trustee species. The remedial strategies currently being employed and/or considered by the District are given below.

Option 1 – Excavate impacted soils to the SQAG TEC

Upon delineating the "hot spot" areas of chlordane, barium, lead and/or copper impacted soils, above their respective SQAG PECs, soils would be excavated to one foot below land surface or to the bedrock, if encountered less than one foot below land surface. Depending on the size of the "hot spots", this option may not feasible. This option will demonstrate the costs for essentially removing the risks associated with chlordane and metals impacted soils in the Study Area so that this area could be flooded. The excavated soils will be transported off-site and disposed at a licensed facility. The excavated areas would not be backfilled.

Option 2 – Convert "Hot Spots" Into Uplands Area

The areas of chlordane and metals impacted soils could be capped with up to 2 feet of clean fill material essentially creating an uplands in the areas identified. This will prevent exposure of the chlordane and metal impacts to most of the benthic macro-invertebrates, which are anticipated to inhabit the sediment once the hydroflow is restored in the Study Area. Prior to implementing this option, a series of leachability tests will need to be conducted to ensure that the chlordane and metals will not leach from the soils. A stormwater management plan to maintain the newly created uplands area will need to be formulated.

Option 3 – Soil Inversion

Soil inversion consists of inverting a 2-foot section of the soil horizon, where as the impacted soils are placed 2 feet below land surface and soils that are not impacted or soils with lower concentrations cover the impacted soils. A pilot test will need to be conducted to document that this option is effective and efficient in reducing or eliminating the ecological risks associated with the chlordane and metals impacted soils. This option may not be practival because of the relatively thin soil thickness; only 6 inches to 18-inches thick in some places. Also the presence of pinnacle rock may affect this option.

Option 4 – Re-locate Chlordane and Metals Impacted Soils

The conceptual plan for restoring the hydroflow includes the construction of a series of berms and roads. Option 4 consists of excavating the areas of chlordane and metals impacted soils to at least 1 foot below land surface for relocation outside the Study Area and re-use the impacted soils as material to construct proposed berms or road base. The District's project manager for construction of the C-111 Spreader Canal will need to be consulted to ensure that the relocated soils are suitable for use as material for the berms/road base. The estimated amount of soils generated from the 150 acres ranges between 242,000 cubic yards up to 484,000 cubic yards. Prior to implementing this option, a series of leachability tests will need to be conducted to ensure that the chlordane and metals will not leach from the excavated soils. This option may be difficult to conduct due to the presence of pinnacle rock.

Because construction of the berm and levee are already included in the budget the costs associated with using the impacted soils, i.e. excavation, transportation, will be greatly reduced.

Prior to implementing corrective actions, the Service will need to be consulted on the option of options to be considered. Concurrence from the Service will be required prior to implementing the corrective actions.

TABLE OF CONTENTS

SECTION	PAGE
EXECUTIVE SUMMARY	**I**
1.0 INTRODUCTION	**1**
1.1 OBJECTIVE	1
1.1.1 Phase I Environmental Site Assessment	1
1.1.2 Phase II Environmental Site Assessment	1
1.2 SCOPE OF WORK	2
1.3 LIMITING CONDITIONS	2
2.0 PHASE I ENVIRONMENTAL SITE ASSESSMENT	**3**
2.1 PHYSICAL LOCATION AND DESCRIPTION OF PROPERTY	3
2.2 ENVIRONMENTAL SETTING	3
2.2.1 Topography	3
2.2.2 Soils	3
2.2.3 Geology	3
2.2.4 Hydrogeology	4
3.0 HISTORICAL SITE AND SURROUNDING PROPERTY CONDITIONS	**4**
3.1 CURRENT AND PRIOR OWNERSHIP	4
3.2 INTERVIEWS	5
3.3 ADJOINING PROPERTIES	5
3.4 AERIAL PHOTOGRAPHY	5
3.5 OTHER DOCUMENTS	6
4.0 SITE INSPECTION	**6**
4.1 CURRENT USES OF THE STUDY AREA	6
4.2 SITE OBSERVATIONS	6
4.2.1 Hazardous Substances and Waste	7
4.2.2 Underground/Aboveground Storage Tanks	7
4.2.3 PCB-Containing Equipment	7
4.2.4 Solid Waste	7
4.2.5 Drains and Sumps	7
4.2.6 Wastewater	7
4.2.7 Wells	7
4.2.8 Pits, Ponds, Lagoons, and Canals	7
4.2.9 Other Physical Evidence of Contamination	7
4.3 CURRENT USES OF THE ADJOINING PROPERTY	7
4.4 SURROUNDING PROPERTIES OF POTENTIAL ENVIRONMENTAL CONCERN	7
5.0 REGULATORY AGENCY REVIEW	**8**
5.1 ENVIRONMENTAL DATABASES REVIEW	8
5.1.1 Federal NPL List	8
5.1.2 Federal CERCLIS List	8
5.1.3 Federal RCRA List	8
5.1.4 USEPA FINDS List	9
5.1.5 Emergency Response Notification System (ERNS)	9
5.1.6 FDEP Florida Hazardous Waste Sites (SHWS) List	9
5.1.7 FDEP Solid Waste Disposal Facilities/Landfill Sites	9
5.1.8 FDEP AST/UST and Leaking UST Sites (LUST) Listing	9

5.1.9 MINES Mines Master Index File 9
5.1.10 Orphan Sites 10
5.2 Regulatory Agency File Review 10
6.0 FINDINGS AND CONCLUSIONS – PHASE I ESA 10
7.0 PHASE II ENVIRONMENTAL SITE ASSESSMENT 12
7.1 CONSTITUENTS OF POTENTIAL ENVIRONMENTAL CONCERN 12
7.1.1 Agrochemicals 12
7.1.2 Metals 12
7.1.3 Total Organic Carbon 12
7.2 GENERAL FIELD SAMPLING AND LABORATORY METHODOLOGY 12
7.3 QUALITY ASSURANCE/QUALITY CONTROL 14
7.4 APPLICABLE REGULATORY STANDARDS 14
8.0 ASSESSMENT RESULTS 14
8.1 ORGANOCHLORINE PESTICIDES RESULTS 15
8.2 METALS RESULTS 15
8.3 EVALUATION OF THE 1-MILE CORRIDOR 15
8.3.1 Evaluation of the Area between the Northern and Middle Boundaries 16
8.3.2 Evaluation of the Area between the Middle and Southern Boundaries 16
8.2 EVALUATION OF AREA SOUTH OF THE SOUTHERN BOUNDARY 17
9.0 EVALUATION OF 95% UPPER CONFIDENCE LIMIT 17
10.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT 19
11.0 CONCLUSIONS AND RECOMMENDATIONS 20
12.0 REFERENCES 25

LIST OF FIGURES

Figure 1 General Site Vicinity
Figure 2 Site Map, Areas of Concern and Grid Locations
Figure 3 Organochlorine Pesticides Analytical Results Concentration Map
Figure 4 Metals Analytical Results Concentration Map
Figure 5 Organochlorine Pesticides TEC/PEC Exceedance Map
Figure 6 Metals TEC/PEC Exceedance Map
Figure 7 4,4-DDE Soil Analytical Results Map
Figure 8 Total Chlordane Soil Analytical Results Map
Figure 9 Barium Soil Analytical Results Map
Figure 10 Cadmium Soil Analytical Results Map
Figure 11 Copper Soil Analytical Results Map
Figure 12 Lead Soil Analytical Results Map
Figure 13 Selenium Soil Analytical Results Map

LIST OF TABLES

Table 1 Summary of Soil Analytical Results
Table 2 Summary of Soil Analytical Results (Total Organic Carbons)
Table 3 Additional Assessment Costs

APPENDICES

Appendix A	Site Photographs
Appendix B	Environmental Data Resources, Inc. Report
Appendix C	District Potable Water Well Survey
Appendix D	GPS Points
Appendix E	Soil Analytical Laboratory Reports and Chain of Custody Records
Appendix F	COCs and Analytical Laboratory Reports for Split Samples and Equipment Blanks
Appendix G	Statistical Analysis - 95% Upper Confidence Limit
Appendix H	Screening Level Ecological Risk Assessment Report

1.0 INTRODUCTION

URS Corporation (URS) was retained by the South Florida Water Management District (District) to conduct a Limited Phase I and II Environmental Site Assessment (ESA) of an estimated 6,770 acres, as part of the District's C-111 Spreader Canal project which is located in southern unincorporated Miami-Dade County, Florida and herein referred to as the "Study Area". The Study Area is situated along a one-mile wide corridor between the District's C-111 and C-L-31E canals along SW 424th Street, east and west of US Highway 1 and Card Sound Road. A Site Vicinity Map is provided as **Figure 1**. It is URS' understanding that the one-mile corridor represents the central alignment of the proposed C-111 Spreader Canal Project. The C-111 Spreader Canal – Phase I is in the District's ***Acceler8*** program, which accelerates funding, design, and construction of select projects. This ***Acceler8*** project is a multi-purpose project that will provide ecosystem restoration of freshwater wetlands, tidal wetlands, and near-shore habitat, and maintenance of flood protection in the Southern Glades wetlands area.

For this project, the north portion of the one-mile wide corridor is referred to as the Northern Boundary and represents the northern-most position of the proposed C-111 Spreader Canal, and the south limit of the one-mile corridor is referred to as the Southern Boundary and represents the southern-most position of the C-111 Spreader Canal. The Middle Boundary is located midway (1/2-mile) between the Northern and Southern Boundaries and represents the proposed location of the C-111 Spreader Canal in the event that the Northern Boundary cannot be used. The Study Area is located in southern halve of Sections 13, through 17, 21, 22, 23, and 24, Township 58 South, Range 38 East, in the southern halve of Sections 13 through the northern halve of Sections 13 through 24, Township 58 South, Range 39 East, and west portions of Sections 18 and 19 , Township 58 South, Range 40 East.

A site map illustrating the project Study Area is included as **Figure 2**. This project was conducted in accordance with URS' proposals dated March 6, and March 21, 2006 to Mr. Robert J. Taylor, Lead Environmental Engineer of the District. The project purpose, scope and limitations are described below.

1.1 OBJECTIVE

1.1.1 Phase I Environmental Site Assessment

The purpose of the Phase I Environmental Site Assessment (ESA) was to evaluate environmental concerns or issues that may be associated with the aforementioned properties. Such environmental concerns or issues are subsequently referred to in this report as a "Recognized Environmental Condition" in general accordance with the ASTM Standard E 1527-00. A Recognized Environmental Condition is defined as:

> "The presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies."

1.1.2 Phase II Environmental Site Assessment

The purpose of the Phase II Environmental Site Assessment (ESA) is to evaluate areas of potential environmental concern that may be associated with present or past land use by performing limited soil sampling. The Phase II ESA was conducted in conjunction with the Phase I ESA to expedite completion

of the site project. Phase II ESA activities included the collection of soil samples from the areas of potential concern identified during the Phase I ESA and laboratory analysis of collected samples, and evaluation of the assimilated data.

1.2 SCOPE OF WORK

The Phase I ESA included a site reconnaissance of the Study Area, a review of Federal and state environmental databases and related agency information for the area and surrounding properties, interviews with owner representatives and regulatory agency contacts, historical aerial photograph review, a review of published geologic information, and other related items. This information was used to evaluate existing or potential environmental impairment at the site due to current or past land use.

The Phase I ESA scope of work included the following items:

- Conduct field inspections of the Study Area to identify hazardous or toxic materials used or stored on site; and identify stressed vegetation or areas of disturbance that may indicate areas of past on-site disposal;
- Interview current owner, tenants or managers having knowledge of current and/or past operations or construction activities;
- Review available aerial photographs to evaluate current and historical land use for the site and adjacent properties;
- Inspect areas suspect of discharge and disposal areas, including obvious evidence of stained soils resulting from chemical handling and/or storage, aboveground storage tanks (ASTs) or petroleum discharges;
- Review commercially available environmental databases;
- Observations of regional land use within ¼ mile of the properties, including readily visible conditions posing significant environmental concerns to the subject site;
- Review appropriate environmental agency information pertaining to the site (if available in a timely manner).

The Phase II ESA included surface soil investigations of Study Area on land used for former agriculture purposes identified in the Phase I ESA. The Phase II ESA scope of work included the following tasks:

- Collect soil samples from the former cultivated areas of concern and evaluate for the presence of contaminants originating from on- and off-site sources;
- Conduct a statistical analysis of detected parameters
- Conduct a Screening Level Ecological Risk Assessment of Chemicals of Potential Environmental Concern; and
- Develop budgetary cost estimates associated with additional assessment and/or corrective actions based on results of the investigation.

1.3 LIMITING CONDITIONS

URS was provided access to the entire Study Area with exception to the former US Naval Listening Station and the Everglades Youth Development Center. No other conditions limiting URS' ability to complete the Scope of Work were encountered during the performance of the Phase I/II ESA.

2.0 PHASE I ENVIRONMENTAL SITE ASSESSMENT

2.1 PHYSICAL LOCATION AND DESCRIPTION OF PROPERTY

The Study Area consists of approximately 6,770 acres of land located along a one-mile wide corridor between the District's C-111 and C-L-31E canals along Southwest 424th Street, east and west of US Highway 1 and Card Sound Road in southern unincorporated Miami-Dade County, Florida (**Figure 1**). The majority of the land is used as a conservation area by the Florida Fish and Wildlife Conservation Commission and the District. The area also includes the Everglades Youth Development Center, governmental vacant land, a former listening station for the Department of Defense and numerous smaller, private vacant and undeveloped tracts of land. A site map is provided as **Figure 2**.

2.2 ENVIRONMENTAL SETTING

Environmental characteristics including topography, soils, geology and hydrogeology were evaluated based on site observations, published literature and available maps. These environmental characteristics can affect local groundwater flow, surface water flow and the potential for contaminant migration.

2.2.1 Topography

The United States Geological Survey (USGS), 7.5 Minute Topographic Quadrangle *Glades* depict the Study Area as nearly 5 feet above mean sea level. Elevation data are referenced to the National Geodetic Vertical Datum of 1927.

2.2.2 Soils

The United States Department of Agriculture (USDA), *Soil Conservation Service Soil Survey of Miami-Dade County Area, Florida* indicates that the surficial soils at the Study Area are primarily the soils of the Freshwater and Sawgrass Marsh including the Perrine-Biscayne-Pensuco Association.

The Perrine-Biscayne-Pennsuco Association is nearly level, poorly drained and very poorly drained soils consisting of marl that is 8 to more than 80 inches deep over hard limestone bedrock. This association consists of very shallow to deep soils that consist of marl. These soils are on low coastal plains to the south and southeast of the Atlantic Coastal Ridge, adjacent to Biscayne Bay, and in transverse glades.

This association makes up about 17 percent of the survey area. It is about 45 percent Perrine soils, 38 percent Biscayne soils, 10 percent Pennsuco soils, and 7 percent soils of minor extent. Perrine soils are poorly drained or very poorly drained. Typically, the surface layer is about 11 inches of grayish brown marl that has a texture of silt loam. The next 15 inches is light brownish gray and light gray marl that has a texture of silt loam. Soft limestone bedrock is at a depth of about 26 inches. Biscayne soils are poorly drained or very poorly drained. Typically, the surface layer is about 5 inches of gray marl that has a texture of silt loam. The next 10 inches is gray and light gray marl that has a texture of silt loam. Limestone bedrock is at a depth of about 15 inches. Pensuco soils are poorly drained or very poorly drained. Typically, the surface layer is about 8 inches of dark grayish brown marl that has a texture of silt loam. The underlying material extends to a depth of about 44 inches. This marl has a texture of silt loam. It is grayish brown in the upper 19 inches and dark gray in the lower 17 inches. Limestone bedrock is at a depth of about 44 inches. Most areas of this association support natural vegetation. Some areas are used for urban development. Other areas are used for the cultivation of potatoes, sweet corn, malanga, or ornamental nursery plants.

2.2.3 Geology

The sediments of south Florida are dominated by limestone and dolostone according to the following stratigraphic sequences in descending order:

- **The Miami Limestone** is at or near the surface in the Study Area. This formation is an oolitic limestone that is generally less than 40 feet thick. It characteristically contains large quantities of ooliths which are small spherical particles formed when calcite or aragonite was deposited in concentric layers around a nucleus of some type. The Miami Limestone is considered to be a part of the Surficial Aquifer. It is a good source of water, although it yields less water than the underlying formations.
- **The Key Largo Formation** merges laterally with the Anastasia Formation and with the Miami Limestone in southeast Miami-Dade County and is at the surface throughout the upper Florida Keys. This format attains a thickness of up to 60 feet and consists of limestone derived from coral, algae and some shells. It is essentially a fossil reef, which formed during a period of higher Pleistocene sea level. It is typically very porous and is a very prolific water-producing part of the Surfical Aquifer.
- **The Anastasia Formation** is a sandy, shelly limestone unit that extends along the Atlantic Coast more than 150 miles north of the Study Area and even though it does not occur at the surface in Miami-Dade County it forms a major part of the Surficial Aquifer in coastal areas where it is as much as 120 ft. thick. This unit typically has beds of marine limestone, consisting mainly of cemented whole and broken shells (coquina). These beds are extremely permeable but because they are relatively close to the surface and in close proximity to the ocean, however, the water contained in this formation can be saline.
- **The Fort Thompson Formation** consists of interbedded limestone, sand, shells and is one of the most productive units within the Biscayne Aquifer. It averages 50 to 70 feet in thickness and thickens to the east. It typically consists of alternating freshwater and marine sediments, which generally are permeable. The limestone beds can be cavernous and interconnected providing channels through which water can flow.
- **The Hawthorne Group** consists of interbedded and intermixed sand, silt, clay, dolostone, and limestone. The top of the group consists of sand and clay and forms the base of the Biscayne Aquifer. The lower part consists soft or hard, sandy, phosphatic dolostone or limestone. The upper part of the group acts as a confining unit for the Floridian aquifer system which yields saline water.

2.2.4 Hydrogeology

The Surficial Aquifer in the Study Area extends from the surficial material near or at the surface to a depth of approximately 100 feet where the base aquifer is considered to be the deepest porous limestone bed in the section above the relatively impermeable sand, silt and clay of the Hawthorne Group or the "tight" sand in the Tamiami Formation. The water in the aquifer begins as rainfall, which percolates into the sand or limestone at the surface and flows by gravity below the water table. Superficially, based on aerial photography, the Study Area shows a south to southeast drainage pattern and generally is covered by water.

3.0 HISTORICAL SITE AND SURROUNDING PROPERTY CONDITIONS

3.1 CURRENT AND PRIOR OWNERSHIP

According to the Miami-Dade County Property Appraiser and at the time of the site reconnaissance and the preparation of this report; included among the owners are the District, the Miami-Dade County Department of Environmental Resource Management Environmentally Endangered Lands Program (MDC DERM EEL), Florida Power and Light (FPL), the U.S. Government, U.S. Navy. Mr. Frank Dirico owns of the land used as a former listening station. The owner of the land for the Everglades Youth Development Center appears as the Trust I.I. Fund for the State of Florida. Several other private parties

and individuals appear as owners of smaller vacant and undeveloped tracts of land. The land is currently either un-zoned or zoned as agricultural and the land use code mostly appears as vacant land.

Historically, in 1913 the Model Land Company, a company created by Henry Flagler, purchased 22,000 acres of land which included the Study Area for the purpose of selling the land to homesteaders. The land was subsequently used for agricultural activities for the cultivation of winter vegetables and tropical fruits. Subsequently much of the land was parceled and sold to private individuals.

3.2 INTERVIEWS

URS interviewed Mr. Jason O'Hara Smith, Staff Environmental Analyst for the District, regarding environmental concerns or issues at the Study Area. Mr. Smith stated that historically the land was used for agricultural purposes, with much of the area overgrown with vegetation and the access is difficult.

In order to access most of the area, the District provided transportation for URS by an Argo All-Terrain Vehicle and a qualified operator. URS conducted a telephone interview with Mr. Tom Hambrile, Historian for the Key West Library, and he stated that winter vegetables such as tomatoes and beans were cultivated in the area since the late 1800's. He also stated that the Organoclorine Pesticide 4,4-DDT was sprayed in the region for mosquito control.

Eric Revuelta, a biologist for the Miami-Dade County DERM who accompanied URS and the District on a sampling event corroborated that the former agricultural areas were used for the cultivation of winter vegetables and fruits. Mr. Revuelta indicated that these crops were grown in the winter months. In the summer months, which is the wet season, the plants were affected by various types of fungus and weeds, which were present during the wet season but not in the dry season, or winter months. During the wet season, the cultivated fields were allowed to flood which would inhibit the fungus and weeds. In the winter months excess water in and around the fields was managed and the fields cultivated. Mr. Revuelta also indicated that once fungicides and herbicides were developed, the farming operations moved to the north. The fields were not required to be flooded to control the fungus and weeds due to the farmers using agrochemicals for fungicide and weed control. Crops could be grown throughout the year and these areas did not flood as frequently, therefore less water management was required.

URS conducted telephone interviews with Rodolfo Rego of the Miami-Dade County DERM Pollution Control Division and Mr. Joe Dermacio of the Miami-Dade County Health Department South Miami Satellite Office for any further information regarding current or past environmental issues or concerns for the Study Area. These regulatory interviews are further discussed in Section 5.2.

3.3 ADJOINING PROPERTIES

URS observed the following neighboring properties at the time of the site visit. The identified properties were limited to features and conditions that were visible from public right-of-ways.

North: The Study Area is bordered to the north by undeveloped land and the CEMEX Quarry and Cement Plant located between U.S. 1 and Card Sound Road.
East: The Study Area is bordered to the east by the C-L-31E Canal and further to the east by the cooling canals for the FPL Nuclear Power Plant.
South: The Study Area is bordered to the south by the Southern Glades Wildlife and Environmental Area.
West: The Study Area is bordered to the west by the National Everglades Park.

3.4 AERIAL PHOTOGRAPHY

Historical aerial photographs of the Study Area were available for the 1960's and were reviewed by URS. The aerial photographs reveal that large portions of the Study Area had been used for agricultural

purposes prior to the 1960s. It was observed that vegetation had distinctively grown along cultivation rows. No structures, staging areas, storage or farm support buildings were observed where agro-chemicals may have been staged or stored. The land south of the Southern Boundary appeared to be undisturbed marshland; no agricultural activity, current or past was observed on the aerials south of the Southern Boundary. Based on historical aerial photograph review, the lands that were formerly cultivated appear to be made up of numerous individual farming plots ranging in size from 10 acres up to 200 acres. No large-scale (greater than 500 acres) agricultural parcels were observed. These farming plots appeared to be farms at different periods of time which is probably explains the reason for which no large-scale agricultural parcels were observed.

Three large areas that were used for agricultural cultivation were identified totaling slightly over 4,100 acres in size. The largest area is located west of U.S. Highway 1 and extends to the District's C-111 Canal. The second largest former agricultural area is located east of Card Sound Road, and extends to the District's L-31 A Canal. The third area is located between U.S. Highway 1 and Card Sound Road, south of the limestone quarry.

Two smaller agricultural parcels were identified totaling approximately 83 acres. A 71-acre former agricultural area is located east off of Card Sound Road, just south of the Study Area's southern alignment, and a small 12-acre former agricultural area is located along Card Sound Road on the east side, southwest of the 71-acre area. **Figure 2** is an aerial photograph illustrating the areas of concern located within the Study Area.

3.5 OTHER DOCUMENTS

URS previously conducted a Phase I ESA of over 52,000 acres in the Model Lands area in 1996. Numerous small areas of solid waste were observed. Most of the solid wastes consisted of less than 20 cubic yards of materials consisting of household and construction type wastes. Several solid waste burn piles, discarded tires, abandoned automobiles, and discarded white goods were also noticed. The report identified the solid waste areas as areas of concern and should be removed and properly disposed. An addendum to the Phase I ESA issued in April, 1997, identified three areas of where construction debris landfills were reported to exist. These three areas are located north of the Study Area.

URS contacted Environmental Data Resources, Inc. (EDR) to conduct an environmental database search for the Study Area.

4.0 SITE INSPECTION

4.1 CURRENT USES OF THE STUDY AREA

Currently, the Study Area is mostly used as a wildlife and environmental protection area by the Florida Fish and Wildlife Conservation Commission. The Everglades Youth Development Center occupies approximately 10-acres on Southwest 424th Street, west of U.S. Highway 1. Reportedly, this facility has an administrative building, a food service building, dormitories, a school building, and a medical service and clinical support building. A reported former Navy facility is located east of Card Sound Road. The site is currently vacant. The Photographs taken during the site inspection are provided in **Appendix A**.

4.2 SITE OBSERVATIONS

During the site reconnaissance, former agricultural row crops were observed throughout the Study Area. No abandoned farming equipment, farm support structures, or staging areas were encountered. An active shooting range was observed at the Everglades Youth Development Center. No other improvements were noted.

4.2.1 Hazardous Substances and Waste

A shooting range is located at the Everglades Youth Development Center which may be a source of lead. No other hazardous materials, hazardous wastes or activities that would likely generate hazardous waste were observed in the Study Area.

4.2.2 Underground/Aboveground Storage Tanks

During URS site investigation, no evidence of UST or associated pipes were observed

4.2.3 PCB-Containing Equipment

No equipment that might contain polychlorinated biphenyls (PCBs) was observed.

4.2.4 Solid Waste

Several small piles of solid waste and debris were identified along side of US 1, Card Sound Road and Tallahassee Road. Solid waste consisted of construction debris, household wastes, abandoned white goods and abandoned vehicles.

4.2.5 Drains and Sumps

No drains or sumps were observed during the site investigation.

4.2.6 Wastewater

No wastewater processes were observed.

4.2.7 Wells

No potable wells were observed within the Study Area. However, the Everglades Youth Development Center and the former Navy Facility was not inspected for wells. A permitted water well survey was conducted. Refer to **Section 5.2.**

4.2.8 Pits, Ponds, Lagoons, and Canals

Two manmade pits or ponds were observed west of the Everglades Youth Development Center and south of SW 424th Street. Drainage ditches were located throughout the former agricultural areas. Four District canals are located in the Study Area. The District's C-111 and C-111E canals are located in the western portion of the project. The C-110 canal is located in the west central portion and the C-109 canal parallels U.S. Highway 1. The L-31E borders the eastern portion of the Study Area.

4.2.9 Other Physical Evidence of Contamination

No unusual odors, pools of waste liquids, mounds, manmade depressions or pits were observed on the Study Area.

4.3 CURRENT USES OF THE ADJOINING PROPERTY

The Study Area is bound to the north by mostly wetlands and vacant former agricultural land followed by rural residential houses. To the northwest is agricultural land. Between U.S. Highway 1 and Card Sound Road, the Study Area is bound to the north by the Cemex quarry and cement plant. The property is bound to the west and south by undeveloped wetlands. East of the Study Area are the FP&L cooling ponds.

4.4 SURROUNDING PROPERTIES OF POTENTIAL ENVIRONMENTAL CONCERN

Based on site observations, a review of available documents, and a review of the environmental database, no potential environmental concerns were identified on the surrounding properties.

The assumed groundwater flow is to the south and east. Since areas to the west of the Study Area are undeveloped wetlands, no environmental concerns hydrogeologically upgradient of the property are anticipated. Due to the distance of the properties north of the Study Area and the current land use of the northern properties, and considering the regional groundwater flow direction, no potential offsite environmental concerns to the Study Area was identified.

5.0 REGULATORY AGENCY REVIEW

5.1 ENVIRONMENTAL DATABASES REVIEW

Environmental databases obtained through EDR were reviewed to evaluate if activities on or near the Study Area could provide a threat the environmental quality of the site. The complete list of databases reviewed is provided in the EDR report which is included in **Appendix B**. This information is reported by URS as received from EDR. It is not possible for URS to verify the accuracy or completeness of information contained in these databases. However, the use of, and reliance upon this information is a generally accepted practice in the conduct of environmental due diligence investigations. The databases searched and the information obtained within these databases is summarized below.

- U.S. EPA National Priorities List ("Federal Superfund") (4/19/2006)
- U.S. EPA CERCLIS List (02/01/2006)
- RCRA Resource Conservation and Recovery Act Index System List (RCRIS) (02/21/2006)
- U.S. EPA FINDS Report (Facility Index System) (01/09/2006)
- State of Florida, Department of Environmental Protection (FDEP), Solid Waste Facilities/Landfill Sites (SWF/LF), (2/13/2006)
- FDEP State Hazardous Waste Sites (SHWS), (01/23/2006)
- FDEP AST/UST/LUST List (STI-02) (02/06/2006)
- ERNS Emergency Response Notification System (12/31/2005)

5.1.1 Federal NPL List

The EPA's National Priorities List (NPL) of uncontrolled or abandoned hazardous waste sites was reviewed for sites within a three-mile search radius of the Study Area. To appear on the NPL, sites must have met or surpassed a predetermined hazard ranking system score, been chosen as a state's top priority site, or pose a significant health or environmental threat. The database searches did not identify any NPL sites within the specified 2.0-mile search radius of the Study Area.

5.1.2 Federal CERCLIS List

The EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) listings were reviewed to determine if sites within 2.0-mile of the Study Area are listed for investigation. The CERCLIS database identifies hazardous waste sites that require investigation and possible remedial action to mitigate potential negative impacts on human health or the environment. The database searches did not identify any CERCLIS sites within a 2.0-mile radius of the Study Area.

5.1.3 Federal RCRA List

Under the Federal Resource, Conservation and Recovery Act (RCRA), EPA's Office of Solid Waste maintains an inventory of open dumpsites in the United States. An open dump is defined as a facility,

which does not comply with RCRA Section 2004 criteria for solid waste landfills or disposal, sites. The database searches did not identify open dumps within 2.0-mile of the Study Area.

The current RCRA Notifiers List was reviewed to determine if any RCRA treatment, storage, or disposal sites (TSDs) are within a 2.0-mile radius of the Study Area. The database searches did not identify RCRA TSD facilities within 2.0 miles of the Study Area.

The RCRA-regulated hazardous waste generator notifier's list was reviewed to determine if any RCRA generator facilities are located adjacent to the Study Area. The database search identified the former U.S. Naval Security Group (FL2170024002) referred to in this report as the former U.S. Navy facility, located to the east of Card Sound Road in the central portion of the Study Area as a small quantity hazardous waste generator. The report states that no violations have been reported. The EPA RCRAInfo Database was accessed to and confirmed no violations nor TSDF activities for the facility since it was last updated on 12/04/1989. No other facilities were identified within the 2.0-mile radius of the Study Area.

5.1.4 USEPA FINDS List

The EPA maintains the Facility Index System (FINDS). The FINDS is a compilation of sites, which EPA has investigated, reviewed or has been made aware of connection with its various regulatory programs. These regulatory programs include hazardous waste, water enforcement and permits, underground injection control, drinking water, as well as pesticides and toxic substances. The former U.S. Naval facility was included on the FINDS List, nevertheless no violations were reported. No other facilities were identified within the 2.0-mile radius of the Study Area.

5.1.5 Emergency Response Notification System (ERNS)

The EPA maintains the Emergency Response Notification System (ERNS), which is a list of reported CERCLA hazardous substance releases or spills in quantities greater than the reportable quantity, as maintained at the National Response Center. Based on our review of the ERNS database, there were no ERNS incidences identified within a 2.0-mile radius of the Study Area.

5.1.6 FDEP Florida Hazardous Waste Sites (SHWS) List

The Florida SHWS inventory, which details sites scheduled for investigation or remediation, was reviewed to determine if SHWS are within 2.0-miles of the Study Area. The database search did not identify any SHWS facilities located within a 2.0-mile radius of the Study Area.

5.1.7 FDEP Solid Waste Disposal Facilities/Landfill Sites

The Florida Department of Environmental Protection (FDEP) inventory of solid waste facilities and landfill sites (SWF/LS) was reviewed to determine if SWF/LS are in the vicinity of the Study Area. The database search did not identify any SWF/LS sites within a 2.0-mile radius of the subject properties.

5.1.8 FDEP AST/UST and Leaking UST Sites (LUST) Listing

The FDEP maintains a LUST/UST/AST List, which is a listing of facilities with underground storage tanks (USTs), aboveground storage tanks (ASTs) and leaking underground storage tanks (LUST). The database search identified AEROJET GENERAL CORP as a LUST or UST sites at 42600 SW 232nd Avenue, which is located within a 2.0-mile radii of the Study Area. The database search states that the Discharge Cleanup Status is No Further Action (NFA) Complete.

5.1.9 MINES Mines Master Index File

The Department of Labor, Mine Safety and Health Administration, maintains a database that contains all mine identification numbers issued for mines active or opened since 1971 and it includes violation information. The database search identified RMC SOUTH FLORIDA INC as a non-coal mining MINES

site north of the Study Area. The MINES site is a Cemex quarry and cement plant located immediately north of the central section of the Study Area between U.S. Highway 1 and Card Sound Road. The site has no current U.S. MINE violations.

5.1.10 Orphan Sites

The EDR-supplied Orphan Sites List are sites that have not been geocoded based on an absence of sufficient data regarding their exact location. Based on the Orphan Sites List, and the area reconnaissance, none of these sites have the potential to create a Recognized Environmental Condition to the Study Area.

5.2 REGULATORY AGENCY FILE REVIEW

URS conducted telephone interviews with Rodolfo Rego of the Miami-Dade County DERM Pollution Control Division and Mr. Joe Dermacio of the Miami-Dade County Health Department South Miami Satellite Office for any further information regarding current or past environmental issues or concerns for the Study Area. Neither Mr. Rego nor Mr. Dermacio were aware of current or past environmental issues, concerns, or violations.

The Institution of Food and Agricultural Sciences (IFAS) was contacted for information regarding the Study Area and they indicated that they did not maintain a file on the Study Area. Additionally the IFAS indicated they had no personnel knowledge of environmental issues or concerns on the Study Area.

A water well survey was conducted for permitted potable wells at a ½ -mile radius from the Study Area boundary. Ms. Janet Donnelly, representative of the District was contacted for information regarding permitted potable wells on the Study Area. According to Ms. Donnelly, there is one permitted potable well under Permit No. 13-01213-W located at the Everglades Youth Development Center. Within the ½ mile radius there are four permitted industrial wells under Permit No. 13-00042-W located north of the property at the Cemex Cement Plant. A copy of the District's water well survey is included in **Appendix C**.

6.0 FINDINGS AND CONCLUSIONS – PHASE I ESA

The Phase I ESA was conducted to evaluate the Study Area for Recognized Environmental Conditions. Based on the results of the review of historical aerial photographs and site reconnaissance, five former agricultural areas, approximately 4,186 acres in size, were identified as areas of potential concern. Between the 1940s up to the mid 1950s, these former cultivated areas were used to grow winter row crops. The fields were flooded and fallow during the summer. No evidence of structures, farm support buildings, staging or loading areas were evident in the former agricultural areas.

To further evaluate the soil quality at the Study Area for its suitability for the District's intended use, it is URS' opinion that additional investigations, including surficial soil sample collection, are warranted for these areas.

The Everglades Youth Development Center is reported to have a small arms shooting range, an aboveground storage tank used to store diesel for an emergency generator, and a waste water treatment plant. Access to this facility was not obtained. This facility is located west of U.S. Highway 1 on the south side of Southwest 424 Street, and is situated in the central portion of the Study Area. URS recommends that the disposition of the facility be determined with respect to the C-111 Spreader Canal project. In the event that this area is incorporated into the project URS recommends that a site inspection be conducted and the soil and groundwater quality in the vicinity of the small arms shooting range be evaluated for lead impacts associated with the use of the shooting range. Also, the 10-acre facility should

also be inspected for possible unregulated storage tanks, and for asbestos containing material and lead based paint in the buildings.

URS recommends that the disposition of the former U.S. Naval facility, located east of Card Sound Road, also be determined with respect to the C-111 Spreader Canal project. In the event that this area is incorporated into the project and since access to this facility was not obtained, URS recommends that a site inspection be conducted for possible impacts from handling or use of non-hazardous or hazardous material, and also for possible unregulated storage tanks, and for asbestos containing material and lead based paint in the building.

7.0 PHASE II ENVIRONMENTAL SITE ASSESSMENT

The Phase II Environmental Site Assessment (ESA) activities were based on the preliminary results of the Phase I ESA. The objective of the Phase II ESA was to further evaluate areas of potential environmental concern for the presence of residual agrochemicals associated with historic agricultural operations in the Study Area. The assessment was conducted by collecting soil samples, laboratory analysis of the soil, and evaluating the field and analytical data. The Phase II ESA scope of work included the following items:

- Surficial soil investigations of former agricultural areas identified in the Phase I ESA.
- Statistical evaluation of detected Chemicals of Potential Ecological Concern;
- Screening Level Ecological Risk Assessment
- Develop budgetary cost estimates associated with additional assessment and/or with site remediation based on results of the investigation.

7.1 CONSTITUENTS OF POTENTIAL ENVIRONMENTAL CONCERN

There are two primary groups of Constituents of Potential Environmental Concern (COPECs) that could have impacted soil at the Study Area which include agrochemicals and metals.

7.1.1 Agrochemicals

Since the Study Area was historically used for agricultural purposes, surficial soil samples were collected and evaluated for the presence of residual agrochemicals. During the Phase II ESA, both composite and discrete samples were collected and analyzed for the following:

- Organochlorine Pesticides (EPA Method 8081)

7.1.2 Metals

Fertilizers, plant nutrients, and pesticides may have been used as soil amendments as part of the agricultural activities; therefore; soil samples were collected and analyzed for the following metals:

- Eight Resource Conservation and Recovery Act (RCRA) Metals - Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver (EPA Method 6010) and Mercury (EPA Method 7471)
- Copper and Zinc (EPA Method 6010)

7.1.3 Total Organic Carbon

Total Organic Carbon (TOC) analysis was conducted for food chain modeling and interpretation of sample results to predict risks to U.S. Fish and Wildlife Service (Service) trust resources

- Total Organic Carbon (EPA Method 9060)

7.2 GENERAL FIELD SAMPLING AND LABORATORY METHODOLOGY

The following section details the general field and laboratory methodology used for the sampling and analysis of soil during the Limited Phase II ESA of the C-111 Spreader Canal project site.

For the Phase I ESA, URS identified over 4,150 acres that were or may have been historically utilized for agricultural purposes. In order to determine contaminant distribution and concentration within the former

agricultural areas identified as areas of potential concern, URS followed the Service composite design sampling protocol for large agricultural parcels (greater than 1,000 acres) as discussed with the District and the Service. The areas of potential concern are illustrated as **Figure 2**.

As discussed with the Service, for three large former agricultural areas (approximately 4,100 acres), these areas were divided into 86, 50-acre grids. All the grids east of Card Sound Road, and between U.S.1 and Card Sound Road (a total of 28, 50-acre grids) were selected to be sampled. For the former agricultural areas west of U.S. Highway 1; using a random number generator, a total of 28, 50-acre grids were initially selected, and an additional 11 grids, identified as historical agricultural areas, were also selectively chosen to be sampled. A total of 68, 50-acre grids were selected to be sampled using aerial photographs and a random number generator.

Once the 50-acre grid pattern was established, each grid was subdivided into ten, 5-acre plots or sub-grids. One soil sample was collected from 0-6 inches below land surface (bls) from each of the 5-acre sub grids in the 50-acre grid for a total of 10 sub-samples per grid that were thoroughly mixed to form one composite soil sample for each grid.

URS also collected discreet samples from the small former agricultural areas. As discussed with the Service, the 71-acre former agricultural area was divided into seven, approximate 10-acre sub-grids and one discrete soil sample was collected from each 10-acre sub-grid from 0-6 inches bls. Three composite soil samples were made from the seven discrete soil samples collected. On a small 12-acre former agricultural area, three discrete soil samples and one composite soil sample were collected from 0-6 inches bls. A site map illustrating sampling grid locations is provided as **Figure 2.**

The field sampling procedure consisted of mobilizing by means of an Argo off-road vehicle provided by the District to each grid and confirming the location of the 50-acre grid using a portable Global Positioning Satellite (GPS) receiver and mobilizing to each sample location. At each sample location, a soil boring was advanced from 0 to 6 inches bls, using a stainless steel hand auger, and the soil sample was then placed in a Teflon bag. The location of the sample obtained was recorded utilizing the GPS receiver and marked with a wooden stake at each sub set location. Sample locations were logged utilizing units of Latitude (north) and Longitude (west) in North American Datum (NAD) 83 in order to enable future confirmation of assessed site conditions. A copy of the recorded GPS points is provided in **Appendix D**.

During the field sampling the general soils encountered consisted of a light to dark brown muck to a grayish to tan marl. Limestone was generally encountered at six-inches bls.

Decontamination between sub-samples was not necessary since sub-samples would be later mixed together to form a composite. Immediately following the collection of all 10 sub-samples, the Teflon bag containing the soil sample was sealed, secured, and labeled with the grid identification number, sample date and time, placed on ice and transported to the URS laboratory in Boca Raton, Florida. Between grids or between discrete soil samples, sampling equipment was decontaminated using standard procedures to prevent cross-contamination between samples.

In a sterile environment at the URS laboratory, the samples were thoroughly mixed within the teflon bag and then transferred into a stainless steel bowl and further mixed with a stainless steel spoon. Composite samples were then collected from the thoroughly mixed soil and placed in laboratory supplied bottleware. Labels were affixed to each bottle depicting the project name, grid number, date and time sampled, and the required laboratory analysis. Each sample was then preserved on ice in a cooler and delivered to Palm Beach Environmental Laboratories for analysis following chain of custody procedures for analysis of the COPECs. The chain of custody records and soil analytical laboratory reports are included in **Appendix E**.

Since it has been determined that the Study Area has a history of agricultural activity prior to 1985, both the composite and discrete soil samples were analyzed for organochlorine pesticides by EPA Method 8081 and the Eight RCRA Metals; Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium and Silver. The samples were also analyzed for copper and zinc, and for Total Organic Carbon (TOC).

7.3 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance procedures utilized during this assessment was conducted in general comformance with the Florida Department of Environmental Quality (FDEP) Standard Operating Procedures for Laboratory Operation and Sample Collection Activities, the Service's sampling protocol for agricultural parcels, the District's Quality Assurance Systems Requirements, and URS' Quality Assurance Manual.

Laboratory analytical parameters, procedures, and quality control was conducted in accordance with Test Methods for Evaluating Solid Waste, Physical Chemical Methods, Third Edition (EPA SW-846) methodologies; method specific quality assurance protocols and control procedures outlined in the Palm Beach Environmental Laboratories Comprehensive Quality Assurance Plan. Palm Beach Environmental Laboratories (PBEL) is a State certified and District approved laboratory for analyzing the soil samples. Additionally, split samples were collected and sent for analysis to USBiosystems, a state certified and District approved laboratory. The chain of custody records and soil analytical laboratory reports for the split samples are included in **Appendix F**.

7.4 APPLICABLE REGULATORY STANDARDS

Considering that the natural hydrologic flow will be restored by the C-111 Spreader Canal Project and that the potential use of the former agricultural area as wetlands, the principal component of this assessment is to identify constituents that potentially or adversely affect the ecological environment. Since the soils may eventually become sediment post-inundation and may routinely flood, the soil contaminant concentrations were compared to consensus-based Threshold Effect Concentrations (TEC) and Probable Effect Concentrations (PEC) as described in Table 5.1 of *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater-Ecosystems*, published by MacDonald Environmental Sciences, Ltd. for the FDEP in 2003.

Based upon URS' experience evaluating ecological risks at other similar sites, as well as information from the Service and the District, uncertainties have become apparent associated with the methodology used to estimate copper hazards for the Snail Kite, one of the more sensitive trustee species that is anticipated to be established at the proposed site. Additional research did not reveal any significant information with respect to Snail Kites and their primary food source, the Apple Snail. For these reasons and based on the additional research, an interim Effects Level or PEC of 85 mg/kg was agreed upon by the Service and the District. Additionally, the Service has communicated to URS that an interim Effects Level of 1.0 mg/kg of Selenium should be used for sites in South Florida.

8.0 ASSESSMENT RESULTS

The following section summarizes the laboratory analytical results of URS' Phase II ESA activities as conducted in each grid within the potential areas of environmental concern. Soil analytical laboratory reports are included in **Appendix E.** The soil analytical results are summarized in **Table 1**. Refer to **Figure 3** for an Organochlorine Pesticides Analytical Results Concentration Map and to **Figure 4** for a Metals Analytical Results Concentration Map. Soil Analytical Results for Total Organic Carbons are summarized in **Table 2.**

8.1 ORGANOCHLORINE PESTICIDES RESULTS

Total chlordane was detected in the composite soil sample collected from Grid No. 82 at 31.5 micrograms per kilogram (µg/kg). This concentration is above the chlordane SQAG PEC of 18 µg/kg. Soil samples collected from two grids, No. 10 and No. 65 exhibited total chlordane at 9.69 µg/kg and 4.03 µg/kg. These concentrations exceeded the chlordane SQAG TEC of 3.2.

Low concentrations of 4,4-DDE were detected in the composite soil samples collected from seven grids, No. 33, No. 35, No. 39, No.40 No. 46, No. 49 and No. 57, ranging from 3.28 µg/kg to 17.9 µg/kg. These concentrations exceeded the 4,4-DDE SQAG TEC of 3.2 µg/kg but were below the SQAG PEC of 31 µg/kg.

Other EPA Method 8081 parameters analyzed in the composite and discrete soil samples were either below their respective SQAG TEC values or below laboratory detection limits (bdl). **Figure 5** illustrates the grids with EPA Method 8081 organochlorine pesticide PEC and TEC exceedances.

8.2 METALS RESULTS

Copper, lead, and cadmium were detected in the composite soil samples collected from the two Grids No. 44 and No. 53 above their SQAG PECs. Copper was detected in Grid No. 44 at 924 mg/kg and in Grid No. 53 at 886 mg/kg, respectively. These concentrations are above the Service's SQAG copper interim value of 85 mg/kg. Lead concentrations were 1,480 mg/kg in Grid No. 44, and 1,240 mg/kg in Grid No. 53. These concentrations are above the lead SQAG PEC of 130 mg/kg. Cadmium concentrations were 106 mg/kg in Grid No. 53, and 70.0 mg/kg in Grid No. 44. These concentrations are above the cadmium SQAG PEC of 5.0 mg/kg. **Figure 6** illustrates the grids with metal PEC and TEC exceedances.

Barium was also detected in Grids No. 44 and No. 53 at 37.0 mg/kg and 46.6 mg/kg, which is above the barium SQAG TEC of 20 mg/kg.

Selenium was detected in the composite soil samples collected from four Grids No. 12, No. 16, No. 22, and No. 24.. The selenium concentrations ranged from 1.43 mg/kg to 2.32 mg/kg. These concentrations are above the Service's interim value of 1 mg/kg.

The other metals detected above established SQAGs were arsenic and copper. Arsenic was detected in the composite soil sample collected from Grid No. 20 at 10.1 mg/kg, which exceeds the arsenic SQAG TEC of 9.8 mg/kg. Copper was detected in the composite soil sample collected from Grid No. 46 at 37.0 mg/kg, which exceeds the copper SQAG TEC of 32 mg/kg.

The other metals analyzed in the composite and discrete soil samples were either below their respective SQAG TEC values or below laboratory detection limits

8.3 EVALUATION OF THE 1-MILE CORRIDOR

The soil analytical data reviewed was collected from the Study Area with respect to the District's placement of the C-111 Spreader Canal and restoration of the hydroflow within the 1-Mile Corridor. Ideally, the further north the C-111 Spreader Canal can be positioned, the more area that will be re-hydrated. For the Phase II, the Study Area was defined by three boundaries: Northern, Middle and Southern. The Northern Boundary of the Study Area represents the northern-most position of the C-111 Spreader Canal, while the Southern Boundary represents the southern-most position of the C-111 Spreader Canal. The Middle Boundary is the midway point, ½- miles between the northernmost and southern-most position.

Considering this, the soil analytical results were reviewed with respect to SQAG PECs and TECs, focusing on the samples collected from the grids located between the Northern Boundary and the Middle Boundary, located ½-mile to the south to evaluate if the upper ½-mile portion of the Study Area would be

suitable for the District to re-hydrate. Soil analytical results were also reviewed for samples collected from the grids located between the Middle Boundary and the Southern Boundary to evaluate if the lower ½-mile portion of the Study Area would be suitable for the District to re-hydrate.

The grids where soil samples were collected that are located between the Northern and Middle Boundaries are #s 1,2,20,21,28,29,34 through 37,43,44,45,52,53,58,59,60,65,66,67,69,70,77,78,79,80, and 81. The grids where soil samples were collected that are located between the Northern and Middle Boundaries are #s 3,4,5,7,8,10,12,13,16,22,24,31,32,33,38,39,40,46,47,48,49,54,55,56,57,61,62,63,68,71 through 76, 82 through 86.

8.3.1 Evaluation of the Area between the Northern and Middle Boundaries

Review of the organochlorine pesticides that exceed the SQAGs in grids located between the Northern and Middle Boundaries show that only two composite soil samples, collected from two grids, No. 35 and No. 65, exhibited 4,4-DDE and total chlordane, respectively above their SQAG TEC. The composite soil samples collected from the other grids between the Northern and Middle Boundaries were either below the organochlorine established SQAG TECs or were below detection limits. **Figure 7** and **Figure 8** illustrate the composite and discrete laboratory analytical results for 4,4-DDE and total chlordane, respectively, and the grids PEC and/or TEC exceedances.

Review of the metals that exceed the SQAGs located in grids between the Northern and Middle Boundaries show that the composite soil samples collected from two grids, No. 44 and No. 53, had copper, lead and cadmium concentrations above their respective SQAG PECs. Barium was also detected in Grids No. 44, and No. 53 at concentrations above the SQAG TEC. Arsenic was detected in Grid No. 20 above the SQAG TEC. The composite soil samples collected from the other grids between the Northern and Middle Boundaries were either below the metal SQAG TECs or were below laboratory detection limits. **Figures 9, 10, 11, 12**, and **13** illustrate the composite and discrete laboratory analytical results for barium, cadmium, copper, lead, and selenium, respectively that exceeded the PEC and/or TEC, and the grids with PEC and/or TEC exceedances.

An estimated 100 acres within the Northern and Middle Boundaries potentially have organochlorine pesticide concentrations (4,4-DDE) above the SQAG TEC. **Figure 5** illustrates the grids with organochlorine pesticide concentrations that exceed established SQAG PECs and TECs.

An additional 100 acres have been identified that potentially have metal concentrations (cadmium, copper, lead) above established SQAG PECs, and 50 acres (arsenic) above established SQAG TEC. The impacted areas are located west of U.S. Highway 1. No metal exceedances were detected in the composite soil samples collected from grids located east of U.S. Highway 1. **Figure 6** illustrate the grids with metals concentrations that established SQAG PECs and TECs.

8.3.2 Evaluation of the Area between the Middle and Southern Boundaries

Review of the organochlorine pesticides that exceed the SQAGs in grids located between the Middle and Southern Boundaries show that only one composite soil samples collected from grid No. 82 between the Middle Boundary and Southern Boundary, exhibited total chlordane above the SQAG PEC. Concentrations of 4,4-DDE were detected in grids No. 33, No. 39, No. 40, No. 46, No. 49 and No. 57 above the SQAG TEC. The other composite soil samples collected were either below established SQAG TECs or were below laboratory detection limits. **Figure 7** and **Figure 8** illustrate the composite and discrete laboratory analytical results for 4,4-DDE and total chlordane, respectively, and the grids PEC and/or TEC exceedances.

Review of the metals that exceed the SQAGs in grids between the Middle and Southern Boundaries show that composite soil samples collected four grids, No. 12, No.16, No.24, and No. 46, exhibited selenium at concentrations above the Service's interim value of 1 mg/kg. Copper was detected in Grid No. 46 above

the SQAG TEC. The other composite soil samples collected were either below established SQAG TECs or were below laboratory detection limits. **Figure 11** and **13** illustrate the composite and discrete laboratory analytical results for copper and selenium, respectively, that exceeded the PEC and/or TEC, and the grids with PEC and/or TEC exceedances.

An estimated 50 acres potentially have organochlorine pesticide concentrations, specifically total chlordane, above the SQAG PEC. This area is located east of Card Sound Road. Also 50 acres, located west of U.S. Highway 1 has been identified as having potentially total chlordane concentrations above the SQAG TEC. Three hundred acres, located west of U.S. Highway 1 potentially has been identified with 4,4-DDE concentrations above the SQAG TEC. **Figure 5** illustrates the grids with organochlorine pesticide concentrations that exceed established SQAG TECs and PECs.

An estimated 200 acres potentially have selenium concentrations and 50 acres have copper concentrations above the Service's interium values of 1 mg/kg and 85 mg/kg, respectively. The impacted areas are located west of U.S. Highway 1. No metal exceedances were detected in the composite soil samples collected from grids located east of U.S. Highway 1. **Figure 6** illustrate the grids with metals concentrations that established SQAG TECs and PECs.

8.2 EVALUATION OF AREA SOUTH OF THE SOUTHERN BOUNDARY

No organochlorine pesticides were detected above laboratory detection limits in the six composite soil samples and ten discrete soil samples collected from the grids south of the southern boundary. The metals detected, with the exception of the two split soil samples, were either below the SQAG TECs or below laboratory detection limits.

Selenium was detected above the Service's interim value of 1 mg/kg in the split composite soil sample DC-1 and the split discrete soil sample D-4 location. Other metals analyzed were below SQAG TECs or were below laboratory detection limits in the remaining 8 discrete soil samples and six composite soil samples. Selenium was not detected in the samples analyzed by the primary laboratory. **Figure 13** illustrates the composite and discrete laboratory analytical results for selenium, and the grids that exceeded the Service's interim value.

9.0 EVALUATION OF 95% UPPER CONFIDENCE LIMIT

Subsequent to the soil sampling program implemented by URS to evaluate the soil quality in the Study Area, a statistical analysis was conducted to obtain the numerical mean and 95% upper confidence limit (UCL) concentrations of select constituents in the easement. The 95% UCL equals or exceeds the true average, 95 percent of the time.

Analytical laboratory data of composite soil samples collected indicated elevated levels of residual agrochemical constituents. Eight chemicals of potential ecological concern (COPEC) were identified: two organochlorine pesticides (total chlordane and 4,4-DDE), and six metals (arsenic, barium, copper, lead, and selenium). The mean and 95% UCL concentrations were calculated for the eight constituents that could potentially pose an ecological threat once the hydroflow is re-established.

The analytical data generated from the analysis of soil samples collected were used to complete the statistical analysis for the area as a whole. According to the Service sampling protocol for agricultural parcels, this statistical analysis is used to evaluate whether or not serious widespread ecological effects are possible due to exceedances of the TEC. Separate statistical analyses were conducted for each compound detected above the respective TEC concentration. A 95% UCL was calculated for each detected COPEC for the entire Study Area. A 95% UCL was also detected for just the detected COPECs

within the area between the middle boundary and the southern boundary. Refer to **Appendix G** for a copy of the statistical analysis.

Initially, URS calculated the 95% UCL on the entire 1-mile corridor. All the composite soil analytical data collected from the 68 grids composite soil samples were used in calculating the 95% UCL for the COPECs to evaluate if the C-111 Spreader Canal positioned along the Northern Boundary, when the hydroflow is restored, the Study Area would be suitable to be inundated. URS then calculated the 95 % UCL for detected COPECs utilizing the data from soil samples collected only between the Middle and Southern Boundaries, and the four grids south of the Southern Boundary. A total of 40 composite samples were used to evaluate the lower ½-mile portion of the 1-mile wide corridor for inundation, in the event that the upper ½-mile portion of the 1-mile wide corridor is not suitable to inundate, and the C-111 Spreader Canal could not be located along the preferred Northern Boundary, and had to be positioned ½-mile south to the Middle Boundary of the 1-mile corridor. Given below is a summary of the statistical analysis.

Study Area – Northern Boundary to Southern Boundary*

COPEC	Mean	95% UCL
Total Chlordane	0.92	3.02
4,4-DDE	1.26	3.08
Arsenic	2.62	2.98
Barium	13.56	14.7
Cadmium	***4.62***	***12.59***
Copper	***36.29***	***116***
Lead	***48.8***	***170***
Selenium	***2.62***	***3.8***

* Includes former agricultural areas south of southern boundary

Bold and Italicized – Exceeds SQAG TEC. Copper and selenium exceeds the Service's Interim Values

Study Area – Middle Boundary to Southern Boundary*

COPEC	Mean	95% UCL
Total Chlordane	1.23	***4.77***
4,4-DDE	1.90	***4.91***
Copper	11.58	13.8
Selenium	***2.59***	***4.20***

* Includes former agricultural areas south of southern boundary

Bold and Italicized – Exceeds SQAG TEC. Selenium exceeds the Service's Interim Value.

The 95% UCL concentrations for Total Chlordane exceeded the SQAG TEC in the Middle to Southern Boundary data set. The 95% UCL concentrations for 4,4-DDE exceeded the SQAG TEC in the Middle to Southern Boundary data set. Both the mean and the 95% UCL concentrations for cadmium, copper, lead and selenium exceed their respective SQAG TECs for the entire Study Area. Nevertheless, only the mean and 95% UCL concentrations for selenium and the 95% UCL concentrations for cadmium exceed their respective SQAG TECs for the middle to southern boundary data set.

Based on the analytical data for each parameter, the sample data set of 68 points was used to estimate 95% UCL values, using the PRO-UCL, statistical methods approved by the US EPA. For each parameter, percentages of detection and censoring were calculated using the number of measured concentrations. The database sheets and calculations for the 95% UCLs are included in Appendix D.

10.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Due to the elevated concentrations of agrochemicals detected in the soils at the C-111 Spreader Canal Project in ascendance of the SQAGs, a Screening Level Ecological Risk Assessment (SLERA) was conducted to determine the potential for ecological impacts to occur from these agrochemicals, should the area be rehydrated.

Under the event that rehydration occurs in the entire Study Area, that is from the Northern Boundary to the Southern Boundary, no unacceptable risks were indicated for the fish and benthic community. In addition, all hazard quotients (HQs) for the Trustee bird species were less than one, indicating that there would be no unacceptable risks to higher-trophic level, avian receptors. However, it must also be considered that some Trustee species could forage within areas smaller than the exposure unit defined by the entire area, and as a result may be exposed to maximum concentrations. For example, if a sensitive species such as the snail kite were to preferentially feed in the either one of the two grids with the highest copper concentrations (grids 44 and 53), unacceptable risk may be present.

Under the event that rehydration occurs in the area between the Middle and Southern Boundaries, no unacceptable risks were predicted to either the fish and water column community or Trustee bird species. Although the Service's interim value of 1 mg/kg for selenium was slightly exceeded in composite soil samples collected grids 12, 16, 22, and 24 and discrete samples collected from grids D3 and D4, the District's fugacity-based food web model indicated no significant risks to avian receptors using site-specific exposure assumptions. The potential risk to benthic macroinvertebrates from exposure to selenium in sediments is unknown because a screening value could not be found. This represents an uncertainty in the overall evaluation, but the uncertainty is considered low.

The Screening Level Ecological Risk Assessment Report is included in **Appendix H**.

11.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Phase I

The C-111 Spreader Canal project is located in southern Miami-Dade County, Florida, and consists of 6,770 acres. This project, referred to as the "Study Area" is situated along a 1-mile corridor between the District's C-111 and L-31 East canals, and located south of Florida City.

The northern extent of the one-mile wide corridor is referred to as the Northern Boundary and represents the northern-most position of the proposed C-111 Spreader Canal, and the south limit of the one-mile corridor is referred to as the Southern Boundary and represents the southern-most position of the C-111 Spreader Canal. The Middle Boundary is located midway (1/2-mile) between the Northern and Southern Boundaries and represents the proposed location of the C-111 Spreader Canal in the event that the Northern Boundary cannot be used.

Five former agricultural areas, approximately 4,186 acres were identified as areas of potential concern by the Phase I ESA. The largest tract, located along the western portion of the corridor is an estimated 2,740 acres. This tract extends from the western extent of the project at the C-111 Canal, east to U.S. Highway 1. Three tracts of land, ranging in size from 299 acres to 70 acres are located east of U.S. Highway 1. A small 11-acre tract is located to the south of these tracts adjacent to Card Sound Road. The 11-acre tract and the 70-acre tract are the only identified former agricultural areas located south of the Southern Boundary.

The former agricultural areas were active in the 1930s and 1940s up to the mid 1950s. Reportedly, vegetable row crops, consisting of tomatoes, corn, squash, and other vegetables were grown in the former cultivated areas. These vegetables were grown in the winter due to the present of fungi in the soils during the summer months. During the summer months the cultivated fields were allowed to flood in order to eliminate the fungi that grew in the soils during the rainy season.

No evidence of buildings, storage/staging areas, process operations, or other farm support structures were observed on the former agricultural areas or within the Study Area.

The Everglades Youth Development Center and a former Navy listening station for the Department of Defense are located within the Study Area. Small, vacant and undeveloped tracts of land make up the remaining portion of the Study Area.

Phase II

Extensive soil quality evaluations were conducted in the 4,186 acres of former agricultural area. As discussed with the Service, the former agricultural areas were divided into 82, 50-acre grids. All the grids east of Card Sound Road, and between U.S.1 and Card Sound Road (a total of 29, 50-acre grids) were sampled. For the former agricultural areas west of U.S. Highway 1; using a random number generator, a total of 28, 50-acre grids were initially selected, and an additional 11 grids, identified as historical agricultural areas, were also selectively chosen to be sampled, resulting in 39 of the 56 grids (70%) being sampled. A total of 68, 50-acre grids were selected to be sampled using aerial photographs and a random number generator. One composite soil sample was collected from each of the 68 grids.

Discreet soil samples were also collected from the small former agricultural areas. The 70-acre former agricultural area was divided into seven, approximate 10-acre sub-grids and one discrete soil sample was collected from each 10-acre sub-grid. Three composite soil samples were made from the seven discrete

soil samples collected. On the small 11-acre former agricultural area, three discrete soil samples and one composite soil sample were collected.

Northern to Middle Boundary

The composite soil samples collected from between the Middle and the Northern Boundary indicates that copper, lead, and cadmium were detected in Grid No. 44 and No. 53 above their respective SQAG PECs.

Copper was detected in Grid No. 44 at 924 mg/kg and in Grid No. 53 at 886 mg/kg, above the Service's copper interim value of 85 mg/kg.

Lead concentrations were 1,480 mg/kg in Grid No. 44, and 1,240 mg/kg in Grid No. 53, above the lead SQAG PEC of 130 mg/kg.

Cadmium concentrations were 106 mg/kg in Grid No. 53, and 70.0 mg/kg in Grid No. 44, above the cadmium SQAG PEC of 5.0 mg/kg.

Barium was also detected at these two grids above its respective SQAG TEC.

The organochlorine pesticides, 4,4-DDE and total chlordane, detected between the Middle and Northern Boundary in two samples collected from Grids No. 35 and No. 65, respectively, above their SQAG TEC. Other organochlorine pesticides were either below SQAG TECs or below laboratory detection limits.

Middle to Southern Boundary

The evaluation of the area located between the Middle and the Southern Boundary indicate that total chlordane was detected in Grid No. 82 at 31.5 µg/kg exceeding the chlordane SQAG PEC of 18 µg/kg. Total chlordane exceeded the SQAG TEC at Grid No. 10 and 4,4-DDE exceeded its respective SQAG TEC at six grids. Other organochlorine pesticides were either below SQAG TECs or below laboratory detection limits.

Selenium was detected in the composite samples collected from Grids No. 12, No. 16, No. 22, and No. 24, ranging from 1.43 mg/kg to 2.32 mg/kg, exceeding the Service's interim value of 1 mg/kg. Other metals analyzed were either below SQAG TECs or below laboratory detection limits.

No metal exceedances were detected in the composite soil samples collected from the 28 grids located east of U.S. Highway 1. No organochlorine pesticides were detected above laboratory detection limits in the four composite soil samples and 10 discrete soil samples collected from the former agricultural areas south of the Southern Boundary. The metals detected in these soil samples were either below SQAG TECs or below laboratory detection limits.

95% Upper Confidence Limit

Northern to Southern Boundary

- calculation for the area located between the Northern to Southern boundary; both the mean and 95% UCL concentrations for cadmium, copper, lead and selenium exceeding their respective SQAG TEC levels.

Middle to Southern Boundary

- For the Middle to the Southern Boundary; the mean and 95% UCL concentrations for selenium are 2.44 µg/kg and 4.02 µg/kg, respectively. Both the mean and the 95% UCL exceed the selenium SQAG TEC. The 95% UCL concentrations for Total Chlordane and 4,4-DDE are 5.19

μg/kg and 4.91 ug/kg, respectively exceeding the SQAG TECs of 3.2 μg/kg and 3.2 ug/kg, respectively.

Screening Level Ecological Risk Assessment
Northern to Southern Boundary

- Under the event that rehydration occurs in the entire Study Area, no unacceptable risks were indicated for the fish and benthic community, although some potential risks may occur to the benthic community in the form of exposure to cadmium, copper and lead due to elevated concentrations in Grids 44 and 53.
- The hazard quotient (HQ) for copper slightly exceeded 1 indicating a low potential risk, specifically for the nail kite. This risk is mainly associated with preferential feeding in one of the two Grids 44 and 53 with high copper concentrations.
- All other HQs for the Trustee bird species were less than one, indicating that there would be no unacceptable risks to higher-trophic level, avian receptors. However, it must also be considered that some Trustee species could forage within areas smaller than the exposure unit defined by the entire area, and as a result may be exposed to maximum concentrations, (i.e. grids 44 and 53 which have elevated cadmium, lead, and copper above SQAG PECs), unacceptable risk may be present.

Middle and Southern Boundary

- Under the event that rehydration occurs in the area between the middle and southern boundaries, no unacceptable risks were predicted to either the fish and water column community or Trustee bird species.
- The Service's interim value of 1 mg/kg for selenium was slightly exceeded in composite soil samples collected grids 12, 16, 22, and 24 and discrete samples collected from grids D3 and D4, the District's fugacity-based food web model indicated no significant risks to avian receptors using site-specific exposure assumptions.
- The potential for ecological risks associated with this scenario, overall are considered to be low.

Recommendations

The Phase II ESA has identified 100 acres in the Northern to Middle Boundaries where soil samples collected have exhibited cadmium, lead, and copper concentrations greater than the SQAG PEC of 5 mg/kg, 130 mg/kg, and the Service's interim value of 85 mg/kg, respectively. In the Middle to Southern Boundaries, 50 acres has been identified with total chlordane concentrations above the 18 mg/kg SQAG PEC. Selenium has also been identified in 215 acres also located in the Middle to Southern Boundaries at concentrations above the Service's interim value of 1 mg/kg.

Based on the SLERA the 100 acres of cadmium, lead, and copper, and the 50 acres of chlordane impacted soils pose a potential risk to the Service's trustee species. The 215 acres of selenium impacted soils, based on the SLERA, do not appear to pose undo risk to the Service's trustee species.

The SLERA has indicate that, with the exception of the 150 acres mentioned above, the Northern Boundary is suitable for the placement of the C-111 Spreader Canal, and the 1-mile corridor can be inundated without causing undo risk to the Service's trustee species

In order to evaluate if "hot spots" exist in the 150 acres, URS recommends that additional soil sampling be conducted. Because elevated total chlordane was exhibited in the composite soil sample collected from grid 82 and cadmium, lead, and copper were exhibited in the composite soil samples collected from

grids 44 and 53, URS recommends returning to each of these grids and collecting individual discrete samples from each of the ten 5-acre sub-grids sample locations and collect discrete soil samples.

In accordance with the Service's recent correspondence in which the Service has requested additional sampling in grids in close proximity to impacted areas, which had not been previously evaluated, URS recommends collecting composite samples from grids 42, 50, and 51 located diagonally and adjacent to grids 44 and 53; which were not assessed during this Phase II ESA. The composite soil samples should be analyzed for cadmium, copper and lead, in order to further determine the extent of the contamination in the vicinity of grids 44 and 53. Because composite soil samples were collected in grids that surround grid 82, which exhibited elevated chlordane, and no elevated chlordane was exhibited above the SQAG TEC, sampling in adjacent grids is not warranted.

Additionally, since the soils at Grids No. 12, No. 16, No. 22, and No. 24 located in the area south of the middle boundary exceeded the Service's interim value of 1 mg/kg for Selenium, URS recommends returning to each of the previous grids and collecting individual discrete samples from each of the ten 5-acre sub-grids which together formed the original composite, submitting the samples for analysis and determining the distribution of the contaminant selenium. Additionally, URS recommends collecting composite samples from Grids No. 11, No. 14, No. 15, No. 17, No. 18, No. 23, No. 25, and No. 30 located adjacent and diagonally; which were not assessed within this Phase II ESA, and evaluating for selenium, in order to verify that no "hot spots are present in grids 12, 16, 22, and 24 and elevated selenium is not present in the surrounding grids.

The soil analytical data will be reviewed and areas of elevated chlordane, cadmium, lead, and/or copper identified. Based on the size of these "hot spots" a remedial strategy will be developed to abate the potential risks the impacted soils in these "hot spots" pose to the Service's trustee species. The remedial strategies currently being employed and/or considered by the District is given below.

Option 1 – Excavate impacted soils to the SQAG PEC

Upon delineating the "hot spot" areas of chlordane, cadmium, lead and/or copper impacted soils, above their respective SQAG PECs, soils would be excavated one foot below land surface or to bedrock, which ever is encountered first. Depending on the size of the "hot spots", this option may not feasible. This option will demonstrate the costs for essentially removing the risks associated with chlordane and metals impacted soils in the Study Area so that this area could be flooded. The excavated soils will be transported off-site and disposed at a licensed facility. The excavated area (s) would not be backfilled.

Option 2 – Convert "Hot Spots" Into Uplands Area

The areas of chlordane and metals impacted soils could be capped with up to 2 feet of clean fill material essentially creating uplands in the areas identified. This will prevent exposure of the chlordane and metal impacts to most of the benthic macro-invertebrates, which are anticipated to inhabit the sediment once the hydroflow is restored in the Study Area. Prior to implementing this option, a series of leachability tests will need to be conducted to ensure that the chlordane and metals will not leach from the soils. A stormwater management plan for the newly created uplands area will need to be formulated.

Option 3 – Soil Inversion

Soil inversion consists of inverting a 2-foot section of the soil horizon, where as the impacted soils are placed 2 feet below land surface and soils that are not impacted or soils with lower concentrations cover the impacted soils. A pilot test will need to be conducted to document that this option is effective and efficient in reducing or eliminating the ecological risks associated with the chlordane and metals impacted

soils. This option may not be practical because of the relatively thin soil thickness; 6 inches to 18- inches thick in some places. Also, the presence of pinnacle rock in this area may affect this option.

Option 4 – Re-locate Chlordane and Metals Impacted Soils

The conceptual plan for restoring the hydroflow includes the construction of a series of berms and roads. Option 4 consists of excavating the areas of chlordane and metals impacted soils to at least 1 foot below land surface for relocation outside the Study Area and re-use the impacted soils as material to construct proposed berms or road base. The District's project manager for construction of the C-111 Spreader Canal will need to be consulted to ensure that the relocated soils are suitable for use as material for the berms/road base. The estimated amount of soils generated from the 150 acres ranges between 242,000 up to 484,000 cubic yards. Prior to implementing this option, a series of leachability tests will need to be conducted to ensure that the chlordane and metals will not leach from the excavated soils. Presence of pinnacle rock may affect this option. This option may also be difficult due to the presence of pinnacle rock.

Because construction of the berm and levee are already included in the budget the costs associated with using the impacted soils, i.e. excavation, transportation, will be greatly reduced.

12.0 REFERENCES

Environmental Data Resources, Inc., EDR Data Map, C-111 Spreader Canal, Miami-Dade County, Florida. Inquiry Number 01683476.1r May 26, 2006

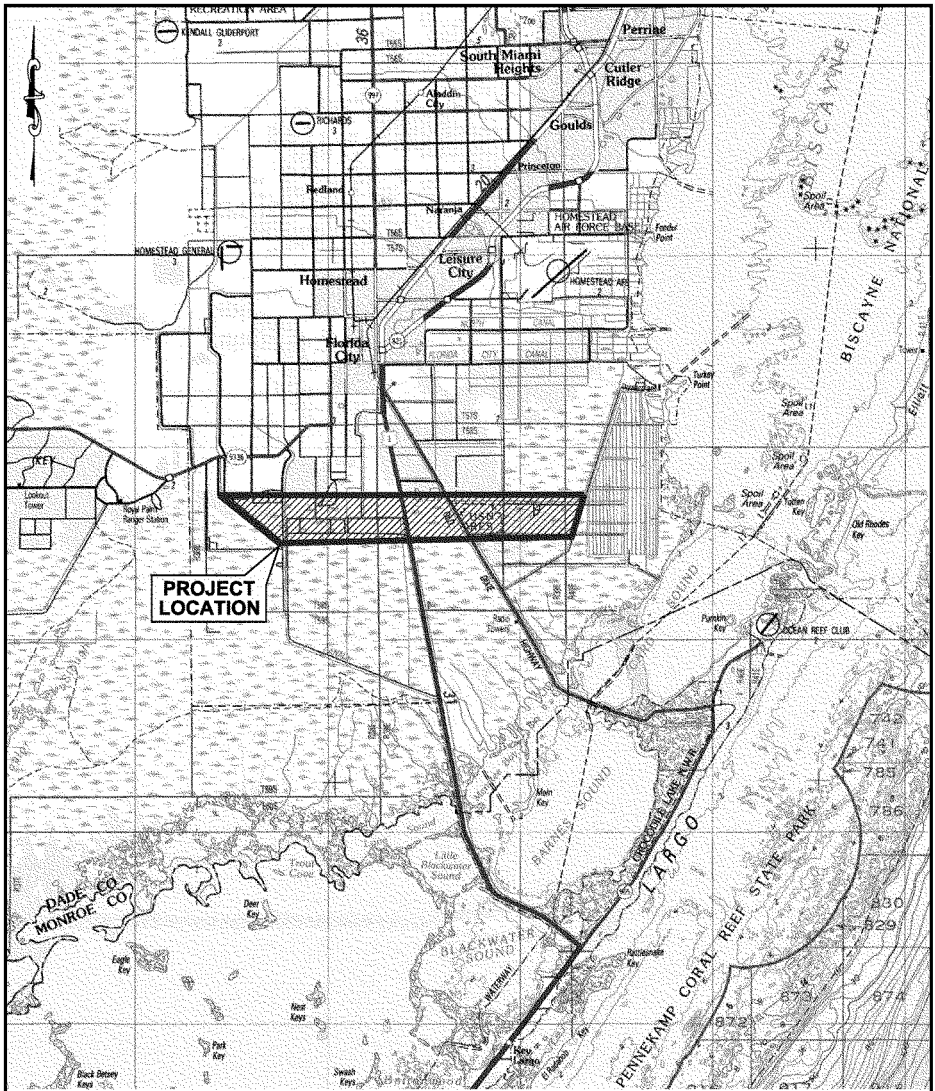
United States Department of Agriculture, Soil Survey of Dade County Area, Florida, US Department of Agriculture, 1996.

MacDonald Environmental Sciences, LTD. *Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters*. January 2003.

Dames & Moore, *Phase I Environmental Assessment Model Land Properties Southern Dade County*, December 18, 1996

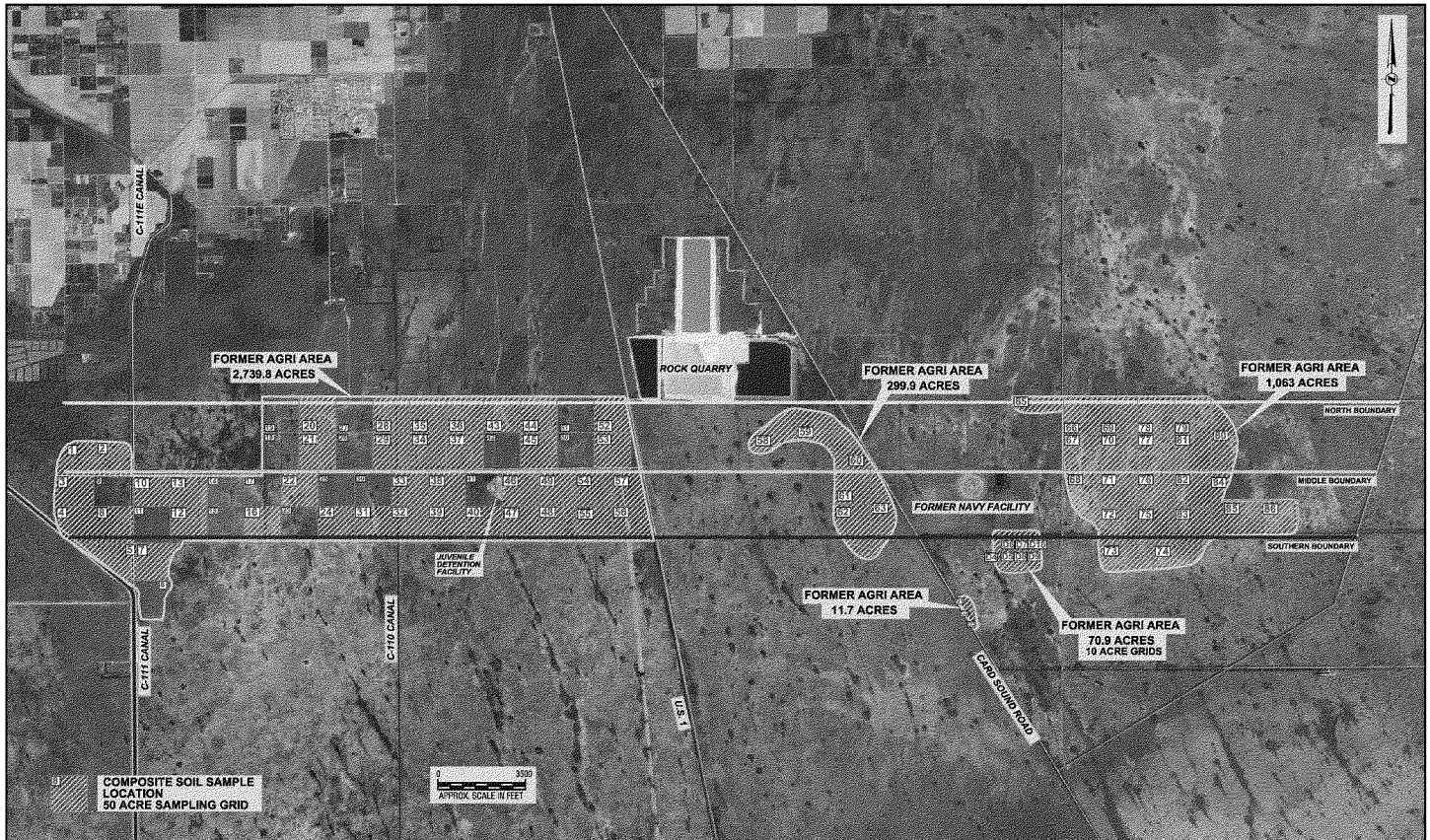
United States Geological Survey, 7.5-minute series, Quadrangle map *"GLADES"*.

FIGURES



GENERAL SITE VICINITY

DRAWN: R.A.C. DATE: JULY 06	URS 7800 CONGRESS AVENUE, SUITE 200 BOCA RATON, FLORIDA 33487 PHONE: (561) 994-5500 FAX: (561) 994-6524		**FROG POND** MIAMI-DADE CO., FLORIDA JOB NO.: 38615964 DATE: JULY 2006	FIGURE: 1



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DATE: FEB. 2006			

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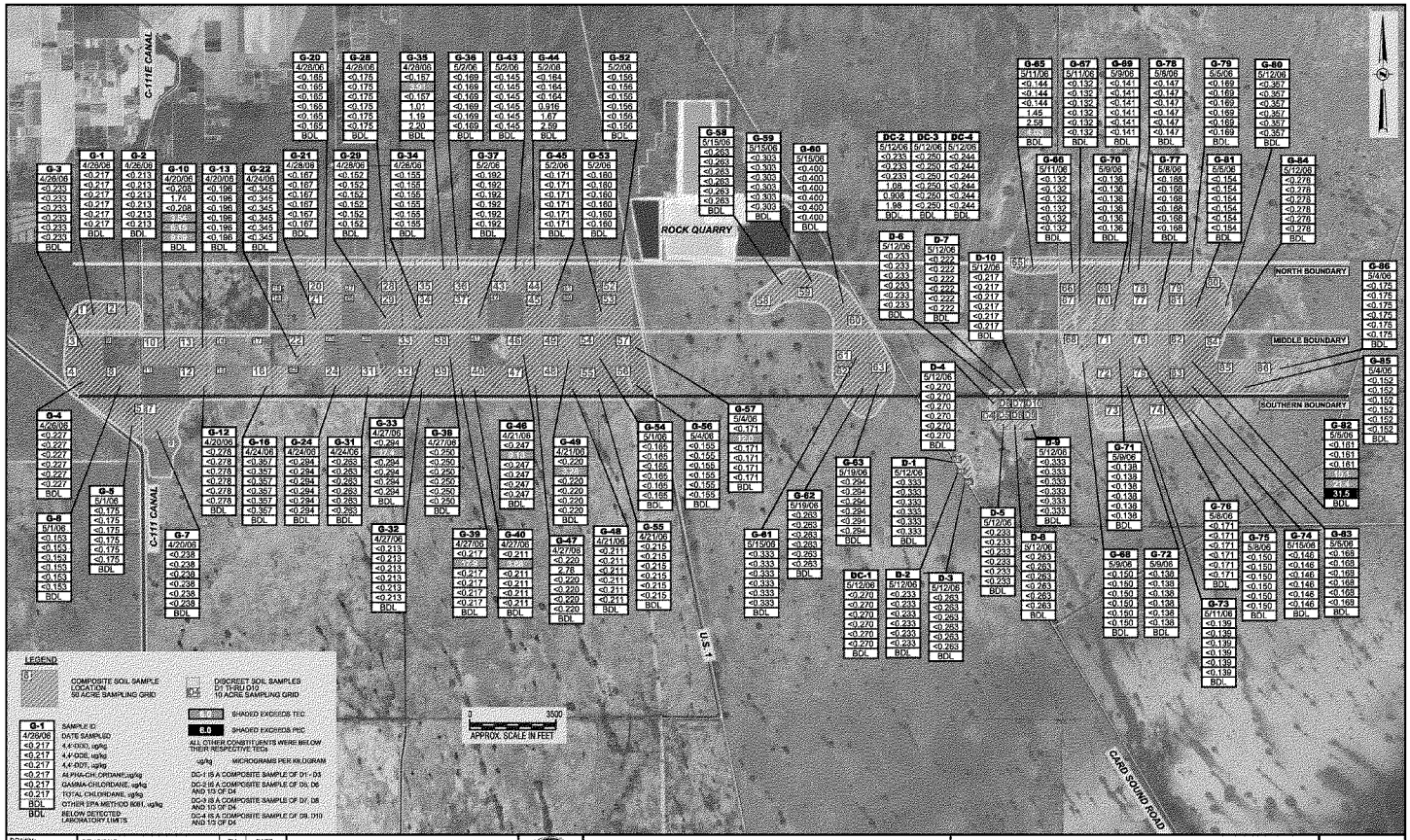
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 36615-881 DATE: MARCH 2006

SITE MAP, AREAS OF CONCERN AND GRID LOCATIONS

FIGURE: 2



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DATE: MAY 06			

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C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA
DATE: MAY 2006

EPA METHOD 8081 ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 3

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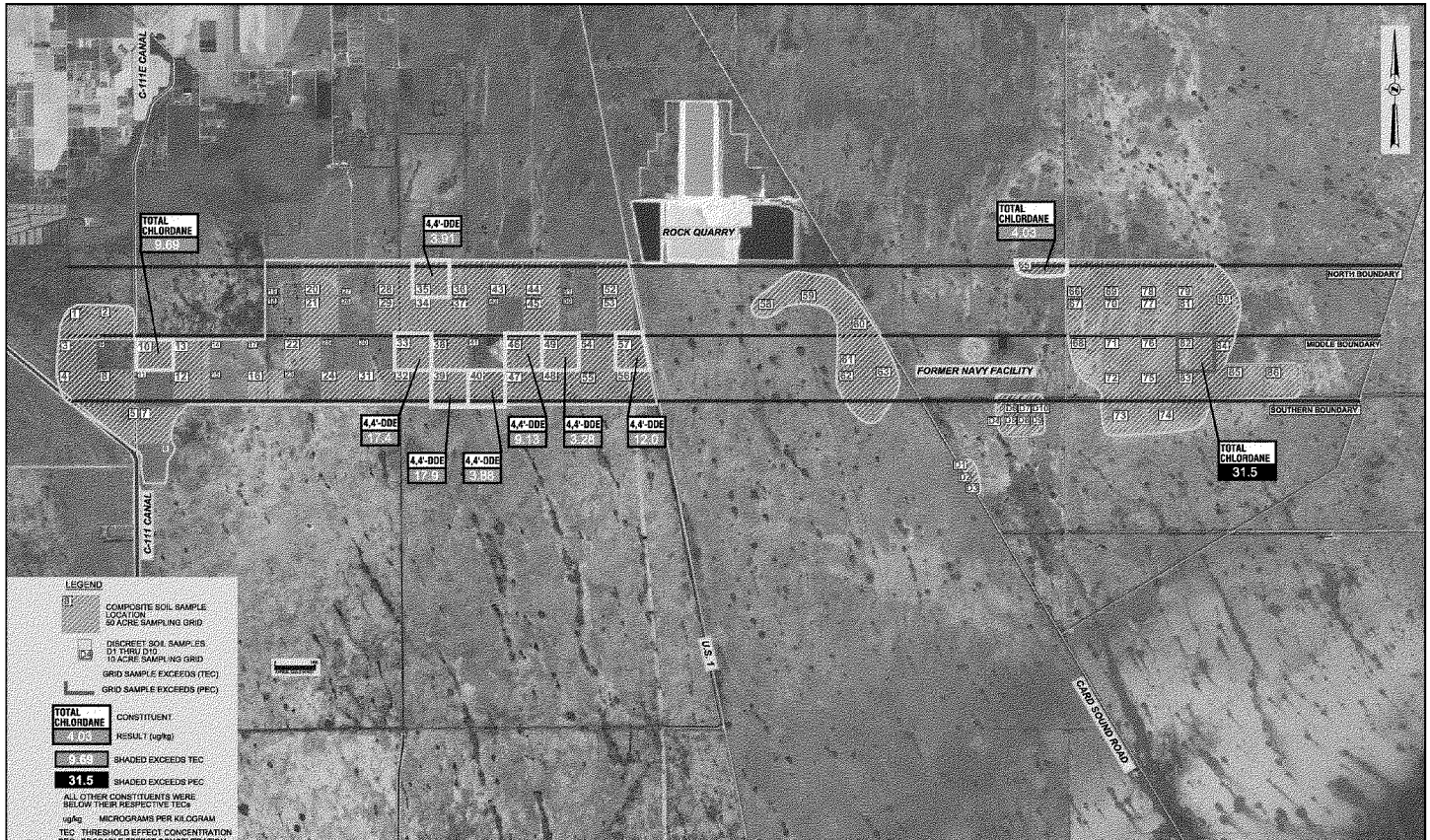
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 38615-881 DATE: MAY 2006

8 RCRA METALS, COPPER & ZINC ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 4



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C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 38615-881 DATE: MAY 2006

EPA METHOD 8081
TEC / PEC EXCEEDANCE MAP

FIGURE: 5

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C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

DATE: MAY 2006

METALS TEC / PEC EXCEEDANCE MAP

FIGURE: 6

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DATE: JULY 2006			

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C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 38615-881 DATE: JULY 2006

4,4-DDE SOIL ANALYTICAL RESULTS MAP

FIGURE: 7

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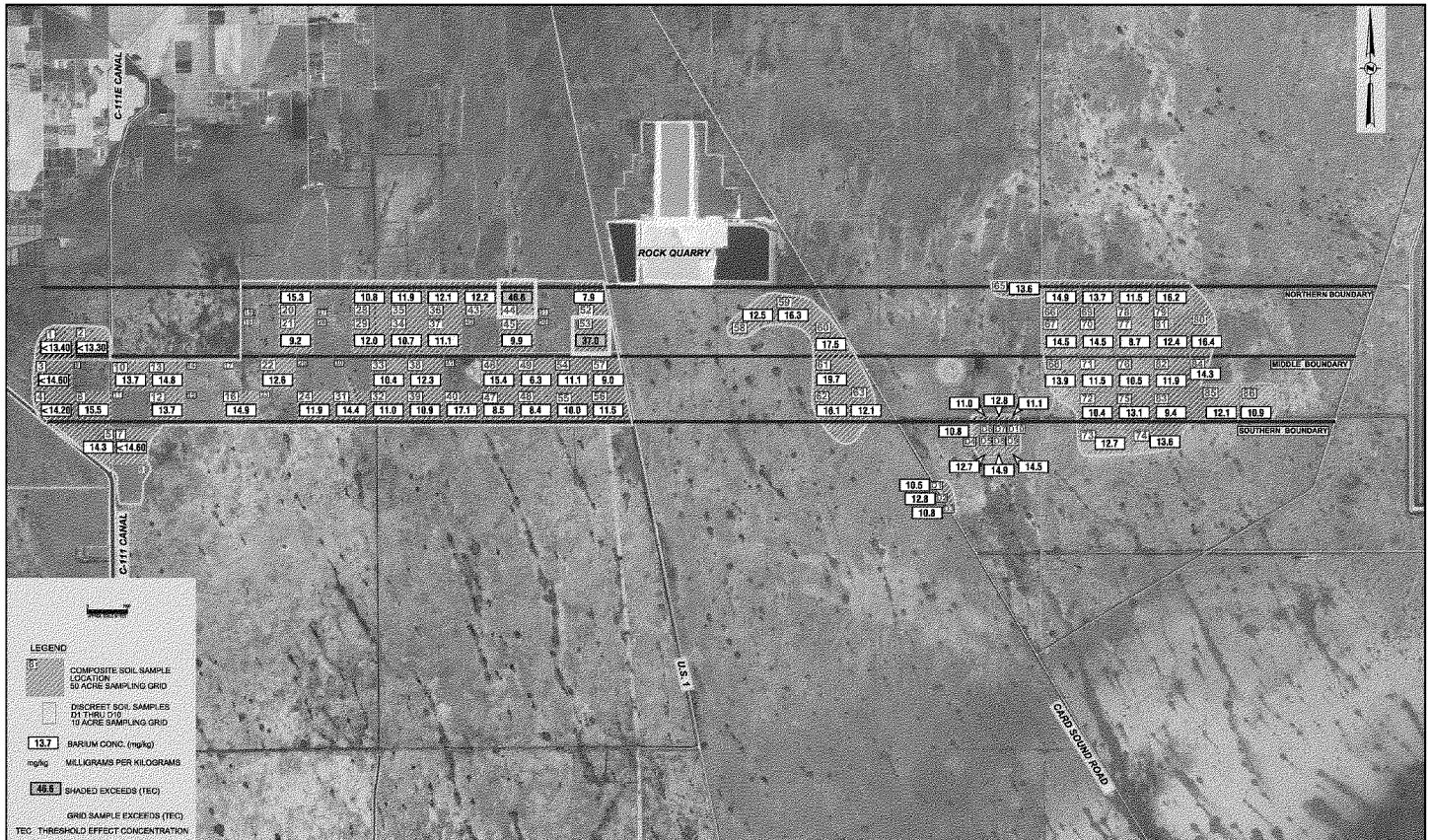
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 36615-681 DATE: JULY 2006

TOTAL CHLORDANE SOIL ANALYTICAL RESULTS MAP

FIGURE: 8



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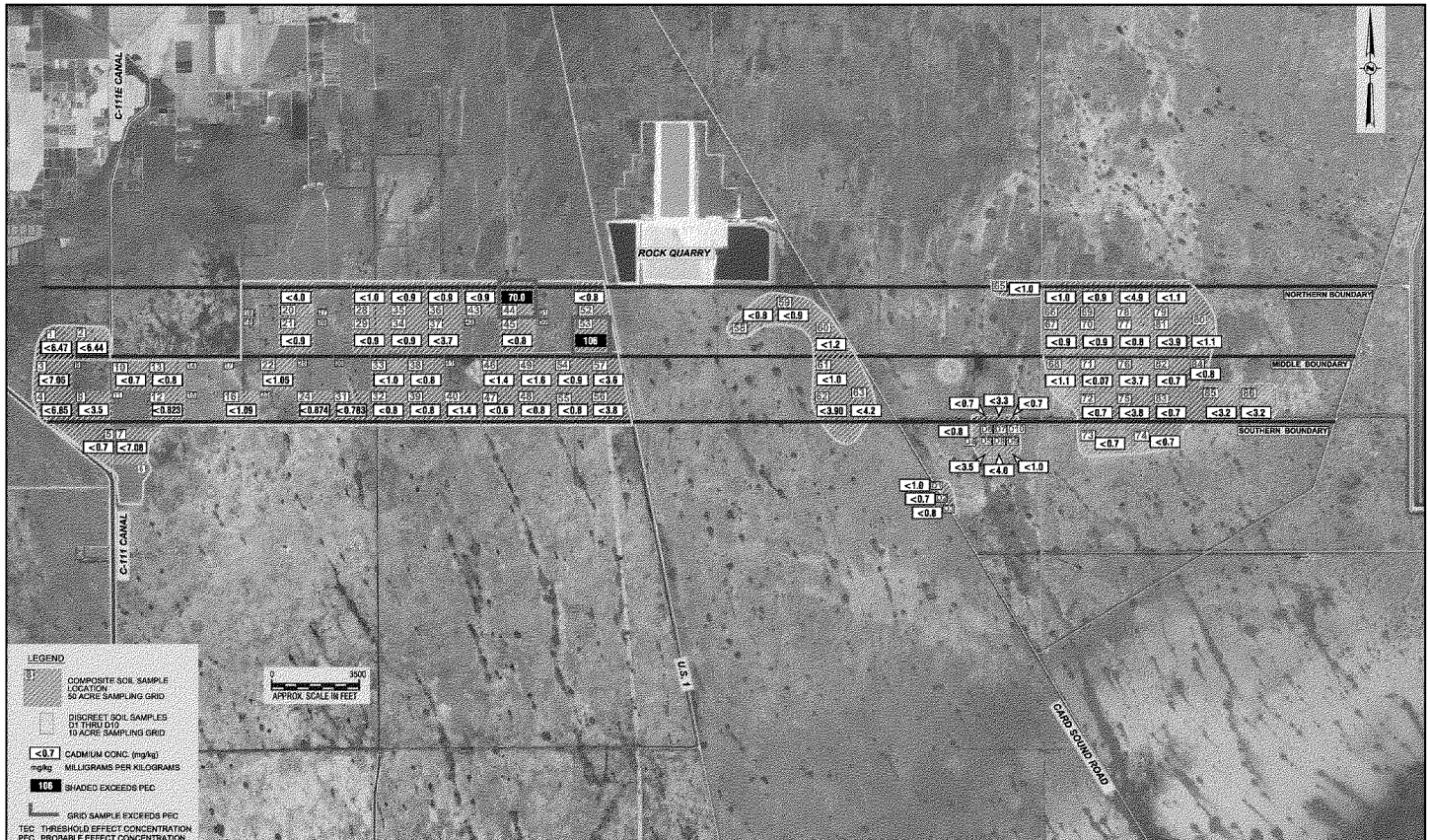
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 38615-881 DATE: MAY 2006

BARIUM SOIL ANALYTICAL RESULTS MAP

FIGURE: 9



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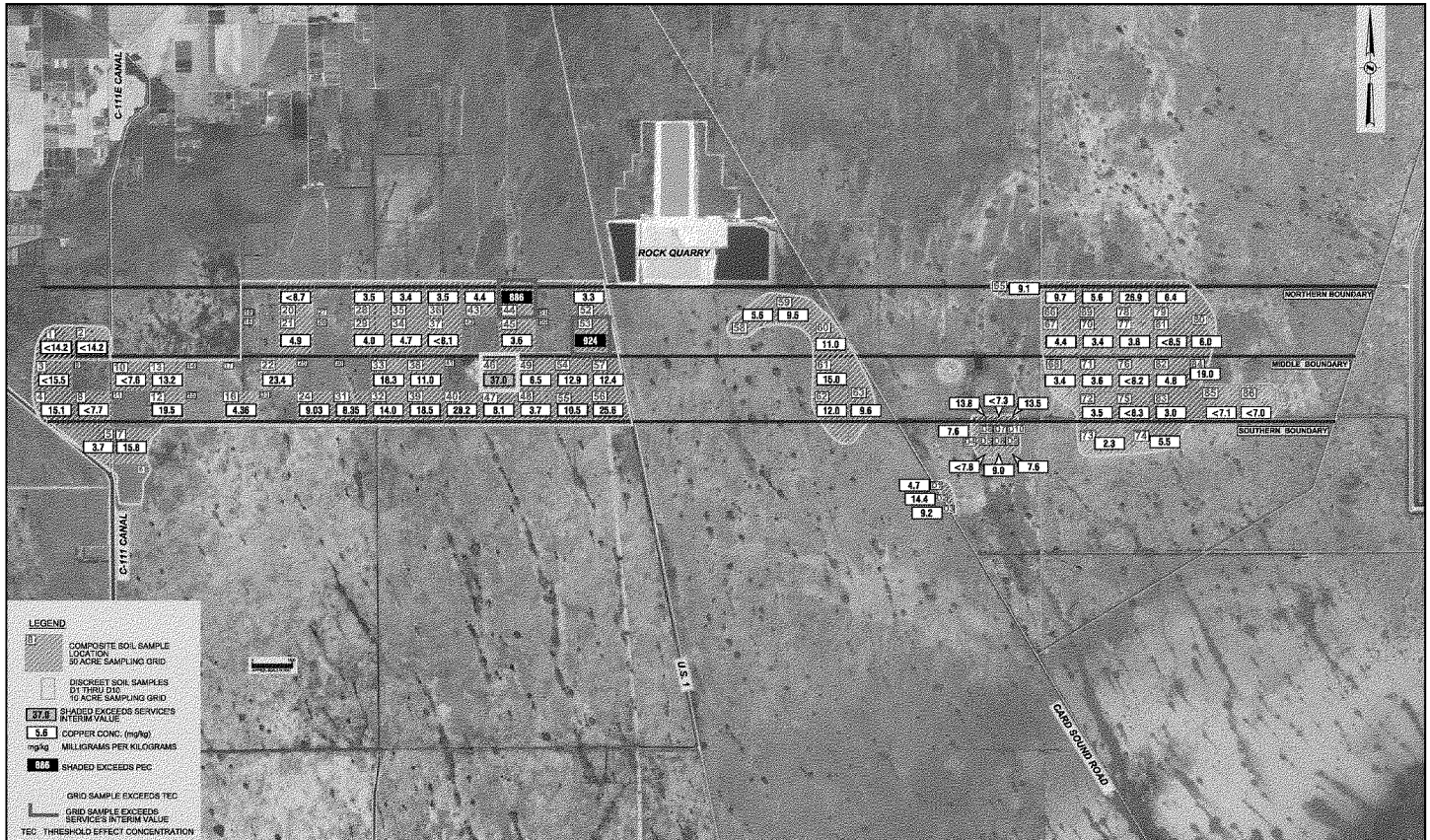
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA
JOB NO.: 38615-881 DATE: MAY 2006

CADMIUM SOIL ANALYTICAL RESULTS MAP

FIGURE: 10



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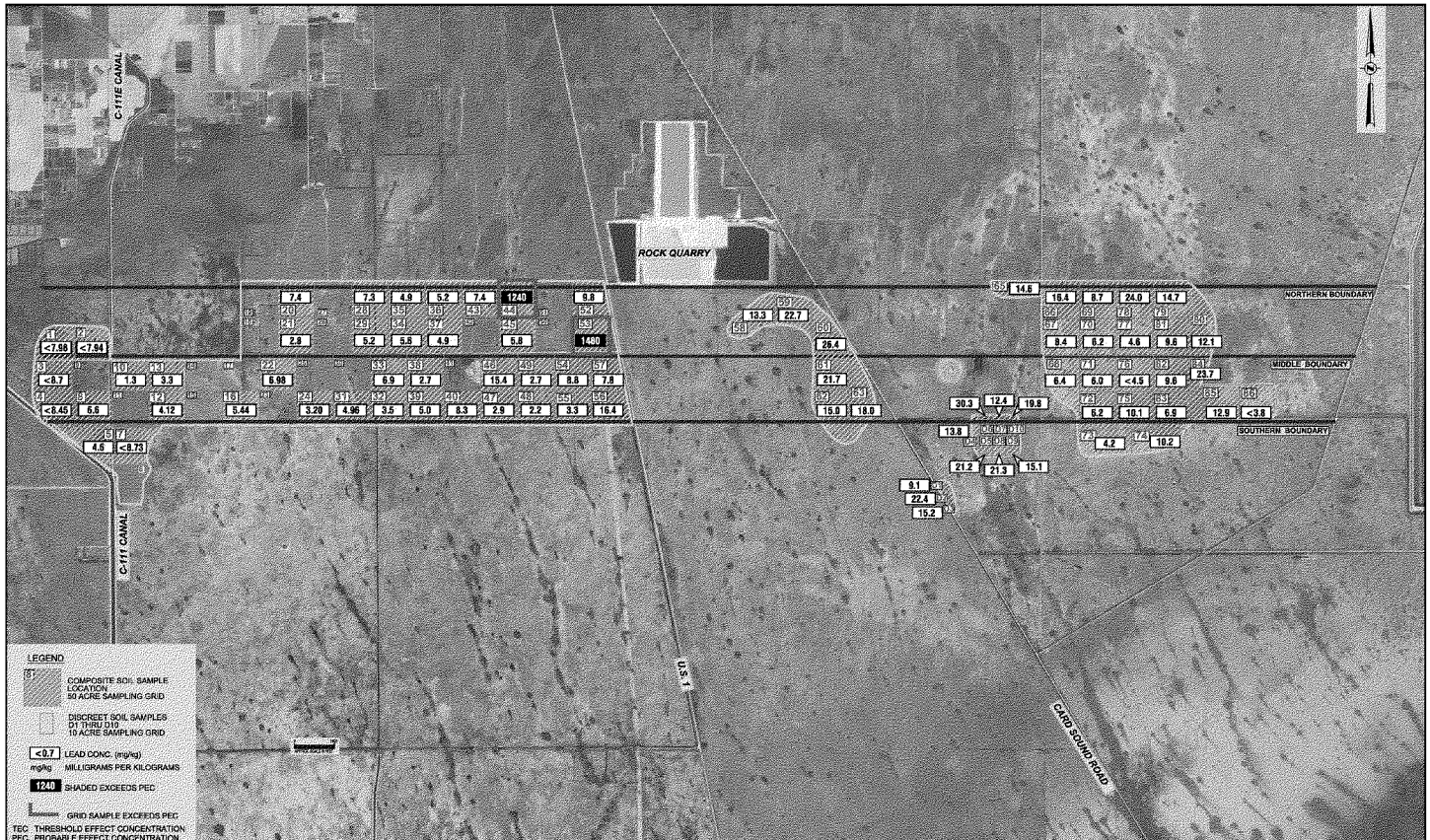
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA
DATE: JULY 2006

COPPER SOIL ANALYTICAL RESULTS MAP

FIGURE: 11



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DATE: MAY 2006			

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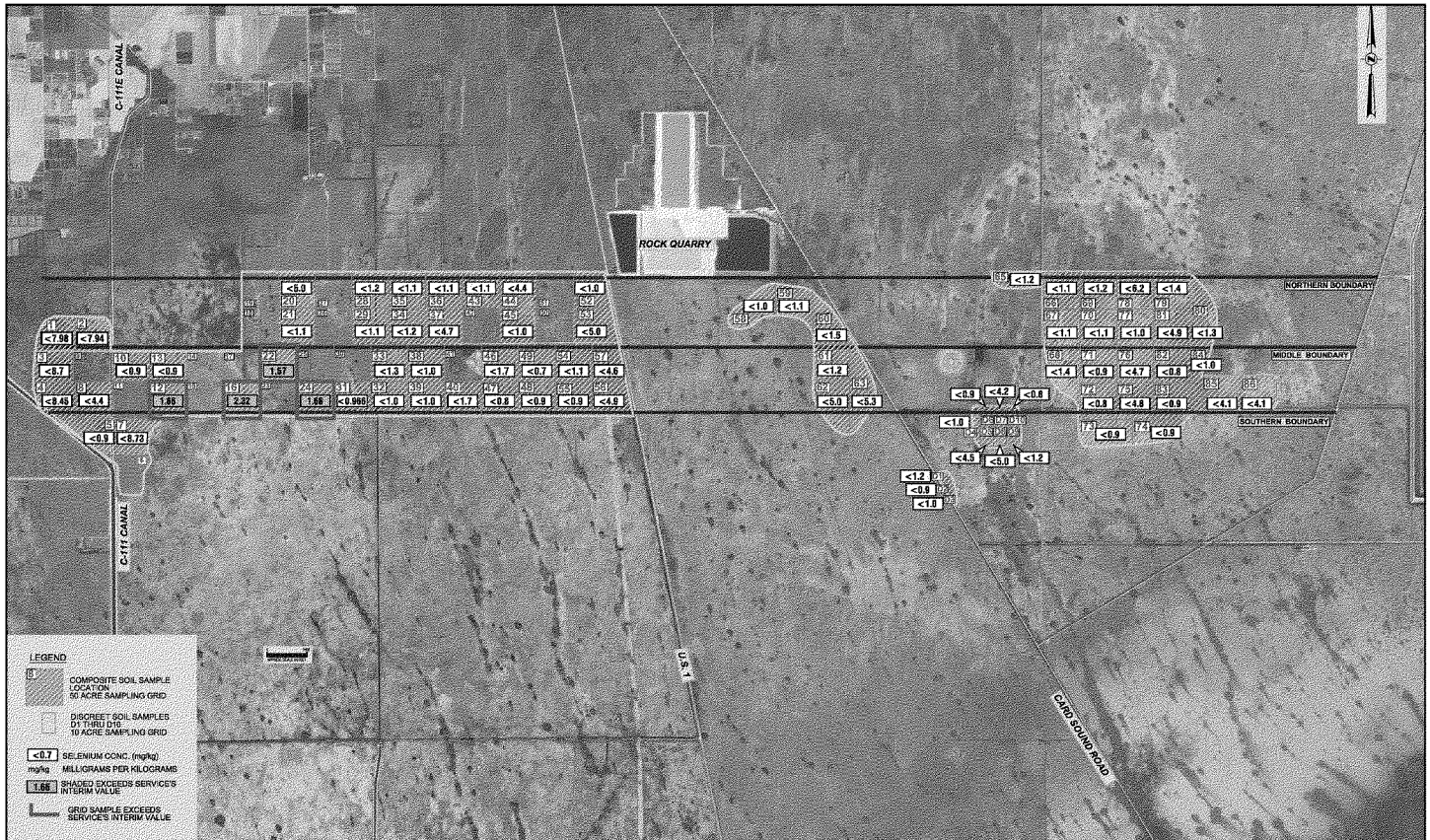
C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

JOB NO.: 38615-881 DATE: MAY 2006

LEAD SOIL ANALYTICAL RESULTS MAP

FIGURE: 12



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DATE: JULY 2006			

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C-111 SPREADER CANAL
MIAMI-DADE CO., FLORIDA

DATE: JULY 2006

SELENIUM SOIL ANALYTICAL RESULTS MAP

FIGURE: 13

TABLES

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS (COMPOSITE GRIDS)
C-111 SPREADER CANAL
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615881

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		West of U.S. 1											
	TEC[1]	PEC[1]	G-1	G-2	G-3	G-4	G-5	G-5 (Split)[2]	G-7	G-8	G-10	G-12	G-13	G-16
Laboratory Analysis			4/26/2006	4/26/2006	4/26/2006	4/26/2006	5/1/2006	5/1/2006	4/20/2006	5/1/2006	4/20/2006	4/20/2006	4/20/2006	4/24/2006
EPA Method 8081 (µg/kg)														
4,4-DDD	4.9	28	< 0.217	< 0.213	< 0.233	< 0.227	< 0.175	< 0.45	< 0.238	< 0.153	< 0.208	< 0.278	< 0.196	< 0.357
4,4-DDE	3.2	31	< 0.217	< 0.213	< 0.233	< 0.227	< 0.175	< 0.45	< 0.238	< 0.153	1.74	< 0.278	< 0.196	< 0.357
4,4-DDT	5.3	570	< 0.217	< 0.213	< 0.233	< 0.227	< 0.175	<0.79	< 0.238	< 0.153	< 0.208	< 0.278	< 0.196	< 0.357
Alpha-Chlordane	---	---	< 0.217	< 0.213	< 0.233	< 0.227	< 0.175	< 0.23	< 0.238	< 0.153	3.54	< 0.278	< 0.196	< 0.357
Gamma-Chlordane	---	---	< 0.217	< 0.213	< 0.233	< 0.227	< 0.175	< 0.57	< 0.238	< 0.153	6.15	< 0.278	< 0.196	< 0.357
Total Chlordane	3.2	18	< 0.217	< 0.213	< 0.233	< 0.227	< 0.175	BDL	< 0.238	< 0.153	9.69	< 0.278	< 0.196	< 0.357
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
9 RCRA Metals (mg/Kg)														
Arsenic	9.8	33	< 6.25	< 6.22	< 6.82	< 6.63	1.25	< 3.35	< 6.84	< 3.28	1.92	1.24	2.27	3.41
Barium	20	60	< 13.40	< 13.30	< 14.60	< 14.20	14.3	13.2	< 14.60	15.5	13.7	13.7	14.8	14.9
Cadmium	1.0	5.0	< 6.47	< 6.44	< 7.05	< 6.85	< 0.7	< 3.59	< 7.08	< 3.5	< 0.7	< 0.823	< 0.8	< 1.09
Chromium	43	110	< 15.70	< 15.70	< 17.20	< 16.70	4.8	88.5	< 17.20	< 8.7	2.6	2.22	2.2	< 2.65
Lead	36	130	< 7.98	< 7.94	< 8.7	< 8.45	4.6	4.78	< 8.73	6.6	1.3	4.12	3.3	5.44
Mercury	0.18	1.1	0.0175	0.0142	0.0216	0.0274	0.02	0.0239	0.0222	0.03	0.02	0.0357	0.03	0.0319
Selenium	1.0*	---	< 7.98	< 7.94	< 8.7	< 8.45	< 0.9	< 4.54	< 8.73	< 4.4	< 0.9	1.43	< 0.9	2.32
Silver	1.0	2.2	< 9.06	< 9.01	< 9.87	< 9.6	< 1.0	< 5.02	< 9.91	< 4.9	< 0.1	< 1.15	< 1.1	< 1.52
Other Metals (mg/kg)														
Copper	32	85**	< 14.2	< 14.2	< 15.5	< 15.1	3.7	< 7.89	15.8	< 7.7	< 7.6	19.5	13.2	4.36
Zinc	120	460	< 21.6	< 21.5	< 23.5	< 22.8	12.9	< 12.2	< 23.6	< 11.9	12.3	8.23	19.4	4.36

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		West of U.S. 1												
	TEC[1]	PEC[1]	G-20	G-21	G-21 (Split)[2]	G-22	G-24	G-28	G-29	G-31	G-32	G-33	G-34	G-35	G-36
Laboratory Analysis			4/28/2006	4/28/2006	4/28/2006	4/24/2006	4/24/2006	4/28/2006	4/28/2006	4/24/2006	4/27/2006	4/27/2006	4/28/2006	4/28/2006	5/2/2006
EPA Method 8081 (µg/kg)															
4,4-DDD	4.9	28	< 0.165	< 0.167	< 0.55	< 0.345	< 0.294	< 0.175	< 0.152	< 0.263	< 0.213	< 0.294	< 0.155	< 0.157	< 0.169
4,4-DDE	3.2	31	< 0.165	< 0.167	< 0.55	< 0.345	< 0.294	< 0.175	< 0.152	< 0.263	< 0.213	17.4	< 0.155	3.91	< 0.169
4,4-DDT	5.3	570	< 0.165	< 0.167	< 0.95	< 0.345	< 0.294	< 0.175	< 0.152	< 0.263	< 0.213	< 0.294	< 0.155	< 0.157	< 0.169
Alpha-Chlordane	---	---	< 0.165	< 0.167	< 0.28	< 0.345	< 0.294	< 0.175	< 0.152	< 0.263	< 0.213	< 0.294	< 0.155	1.01	< 0.169
Gamma-Chlordane	---	---	< 0.165	< 0.167	< 0.69	< 0.345	< 0.294	< 0.175	< 0.152	< 0.263	< 0.213	< 0.294	< 0.155	1.19	< 0.169
Total Chlordane	3.2	18	< 0.165	< 0.167	BDL	< 0.345	< 0.294	< 0.175	< 0.152	< 0.263	< 0.213	< 0.294	< 0.155	2.20	< 0.169
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
9 RCRA Metals (mg/Kg)															
Arsenic	9.8	33	10.1	2.32	< 4.03	3.14	0.961	2.20	1.62	< 0.757	0.91	1.45	1.03	1.74	1.30
Barium	20	60	15.3	9.2	12.4	12.6	11.9	10.8	12.0	14.4	11.0	10.4	10.7	11.9	12.1
Cadmium	1.0	5.0	< 4.0	< 0.9	< 4.32	< 1.05	< 0.874	< 1.0	< 0.9	< 0.783	< 0.8	< 1.0	< 0.9	< 0.9	< 0.9
Chromium	43	110	< 9.8	2.9	< 10.6	< 3.84	2.77	2.8	3.7	2.87	6.2	12.8	6.3	3.7	3.5
Lead	36	130	7.4	2.8	< 5.18	6.98	3.20	7.3	5.2	4.96	3.5	6.9	5.6	4.9	5.2
Mercury	0.18	1.1	0.03	0.03	0.0316	0.0339	0.032	< 0.004	0.04	0.0313	0.04	0.04	0.04	0.04	0.03
Selenium	1.0*	---	< 5.0	< 1.1	< 5.47	1.57	1.66	< 1.2	< 1.1	< 0.966	< 1.0	< 1.3	< 1.2	< 1.1	< 1.1
Silver	1.0	2.2	< 5.6	< 1.2	< 6.04	< 1.47	< 1.22	< 1.3	< 1.3	< 1.1	< 1.1	< 1.4	< 1.3	< 1.3	< 1.2
Other Metals (mg/kg)															
Copper	32	85**	< 8.7	4.9	< 9.49	23.4	9.03	3.5	4.0	8.35	14.0	18.3	4.7	3.4	3.5
Zinc	120	460	20.4	20.6	16.4	17.5	6.41	25.1	21.8	7.57	23.1	23.1	40.7	26.2	25.4

Notes:
[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters, Table 5.1 (MacDonald *et al* 2003)
[2] Split Sample sent to US Biosystems for analysis
TEC = Threshold Effect Concentration, expressed in µg/kg
PEC = Probable Effect Concentration, expressed in µg/kg
* U.S. Fish and Wildlife Service - Personal Communication
** U.S. Fish and Wildlife Service Interim Value
µg/Kg = micrograms per Kilogram
mg/Kg = milligrams per Kilogram
BDL= Below Laboratory Detection Limit
--- = Not Applicable and/or guidance concentrations have not been established

Sample analytical result exceeded the TEC
Sample analytical result exceeded the PEC

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS (COMPOSITE GRIDS)
C-111 SPREADER CANAL
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615881

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		West of U.S. 1												
			G-37	G-38	G-39	G-39 (Split)[2]	G-40	G-43	G-44	G-45	G-46	G-47	G-48	G-49	G-52
Laboratory Analysis	TEC[1]	PEC[1]	5/2/2006	4/27/2006	4/27/2006	4/27/2006	4/27/2006	5/2/2006	5/2/2006	5/2/2006	4/21/2006	4/27/2006	4/21/2006	4/21/2006	5/2/2006
EPA Method 8081 (µg/kg)															
4,4-DDD	4.9	28	< 0.192	< 0.250	< 0.217	< 0.56	< 0.211	< 0.145	< 0.164	< 0.171	< 0.247	< 0.220	< 0.211	< 0.220	< 0.156
4,4-DDE	3.2	31	< 0.192	< 0.250	17.9	< 0.68	3.88	< 0.145	< 0.164	< 0.171	9.13	2.78	< 0.211	3.28	< 0.156
4,4-DDT	5.3	570	< 0.192	< 0.250	< 0.217	< 0.97	< 0.211	< 0.145	< 0.164	< 0.171	< 0.247	< 0.220	< 0.211	< 0.220	< 0.156
Alpha-Chlordane	---	---	< 0.192	< 0.250	< 0.217	< 0.28	< 0.211	< 0.145	0.916	< 0.171	< 0.247	< 0.220	< 0.211	< 0.220	< 0.156
Gamma-Chlordane	---	---	< 0.192	< 0.250	< 0.217	< 0.70	< 0.211	< 0.145	1.67	< 0.171	< 0.247	< 0.220	< 0.211	< 0.220	< 0.156
Total Chlordane	3.2	18	< 0.192	< 0.250	< 0.217	BDL	< 0.211	< 0.145	2.59	< 0.171	< 0.247	< 0.220	< 0.211	< 0.220	< 0.156
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
8 RCRA Metals (mg/Kg)															
Arsenic	9.8	33	< 3.45	2.33	1.59	< 0.849	3.28	1.48	< 3.26	1.21	2.48	1.33	0.77	0.93	0.85
Barium	20	60	11.1	12.3	10.9	9.85	17.1	12.2	48.6	9.9	15.4	8.5	8.4	6.3	7.9
Cadmium	1.0	5.0	< 3.7	< 0.8	< 0.8	< 0.878	< 1.4	< 0.9	70.0	< 0.8	< 1.4	< 0.6	< 0.8	< 1.6	< 0.8
Chromium	43	110	< 9.1	5.8	5.0	4.68	19.9	< 2.2	< 8.6	3.9	18.7	5.2	3.5	5.1	4.6
Lead	36	130	4.9	2.7	5.0	4.98	8.3	7.4	1240	5.8	15.4	2.9	2.2	2.7	9.8
Mercury	0.18	1.1	0.03	0.03	0.04	0.035	0.06	0.05	0.02	0.04	0.09	0.03	0.03	0.03	0.04
Selenium	1.0*	---	< 4.7	< 1.0	< 1.0	1.20	< 1.7	< 1.1	< 4.4	< 1.0	< 1.7	< 0.8	< 0.9	< 0.7	< 1.0
Silver	1.0	2.2	< 5.2	< 1.2	< 1.2	< 1.23	< 1.9	< 1.2	< 4.9	< 1.2	< 2.0	< 0.9	< 1.0	< 0.8	< 1.2
Other Metals (mg/kg)															
Copper	32	85**	< 8.1	11.0	18.5	14.0	28.2	4.4	886	3.6	37.0	8.1	3.7	6.5	3.3
Zinc	120	460	20.7	25.0	28.0	12.0	50.8	29.1	< 11.9	16.0	74.8	22.9	19.6	20.9	18.3

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		West of U.S. 1					Between U.S. 1 and Card Sound Road						
			G-53	G-54	G-55	G-56	G-57	G-58	G-59	G-60	G-61	G-61 (Split)[2]	G-62	G-63
Laboratory Analysis	TEC[1]	PEC[1]	5/2/2006	5/1/2006	4/21/2006	5/4/2006	5/4/2006	5/15/2006	5/15/2006	5/15/2006	5/15/2006	5/15/2006	5/19/2006	5/19/2006
EPA Method 8081 (µg/kg)														
4,4-DDD	4.9	28	< 0.160	< 0.165	< 0.215	< 0.155	< 0.171	< 0.263	< 0.303	< 0.400	< 0.333	< 1.1	< 0.263	< 0.294
4,4-DDE	3.2	31	< 0.160	< 0.165	< 0.215	< 0.155	12.0	< 0.263	< 0.303	< 0.400	< 0.333	< 0.63	< 0.263	< 0.294
4,4-DDT	5.3	570	< 0.160	< 0.165	< 0.215	< 0.155	< 0.171	< 0.263	< 0.303	< 0.400	< 0.333	< 0.63	< 0.263	< 0.294
Alpha-Chlordane	---	---	< 0.160	< 0.165	< 0.215	< 0.155	< 0.171	< 0.263	< 0.303	< 0.400	< 0.333	< 0.32	< 0.263	< 0.294
Gamma-Chlordane	---	---	< 0.160	< 0.165	< 0.215	< 0.155	< 0.171	< 0.263	< 0.303	< 0.400	< 0.333	< 0.80	< 0.263	< 0.294
Total Chlordane	3.2	18	< 0.160	< 0.165	< 0.215	< 0.155	< 0.171	< 0.263	< 0.303	< 0.400	< 0.333	BDL	< 0.263	< 0.294
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
8 RCRA Metals (mg/Kg)														
Arsenic	9.8	33	< 3.70	1.59	2.02	< 3.58	< 3.39	1.75	2.42	2.11	2.91	2.00	< 3.70	< 3.90
Barium	20	60	37.0	11.1	10.0	11.5	9.0	12.5	16.3	17.5	19.7	14.7	16.1	12.1
Cadmium	1.0	5.0	106	< 0.9	< 0.8	< 3.8	< 3.6	< 0.8	< 0.9	< 1.2	< 1.0	< 0.999	< 3.9	< 4.2
Chromium	43	110	< 9.8	7.2	3.8	< 9.5	< 9.0	6.9	5.8	8.5	12.7	9.32	< 9.7	< 10.0
Lead	36	130	1480	8.8	3.3	16.4	7.8	13.3	22.7	26.4	21.7	15.7	15.0	18.0
Mercury	0.18	1.1	0.03	0.05	0.04	0.03	0.03	0.03	0.04	0.05	0.05	0.0433	0.02	0.02
Selenium	1.0*	---	< 5.0	< 1.1	< 0.9	< 4.9	< 4.6	< 1.0	< 1.1	< 1.5	< 1.2	1.83	< 5.0	< 5.3
Silver	1.0	2.2	< 5.0	< 1.3	< 1.1	< 5.4	< 5.1	< 1.1	< 1.3	< 1.7	< 1.4	< 1.40	< 5.5	< 5.9
Other Metals (mg/kg)														
Copper	32	85**	924	12.9	10.5	25.6	12.4	5.6	9.5	11.0	15.0	11.0	12.0	9.6
Zinc	120	460	< 13.5	51.1	35.9	30.7	20.9	13.3	13.5	23.2	23.1	17.6	< 13.0	26.0

Notes:
[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters, Table 5.1 (MacDonald *et al* 2003)
[2] Split Sample sent to US Biosystems for analysis
TEC = Threshold Effect Concentration, expressed in µg/kg
PEC = Probable Effect Concentration, expressed in µg/kg
µg/Kg = micrograms per Kilogram
mg/Kg = milligrams per Kilogram
BDL= Below Laboratory Detection Limit
--- = Not Applicable and/or guidance concentrations have not been established
Sample analytical result exceeded the TEC
Sample analytical result exceeded the PEC

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS (COMPOSITE GRIDS)
C-111 SPREADER CANAL
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615881

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		East of Card Sound Road												
			G-65	G-66	G-67	G-68	G-69	G-70	G-71	G-72	G-73	G-74	G-75	G-75 (Split)[2]	G-76
Laboratory Analysis	TEC[1]	PEC[1]	5/11/2006	5/11/2006	5/11/2006	5/9/2006	5/9/2006	5/9/2006	5/9/2006	5/9/2006	5/11/2006	5/15/2006	5/8/2006	5/8/2006	5/8/2006
EPA Method 8081 (µg/kg)															
4,4-DDD	4.9	28	< 0.144	< 0.132	< 0.132	< 0.150	< 0.141	< 0.136	< 0.138	< 0.138	< 0.139	< 0.146	< 0.150	< 0.47	< 0.171
4,4-DDE	3.2	31	< 0.144	< 0.132	< 0.132	< 0.150	< 0.141	< 0.136	< 0.138	< 0.138	< 0.139	< 0.146	< 0.150	< 0.47	< 0.171
4,4-DDT	4.2	63	< 0.144	< 0.132	< 0.132	< 0.150	< 0.141	< 0.136	< 0.138	< 0.138	< 0.139	< 0.146	< 0.150	< 0.82	< 0.171
Alpha-Chlordane	---	---	1.45	< 0.132	< 0.132	< 0.150	< 0.141	< 0.136	< 0.138	< 0.138	< 0.139	< 0.146	< 0.150	< 0.24	< 0.171
Gamma-Chlordane	---	---	2.58	< 0.132	< 0.132	< 0.150	< 0.141	< 0.136	< 0.138	< 0.138	< 0.139	< 0.146	< 0.150	< 0.60	< 0.171
Total Chlordane	3.2	18	4.03	< 0.132	< 0.132	< 0.150	< 0.141	< 0.136	< 0.138	< 0.138	< 0.139	< 0.146	< 0.150	BDL	< 0.171
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDl	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
8 RCRA Metals (mg/Kg)															
Arsenic	9.8	33	4.87	2.34	0.93	1.28	1.78	1.33	1.17	0.91	1.10	1.76	< 3.54	< 3.48	< 3.49
Barium	20	60	13.6	14.9	14.5	13.9	13.7	14.5	11.5	10.4	12.7	13.6	13.1	11.2	10.5
Cadmium	1.0	5.0	< 1.0	< 0.9	< 0.9	< 1.1	< 0.9	< 0.9	< 0.07	< 0.7	< 0.7	< 0.7	< 3.8	< 3.73	< 3.7
Chromium	43	110	27.6	14.9	6.4	5.6	16.2	12.0	2.9	2.1	< 1.8	4.2	< 9.4	< 9.19	< 9.2
Lead	36	130	14.6	16.4	8.4	6.4	8.7	6.2	6.0	6.2	4.2	10.2	10.1	11.9	< 4.5
Mercury	0.18	1.1	0.05	0.04	0.04	0.04	0.05	0.04	0.03	0.02	0.02	0.02	0.04	0.0373	0.03
Selenium	1.0*	---	< 1.2	< 1.1	< 1.1	< 1.4	< 1.2	< 1.1	< 0.9	< 0.8	< 0.9	< 0.9	< 4.8	< 4.72	< 4.7
Silver	1.0	2.2	< 1.4	< 1.3	< 1.2	< 1.6	< 1.3	< 1.3	< 1.0	< 0.9	< 1.0	< 1.0	< 5.3	< 5.22	< 5.2
Other Metals (mg/kg)															
Copper	32	85**	9.1	9.7	4.4	3.4	5.6	3.4	3.6	3.5	2.3	5.5	< 8.3	< 8.2	< 8.2
Zinc	120	460	23.4	21.9	16.5	17.7	15.6	14.2	11.2	7.7	10.0	16.4	15.7	< 12.7	< 12.7

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		East of Card Sound Road											
			G-77	G-78	G-79	G-79 (Split)[2]	G-80	G-81	G-82	G-83	G-84	G-85	G-85 (Split)[2]	G-86
Laboratory Analysis	TEC[1]	PEC[1]	5/8/2006	5/8/2006	5/5/2006	5/5/2006	5/12/2006	5/5/2006	5/5/2006	5/5/2006	5/12/2006	5/4/2006	5/4/2006	5/4/2006
EPA Method 8081 (µg/kg)														
4,4-DDD	4.9	28	< 0.168	< 0.147	< 0.169	< 0.80	< 0.357	< 0.154	< 0.161	< 0.168	< 0.278	< 0.152	< 0.67	< 0.175
4,4-DDE	3.2	31	< 0.168	< 0.147	< 0.169	< 0.80	< 0.357	< 0.154	< 0.161	< 0.168	< 0.278	< 0.152	< 0.38	< 0.175
4,4-DDT	4.2	63	< 0.168	< 0.147	< 0.169	< 1.4	< 0.357	< 0.154	< 0.161	< 0.168	< 0.278	< 0.152	< 0.38	< 0.175
Alpha-Chlordane	---	---	< 0.168	< 0.147	< 0.169	< 0.41	< 0.357	< 0.154	10.1	< 0.168	< 0.278	< 0.152	< 0.20	< 0.175
Gamma-Chlordane	---	---	< 0.168	< 0.147	< 0.169	< 1.0	< 0.357	< 0.154	21.4	< 0.168	< 0.278	< 0.152	< 0.49	< 0.175
Total Chlordane	3.2	18	< 0.168	< 0.147	< 0.169	BDL	< 0.357	< 0.154	31.5	< 0.168	< 0.278	< 0.152	BDL	< 0.175
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
8 RCRA Metals (mg/Kg)														
Arsenic	9.8	33	1.06	< 4.60	1.99	< 1.2	2.38	< 3.62	1.09	0.81	3.04	< 3.01	< 2.83	< 2.99
Barium	20	60	8.7	11.5	16.2	15	16.4	12.4	11.9	9.4	14.3	12.1	10.5	10.9
Cadmium	1.0	5.0	< 0.8	< 4.9	< 1.1	< 7.2	< 1.1	< 3.9	< 0.7	< 0.7	< 0.8	< 3.2	< 3.03	< 3.2
Chromium	43	110	8.7	18.7	13.5	24.5	7.5	< 9.6	2.2	9.1	4.7	< 8.0	< 7.48	< 7.9
Lead	36	130	4.6	24.0	14.7	12	12.1	9.6	9.6	6.9	23.7	12.9	22.2	< 3.8
Mercury	0.18	1.1	0.04	0.06	0.06	0.0866	0.006	0.04	0.03	0.03	0.04	0.02	0.0222	0.02
Selenium	1.0*	---	< 1.0	< 6.2	< 1.4	2.9	< 1.3	< 4.9	< 0.8	< 0.9	< 1.0	< 4.1	< 3.84	< 4.1
Silver	1.0	2.2	< 1.1	< 6.9	< 1.6	< 1.8	< 1.5	< 5.4	< 1.0	< 1.0	< 1.2	< 4.5	< 4.25	< 4.5
Other Metals (mg/kg)														
Copper	32	85**	3.8	26.9	6.4	4.6	6.0	< 8.5	4.8	3.0	19.0	< 7.1	8.1	< 7.0
Zinc	120	460	10.6	39.4	28.9	14	24.2	36.2	7.5	9.9	8.0	< 11.0	< 10.3	< 10.9

Notes:
[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters, Table 5.1 (MacDonald *et al* 2003)
[2] Split Sample sent to US Biosystems for analysis
TEC = Threshold Effect Concentration, expressed in µg/kg
PEC = Probable Effect Concentration, expressed in µg/kg
µg/Kg = micrograms per Kilogram
mg/Kg = milligrams per Kilogram
BDL= Below Laboratory Detection Limit
--- = Not Applicable and/or guidance concentrations have not been established
Sample analytical result exceeded the TEC
Sample analytical result exceeded the PEC

TABLE 1
SUMMARY OF SOIL ANALYTICAL RESULTS (DISCRETE GRIDS)
C-111 SPREADER CANAL
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615881

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		East of Card Sound Road (DISCRETE SAMPLES)											
	TEC[1]	PEC[1]	D-1	D-2	D-3	DC-1	D-4	D-4 (Split)[2]	D-5	D-6	DC-2	D-7	D-8
Laboratory Analysis			5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006
EPA Method 8081 (µg/kg)													
4,4-DDD	4.9	28	< 0.333	< 0.233	< 0.263	< 0.270	< 0.270	< 0.82	< 0.233	< 0.233	< 0.233	< 0.222	< 0.263
4,4-DDE	3.2	31	< 0.333	< 0.233	< 0.263	< 0.270	< 0.270	< 0.47	< 0.233	< 0.233	< 0.233	< 0.222	< 0.263
4,4-DDT	4.2	63	< 0.333	< 0.233	< 0.263	< 0.270	< 0.270	< 0.47	< 0.233	< 0.233	< 0.233	< 0.222	< 0.263
Alpha-Chlordane	---	---	< 0.333	< 0.233	< 0.263	< 0.270	< 0.270	< 0.24	< 0.233	< 0.233	1.08	< 0.222	< 0.263
Gamma-Chlordane	---	---	< 0.333	< 0.233	< 0.263	< 0.270	< 0.270	< 0.60	< 0.233	< 0.233	0.908	< 0.222	< 0.263
Total Chlordane	3.2	18	< 0.333	< 0.233	< 0.263	< 0.270	< 0.270	BDL	< 0.233	< 0.233	1.98	< 0.222	< 0.263
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
8 RCRA Metals (mg/Kg)													
Arsenic	9.8	33	1.96	1.42	1.42	1.58	1.83	1.81	< 3.29	2.12	< 3.28	< 3.09	3.99
Barium	20	60	10.5	12.8	10.8	11.2	10.8	10.9	12.7	11.0	13.1	12.8	14.9
Cadmium	1.0	5.0	< 1.0	< 0.7	< 0.8	< 0.8	< 0.8	< 3.73	< 3.5	< 0.7	< 3.5	< 3.3	< 4.0
Chromium	43	110	4.1	< 1.7	2.3	3.5	2.2	2.14	< 8.7	4.2	13.3	< 8.2	< 9.8
Lead	36	130	9.1	22.4	15.2	20.3	13.8	12.9	21.2	30.3	32.8	12.4	21.3
Mercury	0.18	1.1	0.06	0.03	0.04	0.04	0.03	0.0248	0.02	0.03	0.02	0.02	0.03
Selenium	1.0*	---	< 1.2	< 0.9	< 1.0	< 1.0	< 1.0	1.66	< 4.5	< 0.9	< 4.4	< 4.2	< 5.0
Silver	1.0	2.2	< 1.4	< 1.0	< 1.1	< 1.1	< 1.1	< 4.47	< 4.9	< 1.0	< 4.9	< 1.6	< 5.6
Other Metals (mg/kg)													
Copper	32	85**	4.7	14.4	9.2	7.5	7.6	2.14	< 7.8	13.8	13.3	< 7.3	9.0
Zinc	120	460	11.5	17.9	19.1	8.8	7.8	8.20	< 12.0	< 11.9	< 11.9	< 11.2	< 13.6

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS		East of Card Sound Road (DISCRETE SAMPLES)				
	TEC[1]	PEC[1]	DC-3	DC-3 (Split)[2]	D-9	D-10	DC-4
Laboratory Analysis			5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006
EPA Method 8081 (µg/kg)							
4,4-DDD	4.9	28	< .250	< 0.78	< 0.333	< 0.217	< 0.244
4,4-DDE	3.2	31	< .250	< 0.45	< 0.333	< 0.217	< 0.244
4,4-DDT	4.2	63	< .250	< 0.45	< 0.333	< 0.217	< 0.244
Alpha-Chlordane	---	---	< .250	< 0.23	< 0.333	< 0.217	< 0.244
Gamma-Chlordane	---	---	< .250	< 0.57	< 0.333	< 0.217	< 0.244
Total Chlordane	3.2	18	< .250	BDL	< 0.333	< 0.217	< 0.244
Other EPA Method 8081 Constituents	---	---	BDL	BDL	BDL	BDL	BDL
8 RCRA Metals (mg/Kg)							
Arsenic	9.8	33	2.01	1.97	2.40	3.04	4.18
Barium	20	60	12.1	12.8	14.5	11.1	11.3
Cadmium	1.0	5.0	< 0.7	< 0.713	< 1.0	< 0.7	< 0.7
Chromium	43	110	< 1.8	< 1.74	< 2.4	3.3	3.4
Lead	36	130	16.9	16.9	15.1	19.8	23.8
Mercury	0.18	1.1	0.02	0.0190	0.03	0.03	0.02
Selenium	1.0*	---	< 0.9	1.57	< 1.2	< 0.8	< 0.9
Silver	1.0	2.2	< 1.0	< 0.999	< 1.4	< 0.9	< 1.0
Other Metals (mg/kg)							
Copper	32	85**	7.4	8.80	7.6	13.5	11.3
Zinc	120	460	< 12.6	7.85	9.2	< 11.1	7.6

Notes:
[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters, Table 5.1 (MacDonald *et al* 2003)
[2] Split Sample sent to US Biosystems for analysis
TEC = Threshold Effect Concentration, expressed in µg/kg
PEC = Probable Effect Concentration, expressed in µg/kg
µg/Kg = micrograms per Kilogram
mg/Kg = milligrams per Kilogram
BDL= Below Laboratory Detection Limit
--- = Not Applicable and/or guidance concentrations have not been established
Sample analytical result exceeded the TEC
Sample analytical result exceeded the PEC

TABLE 2
SOIL ANALYTICAL RESULTS FOR TOTAL ORGANIC CARBON
C-111 SPREADER CANAL
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615881

SAMPLE IDENTIFICATION	G-10	G-33	G-35	G-39	G-39 (Split Sample)	G-40	G-44	G-46	G-49	G-57	G-58	G-59	G-60
Laboratory Analysis	4/26/06	4/27/07	4/28/06	4/27/06	4/27/06	4/27/06	5/2/06	4/21/06	4/21/06	5/4/06	5/15/06	5/15/06	5/15/06
Total Organic Compound (mg/kg)	**45000**	**180000**	**140000**	**87000**	**120000**	**96000**	**34000**	**85000**	**98000**	**66000**	**160000**	**180000**	**310000**

SAMPLE IDENTIFICATION	G-61	G-61 (Split Sample)	G-62	G-63	G-65	G-66	G-67	G-68	G-69	G-70	G-71	G-72	G-73
Laboratory Analysis	5/15/06	5/15/06	5/19/06	5/19/06	5/11/06	5/11/06	5/11/06	5/9/06	5/9/06	5/9/06	5/9/06	5/9/06	5/11/06
Total Organic Compound (mg/kg)	**210000**	**73000**	**120000**	**90000**	**170000**	**150000**	**140000**	**230000**	**200000**	**180000**	**140000**	**110000**	**88000**

SAMPLE IDENTIFICATION	G-74	G-75	G-75 (Split Sample)	G-76	G-77	G-78	G-79	G-79 (Split Sample)	G-80	G-81	G-82	G-83	G-84
Laboratory Analysis	5/15/06	5/8/06	5/8/06	5/8/06	5/8/06	5/8/06	5/5/06	5/5/06	5/12/06	5/5/06	5/5/06	5/5/06	5/12/06
Total Organic Compound (mg/kg)	**150000**	**77000**	**43000**	**45000**	**140000**	**190000**	**190000**	**78000**	**160000**	**97000**	**140000**	**120000**	**130000**

SAMPLE IDENTIFICATION	G-85	G-85 (Split Sample)	G-86	D-1	D-2	D-3	D-3 (Split Sample)	DC-1	D-4	D-4 (Split Sample)	D-5	D-6	DC-2
Laboratory Analysis	05/04/06	05/04/06	05/04/06	05/12/06	05/12/06	05/12/06	05/12/06	05/12/06	05/12/06	05/12/06	05/12/06	05/12/06	05/12/06
Total Organic Compound (mg/kg)	**71000**	**46000**	**95000**	**120000**	**57000**	**84000**	**38000**	**87000**	**85000**	**59000**	**48000**	**52000**	**81000**

SAMPLE IDENTIFICATION	D-7	D-8	DC-3	D-9	D-10	DC-4
Laboratory Analysis	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006
Total Organic Compound (mg/kg)	**110000**	**110000**	**140000**	**170000**	**140000**	**120000**

Notes:
Split Sample sent to US Biosystems for analysis
mg/kg = milligrams per Kilogram

TABLE 3
TOTAL PROJECT COSTS
Limited Phase II Environmental Site Assessment
Additional Sampling C-111 Spreader Canal
Florida City, Miami-Dade County
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

TASKS	URS Costs	Subcontractor Costs						TASK TOTAL
		Driller/Other			Laboratory (b)			
		Number		Unit Cost	Number		Unit Cost	
Task 1. Soil Sampling (Grids)	$ 4,820.00	60	soil borings	$ 20	73	Soil (Metals)	$ 17	$ 7,261.00
					11	Soil (8081)	$ 110	$ 1,210.00
Task 2. Youth Development Center	$ 1,736.00							$ 1,736.00
		15	soil borings	$ 20	16	lead	$ 20	$ 620.00
					1	KAG	$ 290	$ 290.00
					1	Used Oil	$ 555	$ 555.00
		3	monitor wells	$ 485	1	lead	$ 20	$ 1,475.00
					1	KAG	$ 340	$ 340.00
					1	Used Oil	$ 525	$ 525.00
Task 3.Former US Navy facility	$ 1,736.00	4	soil borings	$ 20	2	Used Oil	$ 555	$ 2,926.00
		1	monitor well	$ 485	1	Used Oil	$ 525	$ 1,010.00
Task 6. Asbestos Survey	$ 3,854.00				30	Asbestos	$ 30	$ 4,754.00
Task 7. Reporting	$ 7,136.00							$ 7,136.00
Subtotal	$ 19,282.00	$		3,520.00	$		7,036	$ 29,838.00
Handling @ 5%								*$ 527.80*
PROJECT TOTAL								$ 30,365.80

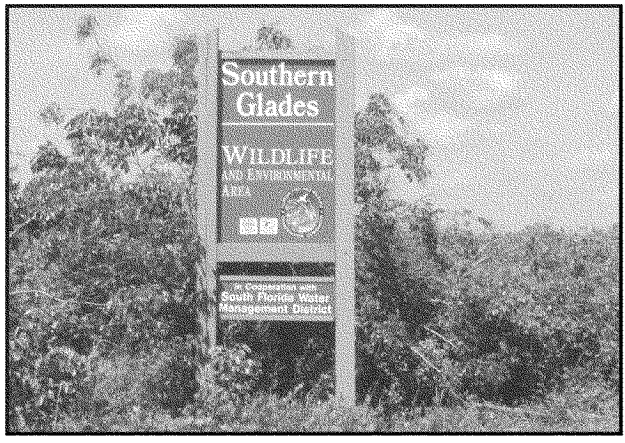

Photo: The area of study includes in its majority the Southern Glades Wildlife and Environmental Area of the Florida Fish and Wildlife Commission which is managed in cooperation with the South Florida Water Management District

Photo: View of the area located north of the middle boundary and west of the C-110 Canal.
The area is used by a nearby alligator farm which provides recreational airboat rides.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
Phone (561) 994-6500
Fax : (561) 994-6524

Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos

Photo: The area located south of the middle boundary in vicinity of the youth development center has distinctive overgrown vegetation along former agricultural rows.

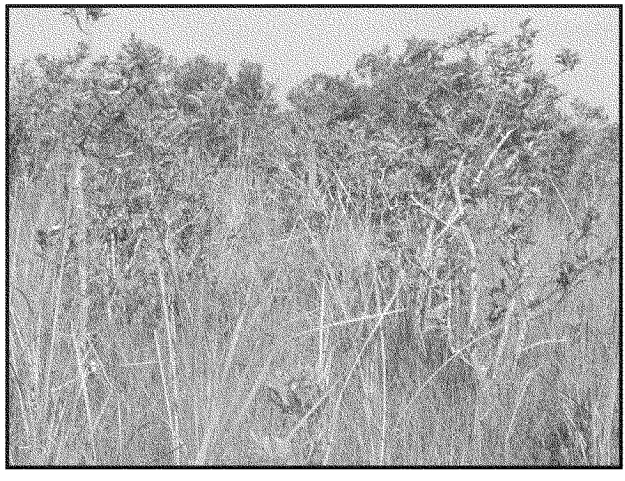

Photo: A view of overgrown vegetation south of the middle boundary.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
Phone (561) 994-6500
Fax : (561) 994-6524

Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos

Photo: View of the C-111 Canal flowing towards the south east.

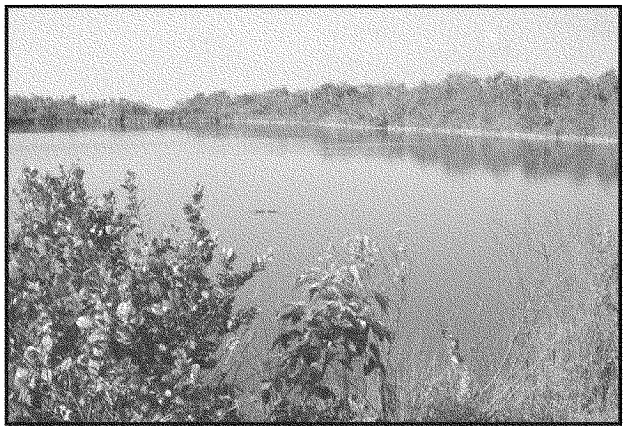

Photo: Lake located south of the middle boundary and east of the youth development center.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
Phone (561) 994-6500
Fax : (561) 994-6524

Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos

Photo: View towards the south from the middle boundary of the C-109 Canal along US HWY 1, observe overgrown vegetation on both sides of the canal.

Photo: View towards the east of 424th Street across US HWY 1. 424th Street is aligned with the middle boundary and serves as an access road to the area.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
Phone (561) 994-6500
Fax : (561) 994-6524

Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos

Photo: View of the area located between US HWY 1 and Canal Sound Road, and the Cemex rock quarry and cement plant located north of the northern boundary.

Photo: View of treated invasive species in the area located east of Card Sound Road, also Australian Pines in the background. During the site investigation, non-native invasive species such as Maleluca and Australian Pine were observed in several areas.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
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Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
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Site Photos

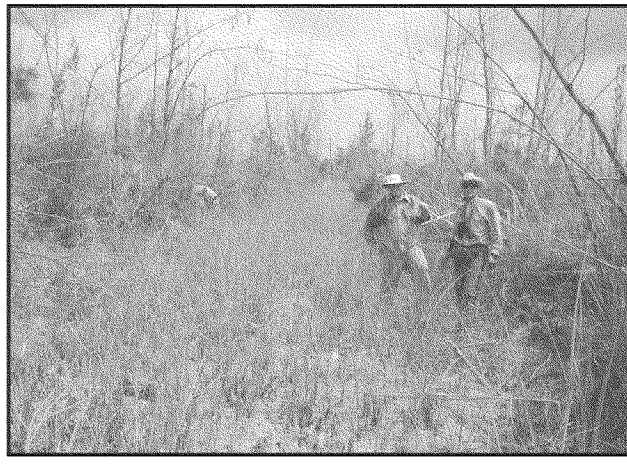

Photo: Former cultivation rows located at Grid No. 73 south of the southern boundary. There is overgrown vegetation distinctively aligned with the rows.

Photo: An Argo Off-Road Vehicle was provided by the SFWMD to access the study area.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
Phone (561) 994-6500
Fax : (561) 994-6524

Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos

Photo: Several abandoned vehicles were observed east of Tallahassee Road.

Photo: A hunting tree stand was observed on Grid No. 70 on private property.

URS
7800 Congress Avenue,Suite 200
Boca Raton, FL 33487
Phone (561) 994-6500
Fax : (561) 994-6524

Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos

Photo: View of the area between the middle and northern boundary east of Tallahassee Road.

Photo: A Florida Soft Shell Turtle in the study area.

URS
7800 Congress Avenue,Suite 200
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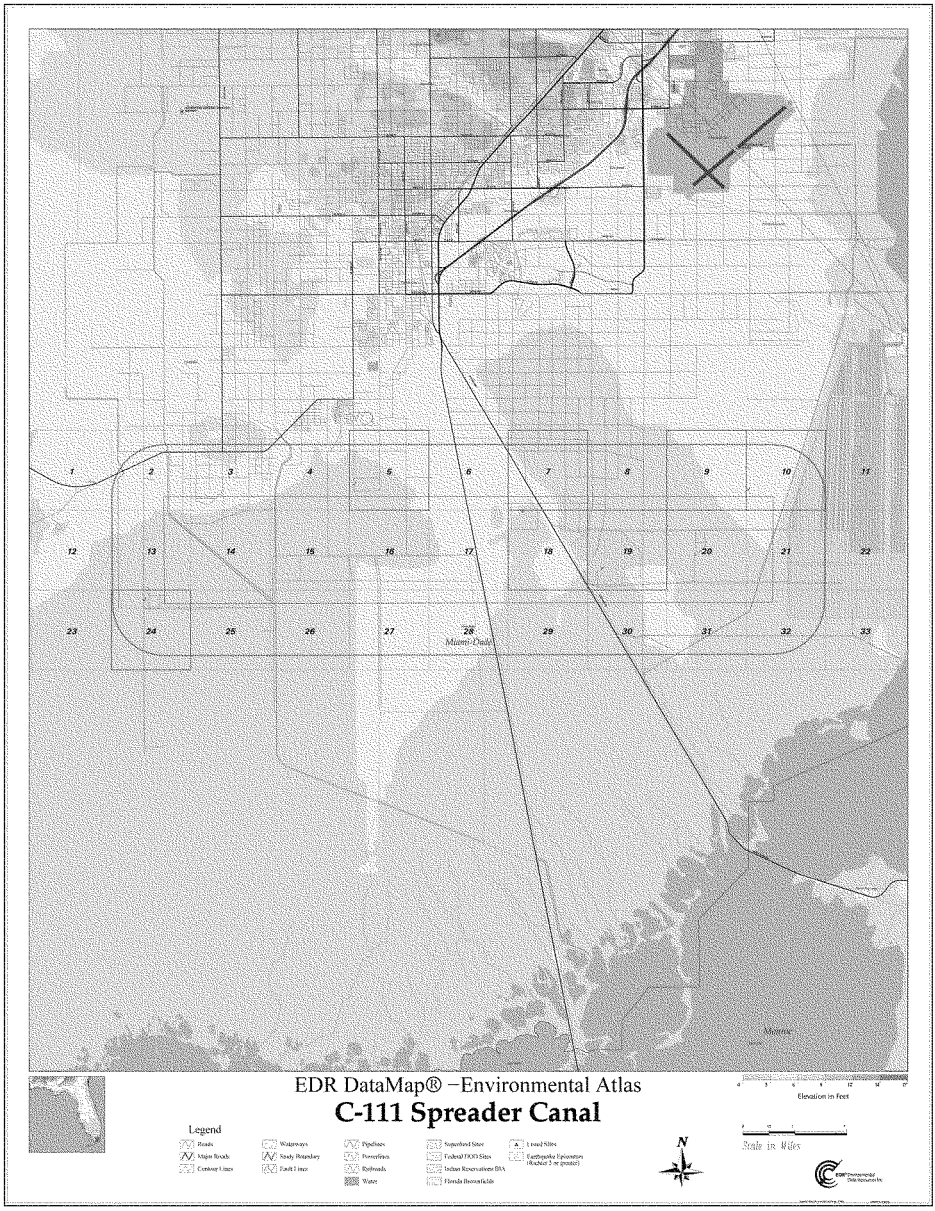
Study Area: C-111 Spreader Canal
Location: South Miami-Dade County, Florida
Client: SFWMD
Project #: 38615881

Site Photos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Miami-Dade
Monroe
EDR DataMap® –Environmental Atlas
C-111 Spreader Canal
Elevation in Feet
Legend
Roads
Major Roads
Contour Lines
Waterways
Study Boundary
Earth Lines
Pipelines
Powerlines
Railroads
Water
Superfund Sites
Federal TSCA Sites
Indian Reservations BIA
Florida Brownfields
Local Sites
Earthquake Epicenters
(Magnitude 2 or greater)
N
Scale in Miles

Ecological Risk Assessment of Frog Pond Soils

January 2009

Prepared for:

WRScompass
10050 NW 116th Way
Suite 18
Miami, Florida 33178

and

URS Corporation.
7800 Congress Avenue
Suite 200
Boca Raton, Florida 33487-1350

On Behalf of:

South Florida Water Management District
West Palm Beach, Florida

Prepared by:

NEWFIELDS
2500 55th Street, Suite 200
Boulder, Colorado 80301

TABLE OF CONTENTS

TABLE OF CONTENTS i
LIST OF TABLES ii
LIST OF FIGURES ii
LIST OF APPENDICES ii
LIST OF ACRONYMS ii
1.0 INTRODUCTION 2
1.1 Expanded ERA 2
1.2 Expanded ERA Questions 2
2.0 METHODOLOGY 2
2.1 Bulk Samples 2
2.1.1 Sample Collection and Analysis 2
2.1.2 Laboratory Methodology 2
2.1.3 Analysis Methodology 2
2.2 Bioassay Samples 2
2.2.1 Bioaccumulation Tests 2
2.2.2 Toxicity Tests 2
2.3 Evaluation of Residual Soil Distribution and Chemistry in Pilot Study Area 2
2.3.1 Depth and Soil Coverage 2
2.3.2 Detailed Vertical Copper Delineation 2
3.0 RESULTS 2
3.1 Bulk Samples 2
3.1.1 Verification Sample Results 2
3.1.2 Sediment/Surface Water Aging Results 2
3.1.3 Bioaccumulation Test 2
3.1.4 Toxicity Test Results 2
3.2 Evaluation of Residual Soil Distribution and Chemistry in Pilot Study Area 2
3.2.1 Soil Depth and Arial Coverage 2
3.2.2 Detailed Vertical Delineation 2
4.0 RISK CHARACTERIZATION 2
4.1 Risk Evaluation Under No Further Corrective Action 2
4.1.1 Aquatic-Feeding Wildlife 2
4.1.2 Aquatic Community 2

4.2 Scraping Option 2
4.2.1 Aquatic-Feeding Wildlife 2
4.2.2 Aquatic Community 2
4.2.3 Area-Weighted Calculation of Copper UCL 2
5.0 SUMMARY AND CONCLUSIONS 2
6.0 REFERENCES 2

LIST OF TABLES

Table	Title
2.1-1	Verification Sample Results
2.1-2	Analytical Methods
3.1-1	Comparison of Verification Sample Results and Post-Scraping Confirmation Results
3.1-2	Sediment Sample Results: Acclimation Phase
3.1-3	Water Quality Parameter Results: Acclimation Phase
3.1-4	Overlying Water Sample Results: Acclimation Phase
3.1-5	Summary of Bioaccumulation Test Tissue Results, *Lumbriculus variegatus*
3.1-6	Summary of Bioaccumulation Test Tissue Results, *Pomacea paludosa*
3.1-7	Average Snail Tissue Mass at Day 28 of the Bioaccumulation Study
3.1-8	Overlying Water Sample Results: Bioaccumulation Phase
3.1-9	Summary of 10-Day Toxicity Tests
3.2-1	Exploratory Sample Results
3.2-2	Analysis of All Grids and Subgrids
3.2-3	Summary of Exploratory Sample Results by Grid
3.2-4	Summary of Exploratory Sample Results by Depth
4.1-1	Hazard Quotients for Detected COPCs in Grid 6; Default Food Web Model
4.1-2	Hazard Quotients for COPCs in Grid 6; Tissue Data
4.2-1	Hazard Quotients for Detected COPCs in the Pilot Study Area
4.2-2	Copper Concentrations in the Top 1 Inch of Soil Following Scraping

LIST OF FIGURES

Figure	Title
1.0-1	Site Location
1.0-2	Frog Pond Study Area
1.0-3	Frog Pond Pilot Study Area
1.1-1	Conceptual Site Model
2.1-1	Bulk Sample Locations
2.3-1	Soil Sample Locations, URS February 2008
2.3-2	Soil Sample Locations, URS September 2008
3.1-1	Metals in Aged Sediment: Acclimation Phase
3.1-2	Organochlorine Pesticides in Aged Sediment: Acclimation Phase
3.1-3	Total and Dissolved Metals in Overlying Water, CS-8 and CS10: Acclimation Phase
3.1-4	Metals and Organochlorine Pesticides in Overlying Water, Grid 6: Acclimation Phase
3.1-5	Total Organic Carbon and Total Dissolved Solids in Overlying Water: Acclimation Phase
3.1-6	Total Metals in Overlying Water, CS-8, CS-10, Grid 6, and Control: Bioaccumulation Phase
3.2-1	Copper Concentration by Depth: Exploratory Soil Samples
4.1-1	Copper Bioaccumulation Factors for Apple Snails
5.0-1	Frog Pond Site Revised Project Footprint

LIST OF APPENDICES

Appendix	Title
A	X-Ray Diffraction Analysis Laboratory Report
B	Laboratory Photos
C	Analytical Results
D	Analytical Laboratory Reports (Provided on CD)
E	Harbor Branch Oceanographic Institute Laboratory Sampling Sheets
F	Frog Pond Toxicity Testing Report
G	Wildlife Model Output

LIST OF ACRONYMS

AFDW	Ash-Free Dry Weight
BAF	Bioaccumulation Factor
BCFs	Bioconcentration Factors
BODR	Basis of Design Report
COPECs	Chemicals of Potential Ecological Concern
CSM	Conceptual Site Model
ESA	Environmental Site Assessment
GC-ECD	Gas Chromatography-Electron Capture Detection
HBOI	Harbor Branch Oceanographic Institute
HQs	Hazard Quotients
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
ICP-OES	Inductively Coupled Plasma-Optical Emission Spectrometry
LOAELs	Lowest Observed Adverse Effect Levels
NOAELs	No-Observed Adverse Effect Levels
OCPs	Organochlorine Pesticides
PEC	Probably Effect Concentration
SLERA	Screening Level Ecological Risk Assessment
SQAGs	Sediment Quality Assessment Guidelines
TEC	Threshold Effect Concentration
TRVs	Toxicity Reference Values
TOC	Total Organic Carbon
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
USFWS	US Fish and Wildlife Service
WQS	Water Quality Standard
WRP	Water Resource Project

1.0 INTRODUCTION

The Frog Pond (the site) consists of over 5,000 acres of agricultural lands currently owned by the South Florida Water Management District (the District) in Miami-Dade County, Florida. The site is located west of the District's C-111 Canal, east of Levee 31 adjacent to the Everglades National Park (**Figure 1.0-1**). Currently, a portion of the property is leased and is actively cultivated by commercial vegetable farmers.

In 2006, URS Corporation (URS) conducted a Phase I and Phase II Environmental Site Assessment (ESA) of 1,380 acres of the Frog Pond in which the District planned to construct a 'leaky reservoir' (**Figure 1.0-2**). The project is needed because the C-111 canal just to the east of the site has disrupted natural groundwater flow patterns by creating a low-resistance pathway that has resulted in drawing groundwater toward the east and away from the Everglades National Park which lies to the south and west of the Frog Pond site. The natural flow patterns in this area are for groundwater to flow toward Taylor Slough and eventually into Florida Bay. The project is intended to help sustain regional groundwater flow into Taylor Slough, and eventually help re-establish more natural flows in the Everglades. In the 'leaky' reservoir concept, water is intended to infiltrate through the bottom of the reservoir to groundwater. In this case, the infiltration is expected to create a groundwater mound beneath the reservoir that will force groundwater flows into Taylor Slough to the west, and keep regional groundwater from flowing into the C-111 canal to the east of the property.

The ESA was conducted using guidance developed by the District and the United States Fish and Wildlife Service (USFWS) (2006) and included a screening level ecological risk assessment (SLERA) that identified several potential risks to USFWS Trust resources due to residual agro-chemicals present in the soils at the Frog Pond should the water resource project (WRP) be constructed. Concentrations of barium, cadmium, chromium, copper, lead, zinc, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane and endosulfan exceeded screening-level risk-based benchmarks in at least one sample within the study area.

Soils within the Frog Pond are generally very thin and most have been created by a process known as 'rock farming'. The native limestone cap rock is crushed using heavy plows and the resulting material is used as farming substrate. Throughout most of the Frog Pond, soils are approximately 6 inches deep underlain by solution riddled limestone. Surface solution cavities in the limestone have been filled with soil during cultivation.

URS (2006) estimated that more than approximately 1,120,000 cubic yards of soils within area of the ESA investigation may contain residual agro-chemicals at concentrations exceeding screening-level benchmarks and proposed that soils could be scraped from interior portions of the reservoir, stockpiled outside of the reservoir footprint and potentially used in levee construction.

In 2007, URS began work on a test-scale soil scraping pilot study in a currently uncultivated area adjacent to the 1,380 acre area that was the subject of the ESA. URS (2008) sampled a number of locations within the 50-acre area and selected a 5-acre sub-area that contained elevated copper and zinc concentrations in the soils (**Figure 1.0-3**).

All soils were subsequently removed from the 5-acre pilot study area and stockpiled nearby. A total of 5,378 cubic yards of material was removed from the ground surface. Soils were sampled both pre- and post-scraping and were analyzed for copper, zinc and organochlorine pesticides (OCPs). Pre-scraping samples ranged from 144 to 250 mg/kg copper and 103 to 170 mg/kg zinc, while no OCPs were detected. The upper bound estimate of mean copper concentrations using the 95th upper confidence limit (UCL) was 239 mg/kg, which exceeds 85 mg/kg benchmark for the protection of the Everglades snail kite.

Following scraping, an additional 18 samples were collected from residual, shallow soils remaining after scraping and from within solution cavities of the limestone. Copper concentrations ranged from 8.4 to 249 mg/kg while zinc ranged from 6.9 to 212 mg/kg. Copper concentrations in most (15) of the post-removal samples exceeded the USFWS 85 mg/kg benchmark, as did the UCL (173 mg/Kg).

URS measured the total area of soil depressions within the 5-acre area as equal to 0.11 acres. URS also estimated that approximately 60 cubic yards of soils remained within the solution cavities (average depth equal to 3.9 inches), and a total of 330 cubic yards of soils remained in a thin veneer on top of the limestone averaging less than 0.5 inches in depth. The volume of total residual soils was estimated by URS to be approximately 390 cubic yards. On other properties, the District has elected to conduct corrective actions to reduce copper concentrations to below the USFWS benchmark. However, URS has indicated that removal of the remaining soils from the scraped area at the Frog Pond site may not be feasible with available methods.

NewFields was contracted by the District through URS and WRS Compass (WRS) to complete an expanded ecological risk assessment (ERA) as defined by the ERA Protocol (SFWMD and USFWS 2008) to determine the potential for ecological risk due to residual soils at the Frog Pond if a 'leaky reservoir' were to be constructed at the site following routine scraping. This document describes the studies conducted and the expanded ERA.

1.1 Expanded ERA

Figure 1.1-1 shows the conceptual site model (CSM) on which the risk analysis and study design is based. Soils containing elevated concentrations of chemicals of potential ecological concern (COPECs) were scraped from the surface of the limestone cap rock. As discussed above, while scraping of the soils is expected to remove much of the bulk of the COPEC mass, concentrations in the fine-grained materials left behind in solution holes is expected to be similar

to pre-scraping concentrations. Ecological receptors inhabiting the site could be exposed to COPECs in the soils.

The basis of design report (BODR) for the Frog Pond Detention Area (Brown and Caldwell 2007) indicated very high infiltration rates of as much as 0.96 feet per hour under constant head conditions. As a result, the hydrologic regime of the Frog Pond site will be dominated by flooding and drying events with drying due primarily to infiltration at deeper water levels and evaporation at shallow water levels when only small pockets of water remain in the solution holes.

The preliminary descriptions of reservoir operations described in the BODR indicates that the Frog Pond project area will be subject to frequent wetting/drying cycles as water is directed into the reservoir and infiltrates into the underlying aquifer. Frequent drying and the minimization of residual soils in the project area are likely to limit the potential aquatic and wetland community that develops on the scraped surface. However, standing water is likely to persist in some areas where residual soils in rock depressions cannot be removed, and an aquatic or wetland community could develop in these areas. The size of such areas and the length of time they exist is difficult to predict. If such areas persist long enough, aquatic insects and potentially vertebrate prey could become established and attract aquatic-feeding birds. This risk analysis is intended to evaluate the exposure of aquatic birds under such a scenario.

X-ray diffraction analysis of Pilot Study area soils indicates that much of the copper, zinc and other COPECs in the soils are expected to be adsorbed to the soil particles (Appendix A). When flooded, COPECs in residual soils may be desorbed from the soil particles into pore water and the water column. High infiltration rates will result in a predominately downward flux of released COPECs, preventing widespread lateral diffusion and accumulation in the water column. With repeated hydrologic cycles, the pool of soluble and bio-available COPECs in residual soils is expected to decline.

1.2 Expanded ERA Questions

This expanded ERA was designed to attempt to answer a series of questions related to the fate and transport as well as toxicity of the COPECs at the Frog Pond site. The questions are as follows:

1) How will the COPEC concentrations in water and soil/sediment change with repeated wetting/drying cycles?

2) Are initial conditions potentially toxic to sediment invertebrates?

3) How does bioavailability and toxicity change with wetting/drying cycles?

4) Given time, if an aquatic community were to develop at the site, what is the potential for bioaccumulation of the COPECs?

Experiments were conducted in an environmentally controlled laboratory setting in an attempt to mimic field conditions to the extent practicable. Experiments were conducted in stages in order to approximate the initial water cycling stages that are expected to flush the bulk of soluble COPEC concentrations from the system prior to development of even a limited aquatic community. These experiments are discussed in greater detail in the following sections.

2.0 METHODOLOGY

WRS and URS collected soil samples from the Frog Pond site for use in this expanded ERA. In June, 2008 WRS collected bulk soil samples from three locations at the Frog Pond. Two samples were collected from the Pilot Study scraped area and one sample was collected from within an area of the Frog Pond previously sampled by URS as part of the ESA and identified as a "worst-case" location. The bulk samples were shipped to the NewFields biological testing laboratory in Port Gamble, Washington for analysis of toxicity, bioaccumulation and chemical desorption under simulated field conditions.

These samples were not collected to characterize COPEC concentrations in soils, but to capture COPEC concentrations that are representative of conditions that may be present at the site following soil scraping. As a result, verification analyses were required to confirm that COPEC concentrations approximate conditions required for the laboratory studies.

The samples were targeted at copper concentrations slightly above the 85 mg/kg benchmark within the scraped area, at copper concentrations significantly greater than the benchmark, and at worst-case copper and organic COPEC concentrations that could be present if scraping were not conducted.

URS also collected a number of exploratory samples from within the scraped Pilot Study area. These samples were collected to more accurately delineate the presence and volume of soils remaining in the scraped area, to assess the depth of soils in limestone solution cavities and to delineate the distribution of soils with elevated copper concentrations at depth within the solution cavities. These samples are discussed in Section 2.3.

2.1 Bulk Samples

2.1.1 Sample Collection and Analysis

Soils were collected from three locations at the Frog Pond site. Samples within the scraped Pilot Study area were designated CS-8 and CS-10 (**Figure 2.1-1**) based on the sample designations from the URS Pilot Study (URS 2008). These samples were collected from locations with copper concentrations greater than 85 mg/kg and zinc concentrations greater than 100 mg/kg.

A third sample was collected within the currently cultivated and un-scraped area to the east of the Pilot Study area designated as Grid 6 in the ESA (URS 2006). This sample (**Figure 2.1-1**) was intended to be representative of worst-case agro-chemical concentrations for metals

(barium, cadmium, chromium and copper) as well as OCPs (4,4'-DDE, chlordane, endosulfan, etc.) should no scraping be completed prior to construction of the detention area.

A total of 20 gallons of soil from each location was collected using decontaminated shovels and stainless-steel spoons. The entire sample was then thoroughly mixed by placing the soils on a large sheet of plastic and mechanically mixing for a minimum of five minutes. In order to ensure that the bulk samples were both mixed and representative of the soil chemical concentrations desired, three verification samples were collected from different locations within each bulk sample and shipped to the Columbia Analytical Services laboratory in Jacksonville, Florida for analysis. Results of the verification samples are provided in **Table 2.1-1.**

Samples were then placed in large, food-grade sediment bags and stored in an insulated cooler at approximately 4°C. Upon receipt of the verification sample results indicating that homogenization and concentration goals were met, samples were shipped via overnight courier to the NewFields laboratory in Washington for further testing. Upon receipt by NewFields, the samples were checked for integrity and then held in the dark at 4°C ± 2°C prior to testing.

2.1.2 Laboratory Methodology

Soils were acclimated, or "aged" to partially mimic the repeated wetting cycles in 10-gallon, glass aquaria. Prior to testing, each aquarium was washed with warm soapy water, rinsed with tap water and deionized water, and then solvent-rinsed with acetone. Acclimation was conducted as a static-renewal, soil-in-water exposure, with 100% renewal of overlying water on Days 7, 12, 17, 27, 37, and 48.

To create soil acclimation exposures, soil samples were homogenized using clean, solvent-rinsed, stainless-steel spoons, and then transferred to the test aquaria. One gallon of test soil was placed into each of six test aquaria. Twelve liters (3 gallons) of freshwater was gently added to each test chamber using a diffuser (a perforated 1-L polypropylene beaker). Water was prepared following EPA methodology for synthetic freshwater (EPA Method 821-R-02-012). Perrier™ water was diluted with deionized laboratory water at a ratio of 46 L Perrier and 120 L DI to create a water hardness of 150 mg/L $CaCO_3$. In order to seed the microbial community in the synthetic water, 0.5 L of natural stream water collected from a natural spring that feeds an old-growth forest stream near the NewFields laboratory was added to the diluted Perrier. In addition, 100 g of in-stream deciduous leaf-litter was added to the synthetic water. The synthetic water mixture was aerated and allowed to "age" for seven days prior to testing.

Acclimation chambers were placed on shelves in a temperature controlled bath at 25°C and allowed to settle overnight with no air. All test chambers for each treatment were acclimated under aerobic conditions and were provided trickle-flow aeration. Photographs of the aquaria are presented in Appendix B. Water quality was monitored three days per week (M, W, F) and

included temperature, pH, dissolved oxygen, conductivity, and ammonia. Water hardness and alkalinity were monitored at the end of each renewal cycle, prior to renewal.

2.1.3 Analysis Methodology

All analytical methods are displayed in **Table 2.1-2**. Water and sediment samples were analyzed by Columbia Analytical Services in Jacksonville, Florida. Tissue samples were analyzed by Columbia Analytical Services in Kelso, Washington.

Water

Total and dissolved metal concentrations were determined according to EPA Method 200.8 via inductively coupled plasma-mass spectrometry (ICP-MS). Total organic carbon (TOC) and total dissolved solids (TDS) were determined according to EPA Methods 415.1 and 160.1, respectively. Overlying water from CS-8 and CS-10 aquaria were analyzed for copper and zinc only because these sediments represent chemical conditions of soils on scraped areas of the Pilot Study Area, where copper and zinc concentrations remain elevated (above 85 mg/kg and 100 mg/kg, respectively). OCPs were not detected in the Pilot Study area. Overlying water samples from Grid 6 aquaria were analyzed for the full suite of metals and OCPs because soils were representative of conditions at the Frog Pond if scraping were not conducted prior to flooding (i.e. worst-case scenario).

OCPs were extracted from Grid-6 water samples according to U.S. Environmental Protection Agency (EPA) Method 3510C, and concentrations were determined according to EPA Method 8081A via gas chromatography-electron capture detection (GC-ECD).

Sediment

Total metals concentrations were determined in sediment samples according to EPA Method 6020 via ICP-MS. TOC and total solids were determined according to EPA Methods 9060M and 160.3 (modified), respectively.

OCPs were extracted from Grid-6 sediment samples according to EPA Method 3550, and concentrations were determined according to EPA Method 8081A via GC-ECD.

Tissue

Animal tissue samples were homogenized and freeze-dried prior to analysis. Plant tissue samples were also homogenized, but were dried at 60°C prior to analysis. Total metals concentrations were determined in all tissue samples according to EPA Method 200.8 via ICP-MS. Total chromium was determined via axial inductively coupled plasma-optical emission spectrometry (ICP-OES).

OCPs were extracted from tissue via EPA Method 3540C, and concentrations were determined according to EPA Method 8081A via GC-ECD.

Lipid content was determined in background tissue and in one sample replicate per animal tissue type (snail or worm) according to EPA Method 3540.

2.2 Bioassay Samples

2.2.1 Bioaccumulation Tests

Bioaccumulation tests were performed using two test organisms: the worm, *Lumbriculus variegatus*, and the Florida apple snail, *Pomacea paludosa*. Tests using *L. variegatus* were performed at the NewFields Laboratory in Port Gamble, Washington using acclimated and unacclimated Grid 6 sediment. Due to restrictions, tests using *P. paludosa* could not be performed outside of Florida. NewFields worked with Harbor Branch Oceanographic Institute (HBOI), in Ft. Pierce, Florida to perform the tests. Bioaccumulation tests were conducted for *P. paludosa* using all three acclimated sediment samples: CS-8, CS-10, and Grid 6.

P. paludosa

Aged sediment was used to conduct a standard 28-day bedded-sediment bioaccumulation test using the Florida apple snail. Tests were conducted according to guidance provided in standard method ASTM E 1688, "*A Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates*" and USEPA method, "*Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (USEPA/600-R-99/064)."

Test exposures were prepared by placing approximately 1.8 L of sediment in clean, acid- and solvent-rinsed 27-L aquaria, and then filling with 10 L of reconstituted freshwater. Three replicate chambers were prepared for each test soil and control sediment. Crushed coral aragonite (obtained from CaribSea, Inc.) with a grain size of 2-4 mm was used as the control sediment. Test chambers were placed in randomly assigned positions in a 23°C water bath and allowed to equilibrate overnight. Photographs of the aquaria are located in Appendix B.

Immediately prior to test initiation, overlying water in the test chamber was exchanged. Tests were initiated by randomly allocating approximately 13 specimens of *P. paludosa* into each test chamber. Tests were conducted as static-renewal exposures. Water was siphoned off to approximately 1 cm above the sediment surface and was completely replaced one time per week. Water quality parameters were monitored in one replicate for each treatment on days 1-28. Daily observations were made on each replicate throughout the test and included the number of dead and surfaced animals. Test organisms were fed Publix™ organic romaine lettuce during the bioaccumulation exposures.

At test termination, water quality observations were made in one replicate for each treatment. Upon termination of the test, snails were removed from aquaria and placed in depuration chambers. Snails were held in clean, freshwater for 24 hours to allow them to purge their guts of any sediment or detritus. Following the depuration period, snails were weighed and the shells were separated from the soft tissues. Snail soft tissues were placed in a certified-clean glass jar and frozen (-20°C) overnight. Photographs of the tissue sampling event are located in Appendix B. Tissues were sent via overnight delivery to Columbia Analytical Services in Kelso, Washington for analysis.

Samples of overlying surface water were submitted for chemical analysis on days 0 (collected 24 hours after test initiation), 1, 13, and 28 of the snail bioaccumulation test. Sediment samples were submitted for chemical analysis upon termination of the test (day 28). Methods used for chemical analysis are described in section 2.1.3. The dissolved fraction of metals in overlying water samples was not analyzed during the bioaccumulation testing period.

L. variegatus

Aged sediment was used to conduct a standard 28-day bedded-sediment bioaccumulation test using the worm, *Lumbriculus variegatus*. *L. variegates* is a standard test organism frequently prescribed by USEPA and state agencies for assessing sediment toxicity. Tests were conducted according to guidance provided in standard method ASTM E 1688, "*A Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates*" and USEPA method, "*Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (USEPA/600-R-99/064)."

Test exposures were prepared by placing approximately 1 L of sediment in clean, acid and solvent-rinsed 4-L trays, and then filling with 2 L of reconstituted freshwater. Five replicate chambers were prepared for each test soil and a naturally occurring control sediment. Test chambers were placed in randomly assigned positions in a 23°C water bath and allowed to equilibrate overnight.

Immediately prior to test initiation, overlying water in the test chamber was exchanged. Tests were initiated by randomly allocating approximately 32 g of *L. variegates* into each test chamber. Tests were conducted as static-renewal exposures, with twice-daily water renewals. Water quality parameters were monitored in one replicate for each treatment on days 1-28. Daily observations were made on each replicate throughout the test and included the number of dead and surfaced animals. Test organisms were not fed during the bioaccumulation exposures.

At test termination, water quality observations were made in one replicate for each treatment. To terminate the test, sediment from each test chamber was sieved through a 0.2 mm screen. Living worms were retrieved from the remaining material in the screen. Worms were separated from any detritus or mucus and placed in clean water for depuration. Worms were held in clean,

freshwater for 24 hours to allow them to purge their guts of any sediment or detritus. Following the depuration period, worms were dewatered, weighed, and placed in a certified-clean glass jar and frozen (-20°C) overnight. Tissues were sent via overnight delivery to Columbia Analytical Services in Kelso, Washington for analysis.

2.2.2 Toxicity Tests

Acclimated and unacclimated sediment was used to conduct standard 10-day acute toxicity tests using two organisms: *Hyallela azteca* and *Chironomus dilutus*. The toxicity testing methods followed guidance provided in standard method ASTM E 1706-05, "*Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates*" and USEPA method, "*Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (USEPA/600-R-99/064)."

Test exposures were prepared for *H. azteca* by placing approximately 175 mL of sediment in clean, acid- and solvent-rinsed 1-L glass jars, and filling with 600 mL of diluted Perrier™ mineral water. Test exposures were prepared for *C. dilutus* by placing approximately 100 mL of sediment in clean, acid and solvent-rinsed 300-mL glass jars, and then filling with 175 mL of diluted Perrier™ mineral water. Nine replicate chambers and a control sediment were prepared for each test organism and for each test treatment.

The tests were initiated by randomly allocating 10 *H. azteca* into each test chamber, ensuring that each of the amphipods successfully buried into the sediment. Amphipods that did not bury within approximately one hour were replaced with healthy amphipods. This procedure was repeated for the *C. dilutus* test set-up using 2nd instar organisms. All test chambers were outfitted with a Zumwalt-style water delivery system to facilitate twice-daily water renewals. Daily observations were made on each replicate throughout the test and included the number of dead and surfaced animals. Water quality parameters were monitored in one replicate throughout the duration of the test.

To terminate the test, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered amphipods transferred into a Petri dish. Surviving *H. azteca* individuals from each replicate were placed in pre-weighed, aluminum boats, and dried at 60°C for 24 hours. The dry weight measurements provided an estimate of mean growth per surviving individual.

Survivorship of *C. dilutus* was measured as the total number of larvae and pupae remaining at test termination; however, only the larvae were used to determine the growth endpoint. Surviving larvae from each replicate were placed in pre-weighed aluminum boats and dried at 60°C for 24 hours to determine dry weights. The weigh boats were subsequently ashed at 550°C for 2 hours and reweighed in order to calculate the ash-free dry weight (AFDW) of the surviving larvae. Growth was calculated as AFDW per surviving individual and biomass was calculated as AFDW per number initiated.

2.3 Evaluation of Residual Soil Distribution and Chemistry in Pilot Study Area

2.3.1 Depth and Soil Coverage

In February, 2008 URS completed an estimate of the depth and aerial extent of soil remaining in the Pilot Study area following soil scraping. To accomplish the estimate, the 5-acre Pilot Study area was divided into five one-acre grid cells. Grids were established that spanned the entire east to west width of the Pilot Study area.

One shallow and one deep soil sample was collected from each of the five grids and analyzed for copper and zinc concentrations **(Figure 2.3-1)**. Shallow samples were collected from the thin (< 1 inch) layer of soils that remained on the top of much of the cap rock following scraping. Deep samples were collected from the surface to a minimum of 6 inches in deeper pockets of soil that are found within filled solution cavities in the cap rock.

Additionally, 10 locations were randomly selected within each grid. At each location, a 1 meter square frame was randomly placed on the ground. The proportion of bare rock, thin soils (< 1 inch) and thick soils (> 1 inch) was estimated to the nearest 5% within each 1-meter.

2.3.2 Detailed Vertical Copper Delineation

URS collected soil samples from the 5-acre pilot study area in September 2008. Ten samples were collected from the thin soils (<1 inch deep) that are present on the scraped cap rock **(Figure 2.3-2)**.

Where deeper soils were available, samples were collected at 2 to 3 inch intervals down to a maximum depth of 8 inches.

The samples were analyzed for copper and for TOC. URS submitted the copper samples to Columbia laboratories and the TOC samples to E-Lab for analysis.

3.0 RESULTS

3.1 Bulk Samples

All results for bulk sediment, overlying water, and tissue samples are located in Appendix C. Analytical laboratory reports are located in Appendix D.

3.1.1 Verification Sample Results

Confirmation and verification sample results, and comparison to SQAGs are shown in **Table 3.1-1**. In some cases, confirmation and verification sample results for a given location varied substantially. Differences observed in results of the two sampling events can be attributed to inherent soil heterogeneity and variability in laboratory handling and/or methodology.

Copper and zinc were detected in all replicates of CS-8 and CS-10 soil samples. Average copper concentrations exceeded the TEC, and average zinc concentrations fell below the TEC in both samples (Table 3.1-1). Copper concentrations in all samples also exceeded the 85 mg/kg benchmark for the protection of the Everglades snail kite.

The TEC was exceeded for the following contaminants found in Grid 6 soil: barium, chromium, zinc, 4,4'-DDT, total chlordane, and endrin aldehyde. Copper and 4,4'-DDE concentrations exceeded corresponding PECs.

3.1.2 Sediment/Surface Water Aging Results

Soil/sediment

Acclimation phase sediment analytical data is presented in **Table 3.1-2**. Changes in sediment metal and OCP concentrations during the acclimation process are shown in **Figures 3.1-1 and 3.1-2**. Metals concentrations in all samples fell sharply between Day 1 and Day 7. For CS-8, copper and zinc concentrations decreased slightly through the end of the acclimation period (Day 37). Copper and zinc concentrations in CS-10 sediment appeared to increase slightly between Day 7 and Day 37. It is unclear why concentration increases were observed, but concentrations remained below those observed prior to inundation.

At the end of the acclimation process, copper concentrations remained above the TEC in CS-8 and CS-10, and zinc concentrations fell below the TEC. In Grid 6 sediment, barium, chromium, zinc, and 4,4'-DDE concentrations remained above the TEC, while Cu remained above the PEC. Cadmium fell to 0.72 mg/kg at the end of soil acclimation and no longer exceeded the

TEC. Copper concentrations were less than the 85 mg/kg benchmark at the conclusion of the aging process in CS-8 and CS-10 but remained significantly above the benchmark in the Grid 6 sample.

Surface Water

Water quality in aged sediments was monitored to obtain information on the general trends of COPEC concentrations in overlying water. These tests assumed a minimum amount of water exchange, intended to mimic the worst-case scenario of water standing on residual soils for long periods of time. Actual conditions in the project area will vary.

Water quality parameter results including alkalinity, conductivity, dissolved oxygen, hardness, pH, temperature, and total NH_3 are found in **Table 3.1-3**. The water hardness varied somewhat between samples, but the average water hardness results for each aquaria were near the target value of 150 mg/L $CaCO_3$ and ranged between 147 and 167 mg/L $CaCO_3$. Water temperature remained near 25°C throughout the acclimation period, and pH ranged between 7 and 8. Dissolved oxygen varied between 6 and 8 mg/L, and in general, conductivity readings were highest during the first 10 days of the acclimation period.

Total and dissolved copper concentrations typically increased sharply between Day 1 and Day 7, decreased sharply between Day 7 and Day 17 and remained relatively constant through the end of the testing period (**Figures 3.1-3 and 3.1-4**). For all aquaria, copper concentrations were at maxima at Day 7.

In the Grid 6 sample, barium concentrations showed a similar trend to copper (barium was tested only in Grid 6). Concentrations of zinc were relatively constant throughout the testing period for each of the other samples. The highly elevated zinc concentration detected in CS-8 at Day 37 appears to be anomalous and may have been the result of sampling error, as particulate matter was observed in the sample. Zinc concentrations in CS-8 returned to expected levels in the next sample collected at termination of the aging period.

Results for overlying surface water samples from the acclimation phase are compared to Florida Water Quality Criteria in **Table 3.1-4**. The dissolved copper concentration at Day 7 for CS-8 (16.0 µg/L) exceeded the (hardness-dependent) chronic water quality standard (WQS) calculated for this sample (13.9 µg/L). Dissolved copper concentrations in Grid 6 exceeded the chronic water quality criterion (12.6 µg/L) during all sampling events of the acclimation phase, and exceeded the acute criterion (25 µg/L) only at Day 7. With the exception of the anomalous zinc concentration in CS-8 at Day 37, all other metal concentrations were below state WQSs.

4,4'-DDT and endosulfan sulfate were the only detected OCPs during any study cycle in Grid 6 aquaria. Despite the concentrations of 4,4'-DDE detected in sediment, all concentrations in overlying water fell below method detection limits. Endosulfan sulfate was detected at maxima at Day 7 (0.04 µg/L) with lower concentrations detected at Day 17 and 37 (**Figure 3.1-4**). 4,4'-

DDT was only detected at Day 12 (0.28 µg/L). None of the OCPs detected in overlying water exceeded state WQSs.

TOC was at maxima in all three soil aquaria at Day 7 of the study (**Figure 3.1-5**). Similar to copper, TOC concentrations rose sharply between Day 1 and Day 7, and then decreased sharply between Day 7 and Day 12.

TDS were substantially higher in Grid 6 overlying water than in CS-8 or CS-10 , especially between Day 1 and Day 12. TDS increased sharply between Day 1 and Day 7, decreased sharply between Day 7 and Day 17, and then remained steady or slightly decreased for remainder of the acclimation phase (**Figure 3.1-5).**

3.1.3 Bioaccumulation Test

Summary data for each analyte are presented for worm tissue in **Table 3.1-5** and for snail tissue in **Table 3.1-6**.

Worms

A total of six worm tissue samples (five replicates and one control) were submitted for analysis after 28 days of exposure to Grid 6 soils. Barium, cadmium, chromium, copper, and zinc were detected in all replicates, and the following OCPs were detected: 4,4'-DDE, a-chlordane, dieldrin, endosulfan II, and endosulfan sulfate. The highest concentration detected of all analytes was 4,4'-DDE at 150 µg/kg (Grid 6-replicate 3 and Grid 6-replicate 5). Endrin aldehyde was not detected in any worm tissue replicate (likely due to elevated detection limits).

Barium, cadmium, chromium, copper, and zinc were also detected in all background tissue samples, and in general, concentrations were lower than Grid 6 tissue samples. 4,4'-DDT (1.2 µg/kg), a-chlordane (0.49 µg/kg), and endosulfan I (0.46 µg/kg) were also detected background samples, yet concentrations were lower than in non-control tissue samples (**Table 3.1-5**).

Snails

Summary data for snail tissue wet weight and shell length results are presented in Table 3.1-7. At the end of the bioaccumulation study, average tissue weight was lowest in Grid 6 snails (9.7 g), but average tissue weights for CS-8 and CS-10 snails (15.3 and 13.9 g, respectively) were greater than that of the snails kept in the control aquaria.

Average shell length ranged between 19.8 and 20.1 mm for snails exposed to Site sediment. Average shell length was slightly lower (18.3 mm) for snails kept in control aquaria. Laboratory data sheets containing snail physical data is located in Appendix E.

All snails in one replicate of sediment CS-10 died after day 10. The cause of the mortality is not clear. However, it is unlikely that this mortality is contaminant-related because snails in all four other replicates survived and reproduced successfully (viable eggs were laid in one aquaria).

Following the 28-day exposures, five snail tissue samples (one from each replicate) were submitted for analysis for CS-8. Only four tissue samples were submitted for CS-10 due to the mortality event described above. Because of mortality observed in several replicates from Grid 6, tissues from Grid 6-replicate1 and Grid 6-replicate 3 were composited into one sample to ensure adequate tissue mass for analysis. Separate tissue samples were submitted for the remaining two replicates resulting in four total tissue samples submitted for Grid 6.

All target metals were detected in all replicates of each treatment. Copper concentrations were higher in CS-8 than in CS-10 tissue, while concentrations of zinc were similar. 4,4'-DDE, endosulfan sulfate, and endrin aldehyde were detected in all Grid 6 replicates. Dieldrin was detected in one replicate at 0.57 µg/kg, but was I-qualified. Similar to the worm tissue, 4,4'-DDE was detected at the highest concentration. 4,4'-DDE was detected in acclimation phase sediment samples, but not in overlying surface water.

Barium, cadmium, chromium, copper, and zinc were detected in all background tissue samples, and in general, concentrations were much lower than those in treated tissue. 4,4'-DDE (0.47 µg/kg) was the only OCP detected in the background tissue sample. The result was much lower than those found in the Grid 6 snails and was also I-qualified.

Detectable concentrations of a-chlordane were detected in all Grid 6 worm tissue replicates, but were not detected in any Grid 6 snail tissue replicates. Given that the detection limits were identical for both tissue types, it appears that physiological differences between these two species may have resulted in different bioaccumulation patterns.

Overlying Water

Overlying water was tested only for the snail bioaccumulation tests, and not for *Lumbriculus*. Results for overlying water samples are presented in **Table 3.1-8**. Initial total copper concentrations in CS-8 and Grid 6 test chambers were high in samples collected just after inundation of the sediments with laboratory test water on Day 0. Concentrations then declined sharply by the start of Day 1. This trend was probably due to the suspension of fine particulates during initial inundation. These fine particulates were captured in the Day 0 sample, but had settled out by Day 1. Concentrations of copper in CS-10, and other metals in all samples remained relatively constant throughout the test (**Figure 3.1-6**).

Endosulfan sulfate was detected in Grid 6 overlying surface water at Day 13 of the bioaccumulation test, but no other OCPs were detected.

Copper concentrations in all samples in the snail test were consistently higher than observed in the aging tests discussed in Section 3.1.2 (Figures 3.1-3 and 3.1-4). This may be due to bioturbation caused by the snails. However, concentrations had declined and either reached stable concentrations or were still declining at the end of the 28-day test.

Low concentrations of barium, copper, and zinc were detected in the overlying water of the control aquaria. OCPs were not detected. Water quality parameter results for dissolved oxygen, conductivity, pH, temperature, ammonia, hardness, and alkalinity are located in Appendix E.

3.1.4 Toxicity Test Results

Table 3.1-9 displays the results of the toxicity tests. The full toxicity report is located in Appendix F.

Sediments CS-8 and CS-10 did not exhibit significant reductions in survival or biomass, relative to the control, in either the test with *Hyallela azteca* or *Chironomus dilutus*. This was true for both the acclimated and unacclimated sediment.

Exposure to acclimated and unacclimated Grid 6 sediment resulted in significant reductions in *H. azteca* survival and biomass. *Chironomus* survival was significantly lower in the unacclimated Grid 6 sediment, but not in the acclimated sample. *Chironomus* biomass was significantly decreased in both the acclimated and unacclimated Grid 6 sediment.

While there were some differences in responses between the acclimated and unacclimated sediments, the only significant difference relative to the control was observed in the Grid 6 sediment for the *Chironomus* survival endpoint. There were no significant differences between the acclimated and unacclimated test treatments for either the *Hyallela* or *Chironomus* endpoints.

3.2 Evaluation of Residual Soil Distribution and Chemistry in Pilot Study Area

3.2.1 Soil Depth and Arial Coverage

Exploratory sample results are shown in **Table 3.2-1**. Copper and zinc were much higher in soil remaining on the cap rock (in shallow samples) than in soils found deep in solution pockets (deep samples) in all grids. The average copper concentration of shallow samples (140 mg/kg) remained above the Everglades snail kite benchmark.

Results of the 1-meter analysis survey for remaining coverage of the Site are found in **Table 3.2-2**. Results indicate that after scraping, nearly 89% of the Frog Pond site surface is bare cap

rock or is covered by <1 in of soil. Approximately 39% of the total area has no soil with 50% only covered by a very thin layer. Thick (>1 in) soil was estimated to cover only 11% of the site.

3.2.2 Detailed Vertical Delineation

Maximum concentrations by Grid are compared to benchmark values in **Table 3.2-3**. Maximum concentrations exceeded the TEC and the USFWS interim benchmark value for the Everglades snail kite (85 mg/kg) in each grid. The highest concentration of copper was detected in Grid C-23 at the 0 to 1 in bgs depth (140 mg/kg).

Copper concentration of each sample by depth is illustrated in **Figure 3.2-1**, and copper and TOC results by depth are summarized in **Table 3.2-4**. The average copper concentration was greatest (79.9 mg/kg) at the 0 to 1 in bgs depth. Average copper concentrations were lower at the 1 to 3 in below ground surface (bgs) depth (14.4 mg/kg) and much lower at the remaining depths. TOC content varied slightly between soil depths. On average, the 6 to 8 and 6 to 12 in bgs depths had the greatest amount of TOC, likely because the lower layers of soil have been left undisturbed which has allowed for organic carbon buildup.

The TOC concentrations collected during the detailed vertical delineation test were significantly higher than observed in previous studies. Average TOC concentrations ranged from 4.15% to 5.46% and generally increased with depth. TOC concentrations measured in previous samples were all less than 1%. The TOC analyses initially conducted by Columbian Analytical Services (CAS) are thought to be flawed because the carbon extraction method used by CAS reported only soluble organic carbon rather than total organic carbon. The revised TOC analyses were conducted using the standard TOC analysis method (EPA 9060) and more accurately report TOC. As a result, average TOC concentrations were assumed to be better represented by the data collected in this study.

4.0 RISK CHARACTERIZATION

Construction of a 'leaky reservoir' at the Frog Pond site has the potential to create wetland habitat within the project footprint. Results of the Phase I/II ESA indicated that residual agro-chemicals were present in the crushed limestone soils within the footprint of the future impoundment. The soil scraping Pilot Study was shown to effectively reduce chemical concentrations and significantly reduce mass of residual chemicals in the soil. The Pilot Study did, however, indicate that even after removal of a large majority of the soil, residual concentrations greater than risk-based benchmarks, particularly for copper, were still present.

The data collected as part of this expanded ecological risk assessment are discussed in the following sections to further assess the risk to potential aquatic and semi-aquatic receptors that may inhabit or utilize any habitat created by construction of the impoundment. The potential risks are assessed both considering a no action scenario where soils are not scraped prior to construction and following a corrective action scenario where the soils are scraped prior to construction.

4.1 Risk Evaluation Under No Further Corrective Action

The SLERA completed by URS in the Phase I/II ESA indicated that a potential for risk to future aquatic receptors at the Frog Pond site was potentially unacceptable based on exceedances of screening-level ecological benchmarks. Concentrations of barium, cadmium, chromium, copper, lead, zinc, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane and endosulfan exceeded screening-level risk-based benchmarks for sediment dwelling organisms and/or aquatic feeding wildlife. The screening-level risk predictions were made using either default sediment quality benchmarks or the fugacity-based screening-level risk assessment model (Goodrich 2003 and NewFields 2006).

The ERA Protocol provides the District with two options when the SLERA cannot dismiss the potential for ecological risk at a site. The District may choose to perform corrective actions to reduce residual agro-chemical concentrations to a level at which risks are deemed acceptable or additional risk assessment data may be collected and included in an expanded risk assessment.

The District has identified soil scraping as a preferred corrective action at this site should it be required to reduce the potential for ecological risk to an acceptable level. The data collected as part of this expanded risk assessment are, therefore, discussed in this section in order to determine if corrective action in the form of soil scraping is necessary.

The data presented in Section 3 were collected to provide more site-specific estimates of risk to the aquatic community and to aquatic-feeding birds that are possible using the default SLERA tools.

4.1.1 Aquatic-Feeding Wildlife

The SLERA presented in the Phase I/II ESA indicated the potential for risk to the Everglades snail kite from exposure to copper and zinc and to the osprey receptor from exposure to 4,4'-DDE. In order to address these issues on a more site-specific basis, a bulk soil sample was collected from the area termed Grid 6 in the Phase I/II ESA. This location was believed to be representative of upper-bound agro-chemical contamination in the Frog Pond soils. Analysis of the Grid 6 sample confirmed the presence of agro-chemicals in the sample at concentrations equal to or higher than the 95% UCL concentrations calculated by URS for the Frog Pond site. This indicates that the bioaccumulation tests conducted on the Grid 6 sample are adequately conservative for providing a reasonable worst-case estimate of risks if the soils within the impoundment are allowed to remain in place.

Hazard quotients (HQs) were calculated for 11 avian species using the default foodweb model as an initial step to narrow the focus of the site-specific assessment. HQs are ratios of predicted receptor-specific exposure rates to exposure rates representative of no observed adverse effect levels (NOAELs) and lowest observed adverse effect levels (LOAELs). The NOAEL and LOAEL values are termed toxicity reference values (TRVs).

NOAEL TRVs represent exposure rates at or below which, no adverse effects are expected and LOAELs represent exposure rates at the lowest exposure rate evaluated in the referenced toxicity studies that was associated with adverse effects. The true threshold for effects lies between the NOAEL and LOAEL TRVs.

A NOAEL-HQ less than 1.0 indicates that no further risk analysis is necessary to support site risk management decisions. HQs that exceed 1.0 do not necessarily correspond to unacceptable risk, but indicate the need for further evaluation to determine whether risks are unacceptable

LOAEL-HQs that are greater than 1.0 similarly do not necessarily indicate unacceptable risk, but that sensitive individuals in a population may experience adverse effects, represented by the endpoints on which the TRV is based. For relatively common species with robust populations, this level of effect may not affect the species' capacity to maintain populations. However, for relatively rare species, or long-lived species that have particularly low reproduction rates, effects on a relatively few individuals could result in a decreased capacity to maintain populations. For threatened or endangered species, or Trust species that may have special legal status due to cumulative environmental stresses throughout their ranges, exposures exceeding the LOAEL should be evaluated for risk management decisions.

The HQs calculated using the default model are provided in **Table 4.1-1**. All model input parameters and output calculations are provided in **Appendix G.** NOAEL HQs greater than 1.0 were calculated for one or more receptors for chromium, zinc, endrin aldehyde and 4,4'-DDE. NOAEL HQs greater than 1.0 were calculated for 4,4'-DDE for all receptors. Copper concentrations in the verification samples exceeded the 85 mg/kg benchmark which, for copper only, is used in lieu of the foodweb model.

Chromium risks based on the Grid 6 sample are expected to be over-predicted relative to the sitewide risk. The average concentration in the verification samples (109.3 mg/kg) was nearly double the 95% UCL (56.9 mg/kg) calculated in the Phase I/II ESA and was more representative of a maximum exposure than a 95% UCL exposure. Since the maximum HQ calculated was equal to 1.4 (clapper rail), no HQs greater than 1.0 would be calculated at the 95% UCL concentration and chromium is not considered further.

HQs were recalculated for the limiting receptor, or the receptor with the highest HQ, for zinc (clapper rail), endrin aldehyde (great-blue heron) and 4,4'-DDE (great blue heron) using the maximum detected concentration in the Grid 6 *Lumbriculus variegatus* samples (**Table 4.1-2**). HQs for the snail kite were calculated for copper, zinc and 4,4'-DDE using the maximum detected concentration in apple snails (Table 4.1-2).

Copper

Copper concentrations in the unscraped surface soils at the Frog Pond site significantly exceeded the 85 mg/kg benchmark that the USFWS and District have recently used to assess protection of the Everglades snail kite. Surface soil copper concentrations in the Grid 6 sample averaged 365 mg/kg and were representative of an expected worst-case copper concentration as measured by the Phase I/II ESA.

The maximum and average copper concentrations measured in Grid 6 apple snail tissues were used in the food-web model in place of the predicted tissue concentration. The model predicted a snail tissue concentration equal to 2,040 mg/kg (dry weight) based on a 95% UCL bioaccumulation factor (BAF) equal to 5.59. Based on the short-term bioaccumulation test results from this study, the model BAF appears to over-predict the concentration of copper in snail tissue by a large amount with the maximum measured tissue concentration equal to 426 mg/kg (dry weight) and an average tissue concentration of 325 mg/kg (dry weight). At the maximum tissue concentration, the BAF was equal to 1.2 and the BAF was equal to 0.9 at the average tissue concentration for the Grid 6 sample. The NOAEL HQ calculated using the maximum tissue concentration was equal to 1.2 while the HQ calculated using the average concentration was equal to 0.9.

This result suggests that snail kites feeding exclusively from an impoundment with existing Frog Pond soils would be exposed to copper concentrations approximately equal to the NOAEL. However, soil/sediment copper concentrations are substantially higher than the 85 mg/Kg

benchmark used by USFWS and the District. If the copper concentrations observed in the snail bioaccumulation tests represent the potential bioaccumulation in natural settings, then risk to the snail kites at the Frog Pond site would appear to be minimal, even if the snail fed exclusively on snails from permanent habitat at the site.

The degree to which the bioaccumulation test results represent actual conditions is critical to this conclusion. Other investigators have observed higher BAFs for apple snails exposed to copper in sediments. However, the BAFs appear to be inversely proportional to the concentration in sediments, with higher BAFs observed at lower sediment copper concentrations (Figure 4.1-1**)**. This trend was also observed by Frakes et al. (2008) in field collected snails which included apple snails, but also other snail species. When all available BAFs are plotted with respective test sediment concentrations, the BAFs observed in this study are consistent with other studies. USFWS is currently finalizing some longer-term bioaccumulation studies using apple snails, but results are not available at this time.

Zinc

The maximum detected concentration of zinc in worm tissues from the Grid 6 soil sample was 437 mg/kg which is higher than predicted by the default food web model (367 mg/kg). NOAEL and LOAEL HQs for the clapper rail using the laboratory tissue concentrations were equal to 1.6 and 1.2 respectively (**Table 4.1-2**).

While the maximum detected concentration of zinc in worm tissues may suggest an under-representation of exposure predicted by the food-web model, the average concentration of zinc detected in Grid 6 tissue samples was 409 mg/kg, or slightly greater than predicted by the food-web model.

The NOAEL TRV used in the default food-web model (14.49 mg/kg BW/day) was derived from Sample et al. (1996) and based on a poultry-feeding study which showed reproductive effects at 131 mg/kg BW/day. The large spread between the NOAEL and LOAEL TRVs in that study suggests that the NOAEL TRV may be low relative to the actual threshold of toxicity. USEPA recently completed a comprehensive literature review for zinc and compiled all available and relevant TRVs to calculate a soil screening level (USEPA 2007). While the soil screening level is not directly applicable to this risk assessment, the NOAEL TRV derived for bird receptors is directly relevant. The NOAEL TRV from the USEPA document (66.1 mg/kg BW day) is representative of the highest NOAEL TRV that is less than all LOAEL TRVs that were bounded by no-effect levels. In effect, the USEPA TRV is the highest TRV available that is still less than TRVs for which some ecologically significant effect has been observed and represents the best possible NOAEL TRV for use in this study. The USEPA TRV clearly indicates that the default TRV used in the food-web model is overly conservative.

When the tissue HQs were recalculated using the maximum tissue concentration but the USEPA TRV, the NOAEL HQ was equal to 0.34 indicating that risks to semi-aquatic avian wildlife from zinc were likely to be low even in the un-scraped soils.

It should be noted that the food-web model for inorganic COPCs uses sediment-food bioconcentration factors (BCFs) to estimate exposure, and the diet of the clapper rail is estimated to consist of a mixture of food types. The dominant food type ingested by the clapper rail is aquatic benthic invertebrate tissue (65%) thus the exposure estimate was directly affected by the use of site-specific tissue data. The exposure estimate from the remaining 35% of the diet of the clapper rail (aquatic vegetation, zooplankton and small fish) was not affected by the site-specific data. It is unknown whether the model over- or under-predicts exposure from these food types.

In order to predict the potential for risk to the Everglades snail kite, site-specific apple snail tissue concentrations from the Grid 6 soil sample were also used to calculate HQs. The maximum detected concentration (501 mg/kg) was considerably higher than the snail concentration predicted by the food-web model (367 mg/kg), but the average detected concentration (340 mg/kg) was close to the predicted concentration. The HQs calculated for the snail kite using the maximum detected snail tissue concentration were less than 1.0 when the USEPA NOAEL TRV was used in preference to the default NOAEL TRV.

4,4'-DDE

The default food-web model predicted NOAEL HQs greater than 1.0 for all receptors in unscraped soils for 4,4'-DDE. At 4% TOC content in soils, the fugacity-based model predicted benthic macroinvertebrate concentrations to be 543 µg/kg (wet weight). The model uses each successive trophic-level food item to predict the concentration in the next higher trophic level. As a result, even though the most sensitive receptor (great-blue heron) is estimated to ingest only 2% of its total diet as benthic invertebrates, those benthic invertebrates form the base of the foodchain from which the heron derives its entire diet. Therefore, site-specific measurements of benthic invertebrate tissue concentrations are directly relevant to providing a more accurate site-specific risk estimate for the heron receptor. While direct tissue measurements of fish species that make up the bulk of the heron diet would provide a more direct measure of exposure, bioaccumulation tests for the upper trophic level fish eaten by the heron were not practical given the long time frame necessary to conduct such tests. Insertion of the measured benthic invertebrate tissue concentrations into the food-web model and the model's use of those concentrations as the base of the food-web provide the best available estimation of upper trophic-level tissue concentrations.

The maximum detected 4,4'-DDE concentration in worm tissues (150 µg/kg wet weight) was more than four times lower than predicted by the fugacity model. The lower benthic invertebrate tissue concentrations resulted in lower tissue concentrations at all trophic levels and

subsequently lower HQs than were predicted using the default model. The great blue heron had a NOAEL HQ equal to 1.5 using the default model TRVs.

The NOAEL TRV used to calculate the HQs was derived from a study of American Kestrels (Lincer 1972) and is used as the default model NOAEL TRV (0.11 mg/kg BW/day). USEPA (2007) has recently completed a comprehensive review of TRVs available for DDT and its metabolites (including 4,4'-DDE). The result of that review is the identification of a NOAEL TRV of higher quality than the default value used in the model. USEPA has identified 0.227 mg/kg BW/day as the highest NOAEL TRV for growth, reproduction and mortality endpoints in birds that is lower than the lowest LOAEL for those endpoints. As such the USEPA value represents a better estimate of the NOAEL TRV.

Using the USEPA TRV, the site-specific benthic invertebrate tissue concentrations resulted in a NOAEL HQ equal to 0.72 indicating that risks to aquatic-feeding wildlife are predicted to be low in unscraped soils from 4,4'-DDE.

Using the apple snail tissue from the Grid 6 sample, HQs were also calculated for the Everglades snail kite. The default model predicted apple snail concentrations equal to 543 µg/kg (wet weight) while the maximum detected concentration of 4,4'-DDE in apple snail tissues was equal to 28 µg/kg (wet weight). The laboratory bioaccumulation test indicated a nearly 20-fold over-estimation of apple snail tissue concentrations by the default model. The resulting HQs for the snail kite were less than 1.0 using both the conservative default NOAEL TRV and the USEPA TRV. Since the snail kite receptor is assumed to eat only apple snails, the site-specific risk estimate is thought to be a reasonably accurate estimate of the potential exposure to the snail kite. Risks from 4,4'-DDE are, therefore, predicted to be low to the snail kite in the unscraped soils.

Endrin Aldehyde

The default food-web model predicted HQs slightly greater than 1.0 for several receptors, among which the great blue heron was the most sensitive. As discussed in the previous section for 4,4'-DDE, the maximum detected worm tissue concentration from the Grid 6 bioaccumulation sample was inserted into the model in place of the estimated benthic invertebrate tissue concentration. Endrin aldehyde was detected at a maximum concentration of 3 µg/kg (wet weight) which is significantly lower than the default prediction of 21 µg/kg. The resulting NOAEL HQ for endrin aldehyde was equal to 0.54 using the maximum tissue concentration (endrin TRVs used as a surrogate) indicating that risks to aquatic birds from exposure to endrin aldehyde at the Frog Pond are expected to be low following construction of a reservoir without prior scraping of soils.

4.1.2 Aquatic Community

Data presented in the Phase I/II ESA indicated that a number of COPCs were present at concentrations that exceeded the default SQAG values for benthic macroinvertebrates. The bulk samples collected at the Grid 6 location were generally representative of worst-case COPC concentrations within the Frog Pond footprint and would represent a conservative upper-bound estimate of soil concentrations within the footprint without corrective action prior to construction.

As discussed in Section 3.1.4, significantly reduced growth was noted for both *H. azteca* and *C. dilutus* when exposed to soils collected from Grid 6. Significant effects were observed both with unacclimated soils and with sediments acclimated prior to initiation of the test.

Similarly, significantly reduced survival was observed in *H. azteca* in both acclimated and unacclimated soil/sediment and in *C. dilutus* in unacclimated soils. Survival of *H.* azteca was 3.8% and 15% for the unacclimated and acclimated soils respectively.

The full toxicity report is presented in Appendix F and indicates that test conditions were adequate to support both species and that the effects observed in Grid 6 samples were likely due to COPCs within the samples.

These results indicate that COPCs present at upper bound concentrations within the Frog Pond could have a significant effect on the development of an aquatic community without corrective action prior to project construction. Significant reductions in the survival and growth of benthic macroinvertebrates could limit production of a self-sustaining aquatic food-web within the Frog Pond.

4.2 Scraping Option

The Pilot study conducted on 5-acres of the Frog Pond site clearly indicated that copper and zinc concentrations and mass could be reduced using a technique by which the large majority of soils are scraped from the surface of the cap rock. Complete removal of the soils is not, however, practical, and a thin veneer of soils is expected to remain on a portion of the site following scraping. Thicker soils are also expected to be present within solution cavities covering an estimated 11% of the site.

Soils that remained following scraping were shown to have reduced concentrations of copper and zinc relative to the pre-scraping soils, but with concentrations that still exceeded risk-based benchmarks. Subsequent investigations have indicated that the depth of soil contamination of copper is confined to the top 1 inch of soil with large decreases in copper concentrations at depth.

The following sections discuss the potential for ecological risk by discussing the results of bioaccumulation and toxicity data from two samples collected within the Pilot Study area. These samples were collected from locations representative of copper concentrations slightly greater than the 85 mg/kg benchmark and from areas of higher copper concentration. Only copper and zinc are discussed below because the Pilot Study was located in an area which contained only copper and zinc above risk-based benchmarks. Detectable concentrations of OCPs were not observed in the Pilot Study soil samples collected prior to scraping.

4.2.1 Aquatic-Feeding Wildlife

Two bulk soil samples were collected from the Pilot Study area and submitted to the NewFields laboratory for acclimation. Following the acclimation procedure, the samples were shipped to HBOI in order to complete the 28-day bioaccumulation test for the Florida apple snail.

Average concentrations of copper and zinc were lowest in the CS-10 sample collected from the Frog Pond (97.0 mg/kg and 60.3 mg/kg) and highest in the CS-8 sample (140 mg/kg and 95.7 mg/kg).

Zinc

HQs for the Everglades snail kite were first calculated using the default food-web model for zinc. The NOAEL HQ at both locations were less than 1.0. Similarly, HQs using the maximum detected concentration of zinc in apple snail tissues resulted in HQs less than 1.0 for both samples (Table 4.2-1).

Copper

Copper concentrations in both samples exceeded the 85 mg/kg benchmark for the protection of the Everglades snail kite. The default model uses the upper-bound BAF to estimate apple snail concentrations. Dry weight apple snail concentrations averaged 70.2 mg/kg with a maximum concentration of 90.8 mg/kg in the CS-10 sample. In the CS-8 sample, snail tissue concentrations averaged 121 mg/kg with a maximum of 134 mg/kg.

The interim benchmark was calculated assuming a BAF equal to 5.59. Using the average concentrations from the three verification samples collected from the bulk samples in the Pilot Study areas, the default food-web model predicted apple snail concentrations equal to 539 mg/kg and 778 mg/kg from the CS-10 and CS-8 samples respectively (Table 4.2-1) These results suggest that accumulation of copper in apple snail tissues may be overestimated using the default model and the interim benchmark may be lower than necessary in order to be protective of the snail kite. Based on the apple snail tissue data collected for this study, no risks to the Everglades snail kite are predicted at concentrations observed following scraping in the Pilot Study area.

4.2.2 Aquatic Community

As discussed in Section 3.1.4, no statistically significant effects on growth or survival were noted in either bulk soil sample for *H. azteca* or *C. dilutus*. These results suggest that no unacceptable risks are predicted following construction of the Frog Pond reservoir if soils are scraped prior to construction.

4.2.3 Area-Weighted Calculation of Copper UCL

If soil scraping is selected as a corrective action at the Frog Pond site, it is anticipated that a portion of the area will contain a thin layer of soils with copper concentrations that exceed the 85 mg/kg benchmark. Based on the investigations discussed above, it appears that copper is present at elevated concentrations in only the top 1 inch of soil and below that depth soil concentrations approach background levels (Table 3.2-4).

Additional data indicate that on average only 61% of the scraped area is covered with soil of any depth. Shallow soils cover approximately 50% of the area to a depth of less than 1 inch with 11% of the area containing deeper solution cavities. An estimated 39% of the total area is currently bare rock.

Pilot Study area sample results for copper collected from the 0 – 1 inch depth interval following scraping are shown in **Table 4.2-2**. The 95% UCL of these soils was equal to 106.1 mg/kg with an average concentration of 92.8 mg/kg. If it is assumed that 61% of the post-scraping area contains soils with copper concentrations equal to 106.1 mg/kg and that the remainder of the area does not contain soil (no copper is available), then a simple area-weighted calculation of copper concentrations results in an estimated 64.7 mg/kg (95% UCL = (106.1 mg/kg * 0.61) + (0 mg/kg * 0.39) that is representative of the 95% UCL exposure concentration following soil scraping. This estimate of the area-weighted concentration is expected to be conservative. Soils deeper than 1 inch are present in 11% of the area. The soil interval of most interest is the 0 – 6 inch zone where average soil concentrations are expected to be much lower than the 0 – 1 inch interval concentration assumed over the areas with deeper soils. Additionally, until sufficient sedimentation has occurred in the reservoir, the ability of the thin veneer of soils to support emergent plant life required by the apple snail is questionable. It is likely that emergent vegetation will develop initially only within the deeper pockets of soils where concentrations (on average) are much lower than the thin veneer.

These data indicate that scraping of soils is likely to reduce upper bound average concentrations to below even the 85 mg/kg on an area-weighted basis. If soil scraping is completed at the Frog Pond, confirmation samples of both the thin layer of soils remaining and the deeper pockets of soil, as well as an estimate of the area covered by each, should be collected prior to construction.

Copper mass is also significantly reduced via scraping. The Pilot Study indicated that by mass, approximately 93% of copper was removed via scraping. The data collected as part of this study indicate that the mass of copper removed is likely to be greater than 93% since the Pilot Study assumed that copper was present in equal concentrations in the deeper pockets of soil.

5.0 SUMMARY AND CONCLUSIONS

The Frog Pond site is intended to be a 'leaky reservoir', designed to reduce the migration of groundwater away from the Everglades and from Taylor Slough. This will be accomplished by creating a groundwater mound between the Everglades and the C-111 canal by placing water into the reservoir when it is available.

Analysis of soils at the site indicated that a number of agrochemicals were present at concentrations that exceeded screening level benchmarks and corrective action was potentially needed prior to construction of the project.

The District conducted a Pilot Study to test the effectiveness of complete soil removal as a possible corrective action. Results of the Pilot Study indicated that where soils were scraped from the limestone cap rock, the mass of copper and zinc in the study area was greatly reduced, but concentrations in the remaining soils were still greater than risk-based benchmarks, particularly for copper.

This study was designed to address potential risk issues at the site should soil scraping be chosen as the preferred corrective action at the site. The study addressed questions about potential changes in COPEC concentrations in surface water and sediment with time given repeated inundation cycles, the toxicity of the sediments to aquatic invertebrates, and the potential for COPECs to bioaccumulate in the system to potentially problematic levels following soil scraping.

Surface Water and Sediment Concentrations

Based on the data collected during the soil acclimation studies, bioavailable metal concentrations, particularly copper and zinc, are expected to be reduced with repeatedflooding and filling cycle until the bulk of the metals that are weakly adhered to and readily soluble from soil particles are flushed from the system.

Under the water residence times and water:soil ratios used in these tests, results show that copper concentrations in overlying water may exceed chronic WQSs for most highly affected soils upon initial flooding event(s). Copper concentrations in surface water overlying soils collected from the Pilot Study area exceeded water quality criteria in the initial flooding event but concentrations were significantly reduced in subsequent events.

The water:soil ratios and residence times were intended to represent an overall overestimate of the actual exposures expected at the Frog Pond site, based on preliminary design and operation information from the BODR. These conditions include water standing in pools over soils for up to four weeks.

Copper concentrations in surface water should be monitored following the completion of construction at the site. Sediment concentrations followed a similar trend as concentrations dropped with successive flooding events as the soluble metals were flushed from the system.

Sediment Toxicity

Statistically significant toxic effects were noted for both *H. azteca* and *C. dilutus* when exposed to soils collected from Grid 6, the sample with the highest chemical concentrations. Significant effects were observed both with unacclimated soils and with sediments acclimated prior to initiation of the test. Growth and survival for both species were reduced relative to controls when exposed to soils/sediments from the Grid 6 sample which was representative of a worst-case scenario should no corrective actions be completed prior to construction of the project. Concentrations of barium, chromium, zinc, 4,4'-DDT, endrin aldehyde and chlordane exceeded their respective TECs, while copper and 4,4'-DDE exceeded PEC-SQAGs.

Toxicity tests conducted on soils from the two samples collected within the Pilot Study area showed no significant effects in either growth or mortality for either species. COPC concentrations in these soils were substantially lower than for Grid 6, in which only copper exceeded the TEC in the two samples.

Bioaccumulation Testing

Residual agro-chemical concentrations in the Frog Pond soils contain COPCs at concentrations that could cause unacceptable effects to wildlife receptors that may reside in habitat created following the construction of the 'leaky reservoir' planned at the site based on available screening-level risk assessment models.

Site-specific bioaccumulation tests conducted for up 28 days indicated that even from areas where soil was not removed via scraping, risks to aquatic-feeding birds were low. Bioaccumulation tests on two species conducted using standard USEPA and ASTM approaches indicated that the model may over-predict the potential for bioaccumulation. Soil copper concentrations more than four times greater than the 85 mg/kg benchmark resulted in tissue concentrations that were approximately equal to a NOAEL dose for the snail kite.

Soils in the Pilot Study area similarly exceeded the 85 mg/kg benchmark for copper even following the soil scraping. Tests conducted with apple snails indicated that the 85 mg/kg benchmark may be lower than required to provide adequate protection to the snail kite at this site. Site-specific BAFs calculated using these data are consistent with concentration-dependant BAFs from other studies conducted using apple snails and soils from south Florida agricultural areas. The BAFs were generally lower than those identified from a study with field-collected snails (not apple snails) sediments in a pond within the Everglades Agricultural Area (Frakes et al. 2008). USFWS is currently finalizing some longer-term bioaccumulation studies using apple snails, but results are not available at this time.

Additional Lines-of-Evidence

The removal of site-soils via scraping appears to be a viable corrective action alternative for reducing risk to aquatic-feeding birds. Soil scraping reduced copper and zinc concentrations within the 5-acre Pilot Study area and reduced the mass of copper present in site soils by 93% or more. Area-weighted surface soil concentrations (0 – 1 inch) were calculated based on the detailed delineation of soil coverage and soil depth. The area-weighted copper concentration following scraping was less than the 85 mg/kg benchmark indicating that average exposure is expected to be less than the benchmark following scraping. In addition, scraping removes a substantial amount of COPC mass from the reservoir footprint and reduces the area covered by affected soils, replacing it with bare rock surface.

The extent and quality of habitat that may be created following construction of the reservoir is also unknown. Final construction designs are not yet available, but preliminary designs indicated that the reservoir may be dry for much of the year. The BODR indicated that high infiltration rates through the limestone cap-rock were expected and that this would result in much of the reservoir being dry for significant periods of time. Prolonged dry periods may preclude or diminish the development of a wetland habitat and will almost certainly limit the species that may be present in the area to those that can withstand long periods of low or no water conditions. Fish populations would not be expected under those conditions indicating that bioaccumulation to upper trophic level receptors such as smallmouth bass or other predatory fish would be diminished, thereby reducing the potential exposure to fish-eating wildlife.. Recent revisions to the project design suggest that water may be held within the reservoir for longer periods than estimated in the BODR, but prolonged periods without water are still expected. The successful development of a healthy apple snail population under such conditions is also diminished. The ERA assumes that snail kites feed 100% of the time within the area of concern. Without a healthy population of apple snails, the potential for this significant exposure of snail kites to copper in snails is significantly lower.

Longer periods of inundation would increase the chances of significant development of aquatic habitat and ecological community. Increased areal extent and persistence of habitat would increase the potential that wildlife could feed significantly at the site, and the potential for exposure to COPCs if concentrations in residual soils remain high enough. The extent of habitat cannot be predicted with certainty, and management of the site to minimize habitat development is possible. Such management actions have been adopted for design of other reservoirs in south Florida.

Recommendations

Based on the current conditions at the Frog Pond, soil scraping is recommended to reduce the mass and concentration of copper in the agricultural soils. This soil removal is expected to be adequate to reduce risk to the Everglades snail kite, benthic macroinvertebrates and other

aquatic-feeding birds that may inhabit any habitat created by the construction of a leaky reservoir at the site.

Revised engineering designs indicate that the footprint of the Frog Pond project is smaller than originally considered in the ESA (Figure 5.0-1). Much of the revised footprint lies outside of the footprint investigated in the ESA but does include the Pilot Study area. Additional characterization of soils is being conducted on the revised footprint. These data are not expected to differ significantly from the data collected in the original footprint. However, once they are available, the new data should be reviewed in relation to the data presented in this document to determine if the conclusions reached are applicable to the actual footprint of the Frog Pond project.

Collection of post-scraping confirmation samples within the project footprint is also suggested to assess the effectiveness of soil removal. Plans should also be developed to address potential ecological risk issues should the confirmation sampling indicate that soil scraping does not result in soil concentrations to levels similar to those observed in the pilot study. This could include additional monitoring for the presence of Florida apple snail populations, tissue copper concentrations and/or provisions for adaptive management of the reservoir.

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Tables

Table 2.1-1
Verification Sample Results

Sample	Analyte	Verification Results						
		Rep 1	Qual	Rep 2	Qual	Rep 3	Qual	Average
CS-8	Copper (mg/kg)	147	---	133	---	140	---	140
	Zinc (mg/kg)	102	---	91	---	94	---	95.7
CS-10	Copper (mg/kg)	97	---	95	---	99	---	97.0
	Zinc (mg/kg)	59	---	59	---	63	---	60.3
Grid 6	Barium (mg/kg)	33	---	34	---	29	---	32.0
	Cadmium (mg/kg)	N/A	---	N/A	---	N/A	---	N/A
	Chromium (mg/kg)	116	---	111	---	101	---	109.3
	Copper (mg/kg)	384	---	375	---	337	---	365.3
	Zinc (mg/kg)	207	---	190	---	172	---	189.7
	4,4'-DDD (µg/kg)	2.5	J	2.8	J	2.8	J	2.7
	4,4'-DDE (µg/kg)	77	---	89	---	81	---	82.3
	4,4'-DDT (µg/kg)	9	---	11	---	9.8	---	9.9
	Aldrin (µg/kg)	0.24	U	0.24	U	0.24	U	0.24
	Dieldrin (µg/kg)	0.85	I	1.1	I	1	I	0.98
	a-BHC (µg/kg)	0.2	U	0.2	U	0.2	U	0.2
	b-BHC (µg/kg)	0.3	U	0.3	U	0.3	U	0.3
	g-BHC (µg/kg)	0.66	U	0.66	U	0.66	U	0.66
	d-BHC (µg/kg)	0.16	U	0.16	U	0.16	U	0.16
	Endosulfan (alpha + beta + sulfate) (µg/kg)	N/A	N/A	N/A	---	N/A	---	N/A
	Endosulfan I (µg/kg)	1.8	I	2.1	---	2.1	---	2.0
	Endosulfan II (µg/kg)	4.6	J	5.5	J	4.9	J	5.0
	Endosulfan sulfate (µg/kg)	14	---	18	---	16	---	16.0
	Endrin (µg/kg)	0.23	U	0.23	U	0.23	U	0.23
	Endrin aldehyde (µg/kg)	15	J	19	J	19	J	17.7
	Endrin ketone (µg/kg)	0.35	U	0.35	U	0.35	U	0.35
	a-chlordane (µg/kg)	5.6	---	6.7	---	6.2	---	6.2
	g-chlordane (µg/kg)	3.9	J	4.8	J	4.5	J	4.4
	total chlordane (µg/kg)	9.5	---	11.5	---	10.7	---	10.6
	Heptachlor (µg/kg)	0.52	U	0.52	U	0.52	U	0.52
	Heptachlor epoxide (µg/kg)	1.3	I	1.1	I	1.4	I	1.3
	Methoxychlor (µg/kg)	0.18	U	0.18	U	0.18	U	0.18
	Toxaphene (µg/kg)	19	U	19	U	19	U	19

N/A: Not Analyzed
U: Result qualified as a non-detect (result below MDL)
J: Result estimated
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)

Table 2.1-2
Analytical Methods

Analyte	Analytical Method		
	Water	Sediment	Tissue
Metals (Ba, Cd, Cr, Cu, Zn)	EPA 200.8 ICP-MS	EPA 3050B/6020 ICP-MS	EPA 200.8/EPA 6010B ICP-MS/ICP-OES
Organochlorine Pesticides	EPA 3510C/EPA 8081A GC-ECD	EPA 3550/EPA 8081A GC-ECD	EPA 3540C/ EPA 8081 A GC-ECD
Lipids Content	---	---	EPA 3540
Total Organic Carbon	EPA 415.1	EPA 9060 M	---
Total Dissolved Solids	EPA 160.1	---	---
Total Solids	---	EPA 160.3 MOD	Freeze Dry/Oven Dry

Table 3.1-1
Comparison of Verification Sample Results and Post-Scraping Confirmation Results

		SQAG		Confirmation Samples		Verification Results				
Sample	Analyte	TEC	PEC	Result	SQAG Exceedance	Replicate 1	Replicate 2	Replicate 3	Average	SQAG Exceedance
CS-8	Copper (mg/kg)	32	150	85	TEC	147	133	140	140	TEC
	Zinc (mg/kg)	120	460	135	TEC	102	91	94	95.7	None
CS-10	Copper (mg/kg)	32	150	239	PEC	97	95	99	97.0	TEC
	Zinc (mg/kg)	120	460	179	TEC	59	59	63	60.3	None
Grid 6	Barium (mg/kg)	20	60	28	TEC	33	34	29	32.0	TEC
	Cadmium (mg/kg)	0.99	4.98	1.4	TEC	N/A	N/A	N/A	N/A	---
	Chromium (mg/kg)	43.4	111	100	TEC	116	111	101	109.3	TEC
	Copper (mg/kg)	32	150	320	PEC	384	375	337	365.3	PEC
	Zinc (mg/kg)	120	460	160	TEC	207	190	172	189.7	TEC
	4,4'-DDD (µg/kg)	4.90	28	<0.52	None	2.5 J	2.8 J	2.8 J	2.7	None
	4,4'-DDE (µg/kg)	3.20	31	54	PEC	77	89	81	82.3	PEC
	4,4'-DDT (µg/kg)	4.20	63	11	TEC	9	11	9.8	9.9	TEC
	Aldrin (µg/kg)	N/V	N/V	<0.24	---	0.24 U	0.24 U	0.24 U	0.24 U	---
	Dieldrin (µg/kg)	1.90	62	<0.31	None	0.85 I	1.1 I	1 I	0.98	None
	a-BHC (µg/kg)	N/V	N/V	<0.21	---	0.2 U	0.2 U	0.2 U	0.2 U	---
	b-BHC (µg/kg)	N/V	N/V	<0.31	---	0.3 U	0.3 U	0.3 U	0.3 U	---
	g-BHC (µg/kg)	2.40	5.0	1.5	None	0.66 U	0.66 U	0.66 U	0.66 U	None
	d-BHC (µg/kg)	N/V	N/V	7.4	---	0.16 U	0.16 U	0.16 U	0.16 U	---
	Endosulfan (alpha + beta + sulfate) (µg/kg)	N/V	N/V	107.5	---	N/A	N/A	N/A	N/A	---
	Endosulfan I (µg/kg)	N/V	N/V	N/A	---	1.8 I	2.1	2.1	2.0	---
	Endosulfan II (µg/kg)	N/V	N/V	N/A	---	4.6 J	5.5 J	4.9 J	5.0	---
	Endosulfan sulfate (µg/kg)	N/V	N/V	N/A	---	14	18	16	16.0	---
	Endrin (µg/kg)	2.20	210	N/A	---	0.23 U	0.23 U	0.23 U	0.23 U	None
	Endrin aldehyde (µg/kg)	2.20	210	N/A	---	15 J	19 J	19 J	17.7	TEC
	Endrin ketone (µg/kg)	2.20	210	N/A	---	0.35 U	0.35 U	0.35 U	0.35 U	None
	a-chlordane (µg/kg)	N/V	N/V	2.9	---	5.6	6.7	6.2	6.2	---
	g-chlordane (µg/kg)	N/V	N/V	4	---	3.9 J	4.8 J	4.5 J	4.4	---
	total chlordane (µg/kg)	3.20	18	6.9	TEC	9.5	11.5	10.7	10.6	TEC
	Heptachlor (µg/kg)	N/V	N/V	N/A	---	0.52 U	0.52 U	0.52 U	0.52 U	---
	Heptachlor epoxide (µg/kg)	2.5	16	<0.19	None	1.3 I	1.1 I	1.4 I	1.3	None
	Methoxychlor (µg/kg)	N/V	N/V	N/A	---	0.18 U	0.18 U	0.18 U	0.18 U	---
	Toxaphene (µg/kg)	0.1	32	N/A	---	19 U	19 U	19 U	19 U	---

N/A: Not Analyzed
N/V: No Value
U: Result qualified as a non-detect (result below MDL)
J: Result estimated
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)
SQAG (Sediment Quality Assessment Guidelines) Exceedances are different between confirmation and verification sample results.
SQAGs obtained from MacDonald et al., 2003.
Results presented on dry weight basis.
Note: CS-8 and CS-10 confirmation samples collected after soil scraping.
Grid 6 confirmation sample collected as part of the Limited Phase II Environmental Site Assessment (URS, 2006).

Table 3.1-2
Sediment Sample Results: Acclimation Phase

Analyte	Days after Acclimation Phase Initiation						SQAG Exceedance at End of Acclimation
	1		7		37		
	Result	Qual	Result	Qual	Result	Qual	
CS-8							
Copper (mg/kg)	133	---	94	---	79	---	TEC
Zinc (mg/kg)	104	---	73	---	66	---	None
Total Organic Carbon (mg/kg)	1200	---	3600	---	3100	---	---
CS-10							
Copper (mg/kg)	81	---	41	---	63	---	TEC
Zinc (mg/kg)	52	---	29	---	43	---	None
Total Organic Carbon (mg/kg)	1300	---	4200	---	3900	---	---
Grid 6							
Barium (mg/kg)	39	---	30	---	24	---	TEC
Cadmium (mg/kg)	2.2	---	1.6	---	0.72	I	None
Chromium (mg/kg)	128	---	102	---	80	---	TEC
Copper (mg/kg)	327	---	263	---	225	---	PEC
Zinc (mg/kg)	199	---	167	---	132	---	TEC
4,4'-DDD (µg/kg)	0.58	U	0.46	U	0.6	U	None
4,4'-DDE (µg/kg)	17	---	20	J	20	---	TEC
4,4'-DDT (µg/kg)	5.1	---	3.7	J	3.9	---	None
a-BHC (µg/kg)	0.23	U	0.18	U	0.24	U	---
a-Chlordane (µg/kg)	0.18	U	0.14	U	0.19	U	---
Aldrin (µg/kg)	0.27	U	0.21	U	0.28	U	---
b-BHC (µg/kg)	0.34	U	0.27	UJ	0.35	U	---
d-BHC (µg/kg)	0.18	U	0.14	U	0.19	U	---
Dieldrin (µg/kg)	0.34	U	0.97	I	0.35	U	None
Endosulfan I (µg/kg)	0.22	U	0.9	I	0.77	I	---
Endosulfan II (µg/kg)	0.27	U	2.9	---	0.28	U	---
Endosulfan sulfate (µg/kg)	7.2	J	7.6	---	3.9	J	---
Endrin (µg/kg)	0.25	U	0.2	U	0.26	U	None
Endrin aldehyde (µg/kg)	0.25	U	0.2	U	0.26	U	None
Endrin ketone (µg/kg)	0.39	UJ	0.31	UJ	0.4	U	None
g-BHC (µg/kg)	0.74	U	0.59	U	0.77	U	None
g-Chlordane (µg/kg)	0.91	U	0.73	U	0.95	U	---
Heptachlor (µg/kg)	0.59	U	0.47	U	0.61	U	None
Heptachlor epoxide (µg/kg)	0.2	U	0.8	I	0.21	U	---
Methoxychlor (µg/kg)	0.2	U	0.16	U	0.21	U	---
Toxaphene (µg/kg)	22	U	17	U	22	U	None
Total Chlordane (µg/kg)	1.09	U	0.87	U	1.14	U	None
Total Organic Carbon (mg/kg)	550	---	1800	---	2300	---	---

U: Result qualified as a non-detect (result below MDL)
J: Result estimated
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)
Results presented on a dry weight basis.

Table 3.1-3
Water Quality Parameter Results: Acclimation Phase

Sediment	Water Quality Parameter	Sample Date							
		4/17/2008	4/21/2008	4/22/2008	4/25/2008	4/27/2008	4/30/2008	5/2/2008	5/5/2008
CS-10	Alkalinity (mg/L as $CaCO_3$)	---	---	---	172	193	153	113	151
	Conductivity (µS/cm)	2465	652	622	369	395	340	399	325
	Dissolved Oxygen (mg/L)	7.4	7.3	7.9	7.9	7.6	7	8	7.6
	Hardness (mg/L as $CaCO_3$)	---	---	---	184	180	135	184	134
	pH (SU)	7.4	7.7	8.1	8.2	8.1	7.8	8.1	7.7
	Temperature (°C)	25.6	25.1	24.3	23.5	24.6	25.7	24.7	25.2
	Total NH_3 (mg/L)	0.1	0.1	0	0	0	0	0	0
CS-8	Alkalinity (mg/L as $CaCO_3$)	---	---	---	204	217	153	123	190
	Conductivity (µS/cm)	577	645	636	406	478	323	382	351
	Dissolved Oxygen (mg/L)	6.6	6.8	7.7	7.1	6.9	7.5	7.3	6.9
	Hardness (mg/L as $CaCO_3$)	---	---	---	220	222	140	196	142
	pH (SU)	7.6	7.9	7.9	7.9	8.1	8.1	7.9	7.9
	Temperature (°C)	25.8	25.6	24	24.2	24.4	25.4	25.9	25.9
	Total NH_3 (mg/L)	0.3	0.09	0	0	0	0	0	0
Grid 6	Alkalinity (mg/L as $CaCO_3$)	---	---	---	282	347	180	140	182
	Conductivity (µS/cm)	606	2258	2206	563	717	425	759	420
	Dissolved Oxygen (mg/L)	7.1	7.3	7.7	8.1	7.6	7.5	8.2	7.7
	Hardness (mg/L as $CaCO_3$)	---	---	---	148	156	127	160	136
	pH (SU)	7.6	7.9	7.7	7.9	8	8	8.1	8
	Temperature (°C)	25.3	25	24.4	24.6	25.2	25.9	25.3	25.1
	Total NH_3 (mg/L)	0.08	0.07	0	0	0	0.1	0.06	0

Table 3.1-3
Water Quality Parameter Results: Acclimation Phase

Sediment	Water Quality Parameter	Sample Date								
		5/7/2008	5/9/2008	5/12/2008	5/14/2008	5/16/2008	5/19/2008	5/22/2008	5/28/2008	6/2/2008
CS-10	Alkalinity (mg/L as $CaCO_3$)	194	204	216	106	131	172	204	175	212
	Conductivity (µS/cm)	346	359	390	319	339	343	346	360	375
	Dissolved Oxygen (mg/L)	7.5	7.7	7.4	7.1	7.4	7.5	6.5	6.4	6
	Hardness (mg/L as $CaCO_3$)	157	112	130	140	120	158	136	148	136
	pH (SU)	7.8	8.2	7.8	8	7.9	8	7.9	7.8	7.5
	Temperature (°C)	25.9	24.5	24.7	25.7	18.9	24.9	24.7	25.8	24.5
	Total NH_3 (mg/L)	0.04	0	0	0.03	0	0	0	0	0
CS-8	Alkalinity (mg/L as $CaCO_3$)	188	234	222	144	125	196	216	190	224
	Conductivity (µS/cm)	379	423	441	317	346	363	379	352	387
	Dissolved Oxygen (mg/L)	7.1	7.1	6.5	7.9	6.9	7.3	6.3	6.6	5.8
	Hardness (mg/L as $CaCO_3$)	153	128	172	152	148	161	144	164	200
	pH (SU)	8	8	8	7.9	7.9	7.9	8	7.7	7.9
	Temperature (°C)	26.3	25.2	25.1	25.9	19.2	26.1	25.3	26.1	25
	Total NH_3 (mg/L)	0.04	0	0	0.02	0	0	0	0	0
Grid 6	Alkalinity (mg/L as $CaCO_3$)	200	260	260	157	175	196	232	190	224
	Conductivity (µS/cm)	391	412	473	345	406	439	431	364	491
	Dissolved Oxygen (mg/L)	8	8.2	7.7	7.8	8.9	7.6	6.7	7.2	6.4
	Hardness (mg/L as $CaCO_3$)	138	138	151	148	120	148	160	164	188
	pH (SU)	8.1	8.1	8.2	8.1	8.1	8	8.2	7.7	7.9
	Temperature (°C)	26	25.4	24.9	26.1	19.2	25.6	25.6	25.9	25.3
	Total NH_3 (mg/L)	0.08	0.8	0	0.02	0	0	0	0	0

Table 3.1-4
Overlying Water Results: Acclimation Phase

Analyte	Water Quality Criteria Acute (µg/L)	Water Quality Criteria Chronic (µg/L)	Days after Acclimation Phase Initiation: 1 Result	1 Qual	7 Result	7 Qual	12 Result	12 Qual	17 Result	17 Qual	27 Result	27 Qual	37 Result	37 Qual	48 Result	48 Qual
CS-8 (Average Hardness 167 mg/L as $CaCO_3$)																
Total Copper (µg/L)	N/V	N/V	13.0	---	18.0	---	12.0	---	7.7	---	10.0	---	7.5	---	7.9	---
Dissolved Copper (µg/L)	21.8	13.9	9.2	---	**16.0**	---	12.0	---	7.4	---	8.5	---	7.3	---	7.5	---
Total Zinc (µg/L)	N/V	N/V	5.2	I	6.9	I	4	U	4	U	4	U	4	U	4	U
Dissolved Zinc (µg/L)	181	182	13	---	5.9	I	4	U	4	U	15	---	118	---	9	I
Total Dissolved Solids (mg/L)	N/V	N/V	310	---	350	---	280	---	240	---	260	---	250	---	240	---
Total Organic Carbon (mg/L)	N/V	N/V	3.6	---	6.8	---	3.7	---	2.8	---	2.8	---	2.3	---	2.1	---
CS-10 (Average Hardness 147 mg/L as $CaCO_3$)																
Total Copper (µg/L)	N/V	N/V	7.4	---	9.6	---	5.6	---	4.1	---	4.8	---	4.4	---	4.6	---
Dissolved Copper (µg/L)	19.3	12.4	4.7	---	9	---	5.7	---	3.8	---	4.8	---	4	---	4.2	---
Total Zinc (µg/L)	N/V	N/V	4	U	4	U	4	U	4	U	4	U	4	U	4	U
Dissolved Zinc (µg/L)	162	164	4	U	4	U	4	U	4	U	4	U	4.4	I	4	U
Total Dissolved Solids (mg/L)	N/V	N/V	310	---	350	---	260	---	230	---	240	---	240	---	230	---
Total Organic Carbon (mg/L)	N/V	N/V	3	---	4.9	---	2.4	---	2	---	2.3	---	2.4	---	1.7	---
Grid 6 (Average Hardness 149 mg/L as $CaCO_3$)																
Total Barium (µg/L)	N/V	N/V	12	---	21	---	7.6	---	5.7	---	5.5	---	5	---	4.7	---
Dissolved Barium (µg/L)	N/V	N/V	12	---	21	---	7.8	---	5	---	6.2	---	4.7	---	5.1	---
Total Cadmium (µg/L)	N/V	N/V	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Dissolved Cadmium (µg/L)	2.97	0.32	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Total Chromium (µg/L)	N/V	N/V	1.1	I	1.5	I	2	---	3	---	3.1	---	2.3	---	2.4	---
Dissolved Chromium (µg/L)	790	103	1.1	I	1.6	I	1.9	I	1.5	I	2.6	---	2.1	---	2.2	---
Total Copper (µg/L)	N/V	N/V	16	---	27	---	19	---	15	---	16	---	16	---	16	---
Dissolved Copper (µg/L)	19.6	12.6	**15**	---	**25**	---	**19**	---	12	---	**16**	---	**15**	---	**15**	
Total Zinc (µg/L)	N/V	N/V	4.9	I	4	U	4.7	I	4.3	I	4	U	4	U	4	U
Dissolved Zinc (µg/L)	164	166	6.1	I	4	U	4	U	4	U	4	U	4.7	I	4	U
Total Dissolved Solids (mg/L)	N/V	N/V	1200	---	1900	---	690	---	410	---	410	---	330	---	300	---
Total Organic Carbon (mg/L)	N/V	N/V	2.7	---	5.3	---	2.9	---	2.1	---	2.9	---	3.5	---	2.3	---
4,4'-DDD (µg/L)	N/V	N/V	0.008	U	0.02	U	0.009	U	0.01	U	0.01	U	0.01	U	0.01	U
4,4'-DDE (µg/L)	N/V	N/V	0.009	U	0.02	UJ	0.009	U	0.01	U	0.01	U	0.01	U	0.01	U
4,4'-DDT (µg/L)	N/V	0.59	0.01	U	0.03	U	0.3	---	0.02	U	0.02	U	0.02	U	0.02	U
a-BHC (µg/L)	N/V	N/V	0.008	U	0.02	U	0.009	U	0.01	U	0.01	U	0.01	U	0.01	U
a-Chlordane (µg/L)	N/V	N/V	0.007	U	0.01	U	0.007	U	0.01	U	0.01	U	0.01	U	0.01	U
Aldrin (µg/L)	N/V	0.14	0.007	U	0.01	U	0.008	U	0.01	U	0.01	U	0.01	U	0.01	U
b-BHC (µg/L)	N/V	46	0.009	U	0.02	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
d-BHC (µg/L)	N/V	N/V	0.01	U	0.02	U	0.01	U	0.02	U	0.02	U	0.02	U	0.02	U
Dieldrin (µg/L)	N/V	0.14	0.008	U	0.02	U	0.008	U	0.01	U	0.01	U	0.01	U	0.01	U
Endosulfan I (µg/L)	N/V	N/V	0.009	U	0.02	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Endosulfan II (µg/L)	N/V	N/V	0.007	U	0.01	U	0.007	U	0.009	U	0.01	U	0.01	U	0.01	U
Endosulfan sulfate (µg/L)	N/V	N/V	0.01	U	0.04	---	0.01	U	0.02	I	0.01	U	0.03	---	0.01	U
Endrin (µg/L)	N/V	2.3	0.01	U	0.02	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Endrin aldehyde (µg/L)	N/V	N/V	0.009	U	0.02	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Endrin ketone (µg/L)	N/V	N/V	0.006	UJ	0.01	UJ	0.006	UJ	0.008	U	0.008	U	0.008	U	0.008	U
g-BHC (µg/L)	N/V	63	0.009	U	0.02	U	0.009	U	0.01	U	0.01	UJ	0.01	U	0.01	U
g-Chlordane (µg/L)	N/V	N/V	0.008	U	0.02	U	0.008	U	0.01	U	0.01	U	0.01	U	0.01	U
Heptachlor (µg/L)	N/V	0.21	0.01	U	0.02	U	0.01	U	0.01	U	0.02	U	0.02	U	0.02	U
Heptachlor epoxide (µg/L)	N/V	N/V	0.008	U	0.02	U	0.009	U	0.01	UJ	0.01	U	0.01	U	0.01	U
Methoxychlor (µg/L)	N/V	30	0.01	U	0.02	U	0.01	U	0.02	U	0.02	U	0.02	U	0.02	U
Toxaphene (µg/L)	N/V	0.2	0.53	U	0.97	U	0.56	U	0.73	U	0.74	U	0.74	U	0.75	U

N/V: No Value
U: Result qualified as a non-detect (result below MDL)
J: Result estimated
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)
BOLD and HIGHLIGHTED: Result > Acute WQS
BOLD: Result > Chronic WQS
State of Florida Surface Water Quality Criteria from Chapt. 62-302.530, Criteria for Surface Water Quality Classifications

Table 3.1-5
Summary of Bioaccumulation Test Tissue Results, *Lumbriculus variegatus*

Analyte	Grid 6			Background Tissue	
	Detection Frequency	Max Detect	Average	Result	Qual
Barium (mg/kg)-wet weight	100%	7.6	6.1	3.71	---
Barium (mg/kg)-dry weight	100%	57.5	53.4	26.9	---
Cadmium (mg/kg)-wet weight	100%	0.2	0.12	0.02	---
Cadmium (mg/kg)-dry weight	100%	1.2	1.02	0.14	---
Chromium (mg/kg)-wet weight	100%	2.6	1.1	0.01	I
Chromium (mg/kg)-dry weight	100%	19.8	9.5	0.08	I
Copper (mg/kg)-wet weight	100%	47.8	32.8	3.18	---
Copper (mg/kg)-dry weight	100%	362	282	23	---
Zinc (mg/kg)-wet weight	100%	55.1	46.8	41.5	---
Zinc (mg/kg)-dry weight	100%	437	409	300	---
4,4'-DDD (µg/kg)	0%	2.0	1.6	0.95	U
4,4'-DDE (µg/kg)	100%	150	129	2.7	U
4,4'-DDT (µg/kg)	0%	4.2	3.5	1.2	---
a-BHC (µg/kg)	0%	0.5	0.32	0.23	U
a-Chlordane (µg/kg)	100%	2.1	1.8	0.49	I
Aldrin (µg/kg)	0%	0.8	0.4	0.27	U
b-BHC (µg/kg)	0%	1.0	0.59	0.49	U
d-BHC (µg/kg)	0%	0.3	0.19	0.95	U
Dieldrin (µg/kg)	80%	1.0	0.84	0.29	U
Endosulfan I (µg/kg)	0%	2.0	1.2	0.46	I
Endosulfan II (µg/kg)	40%	2.2	1.3	0.22	U
Endosulfan sulfate (µg/kg)	100%	14.0	11.7	0.95	U
Endrin (µg/kg)	0%	0.4	0.26	0.95	U
Endrin aldehyde (µg/kg)	0%	3.0	2.5	0.25	U
Endrin ketone (µg/kg)	0%	2.4	1.5	1.7	U
g-BHC (µg/kg)	0%	0.5	0.29	0.24	U
g-Chlordane (µg/kg)	0%	2.0	1.2	0.95	U
Heptachlor (µg/kg)	0%	1.3	0.82	0.66	U
Heptachlor epoxide (µg/kg)	0%	0.8	0.55	0.95	U
Methoxychlor (µg/kg)	0%	3.1	1.7	1	U
Toxaphene (µg/kg)	0%	180	132	40	U

Note: All results presented on a wet weight basis, unless otherwise noted.
U: Result qualified as a non-detect (result below MDL)
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)

Table 3.1-6
Summary of Bioaccumulation Test Tissue Results, *Pomacea paludosa*

Analyte	Detection Frequency	Max Detect	Average
CS-8			
Copper (mg/kg)-wet weight	100%	29.6	27.1
Copper (mg/kg)-dry weight	100%	134	121
Zinc (mg/kg)-wet weight	100%	73	62.2
Zinc (mg/kg)-dry weight	100%	323	278
CS-10			
Copper (mg/kg)-wet weight	100%	19.9	15.8
Copper (mg/kg)-dry weight	100%	90.8	70.2
Zinc (mg/kg)-wet weight	100%	71.8	66.3
Zinc (mg/kg)-dry weight	100%	325	294
Grid 6			
Barium (mg/kg)-wet weight	100%	0.93	0.63
Barium (mg/kg)-dry weight	100%	3.7	2.60
Cadmium (mg/kg)-wet weight	100%	6.8	5.8
Cadmium (mg/kg)-dry weight	100%	30.2	24.5
Chromium (mg/kg)-wet weight	100%	0.32	0.21
Chromium (mg/kg)-dry weight	100%	1.27	0.88
Copper (mg/kg)-wet weight	100%	107	76.5
Copper (mg/kg)-dry weight	100%	426	325.0
Zinc (mg/kg)-wet weight	100%	113	79.3
Zinc (mg/kg)-dry weight	100%	501	340.0
4,4'-DDD (µg/kg)	0%	0.99	0.61
4,4'-DDE (µg/kg)	100%	28	22
4,4'-DDT (µg/kg)	0%	0.77	0.62
a-BHC (µg/kg)	0%	0.27	0.27
a-Chlordane (µg/kg)	0%	0.23	0.23
Aldrin (µg/kg)	0%	0.23	0.23
b-BHC (µg/kg)	0%	0.49	0.49
d-BHC (µg/kg)	0%	0.16	0.16
Dieldrin (µg/kg)	25%	0.57	0.33
Endosulfan I (µg/kg)	0%	0.99	0.49
Endosulfan II (µg/kg)	0%	0.93	0.4
Endosulfan sulfate (µg/kg)	100%	2.5	1.68
Endrin (µg/kg)	0%	0.22	0.22
Endrin aldehyde (µg/kg)	100%	1.5	1.0
Endrin ketone (µg/kg)	0%	0.36	0.31
g-BHC (µg/kg)	0%	0.24	0.24
g-Chlordane (µg/kg)	0%	0.99	0.5
Heptachlor (µg/kg)	0%	0.66	0.66
Heptachlor epoxide (µg/kg)	0%	0.38	0.38
Methoxychlor (µg/kg)	0%	1	1
Toxaphene (µg/kg)	0%	48	32

Note: All results presented on a wet weight basis, unless otherwise noted.
U: Result qualified as a non-detect (result below MDL)
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)

Table 3.1-6
Summary of Bioaccumulation Test Tissue Results, *Pomacea paludosa*

Analyte	Result	Qual
Background Tissue		
Barium (mg/kg)-wet weight	0.37	---
Barium (mg/kg)-dry weight	1.6	---
Cadmium (mg/kg)-wet weight	5.76	---
Cadmium (mg/kg)-dry weight	24.6	---
Chromium (mg/kg)-wet weight	0.25	---
Chromium (mg/kg)-dry weight	1.06	---
Copper (mg/kg)-wet weight	4.64	---
Copper (mg/kg)-dry weight	19.8	---
Zinc (mg/kg)-wet weight	52.5	---
Zinc (mg/kg)-dry weight	224	---
4,4'-DDD (µg/kg)	0.11	U
4,4'-DDE (µg/kg)	0.47	I
4,4'-DDT (µg/kg)	0.43	U
a-BHC (µg/kg)	0.15	U
a-Chlordane (µg/kg)	0.23	U
Aldrin (µg/kg)	0.27	U
b-BHC (µg/kg)	0.49	U
d-BHC (µg/kg)	0.16	U
Dieldrin (µg/kg)	0.25	U
Endosulfan I (µg/kg)	0.12	U
Endosulfan II (µg/kg)	0.22	U
Endosulfan sulfate (µg/kg)	0.13	U
Endrin (µg/kg)	0.22	U
Endrin aldehyde (µg/kg)	0.25	U
Endrin ketone (µg/kg)	0.28	U
g-BHC (µg/kg)	0.24	U
g-Chlordane (µg/kg)	0.26	U
Heptachlor (µg/kg)	0.66	U
Heptachlor epoxide (µg/kg)	0.38	U
Methoxychlor (µg/kg)	1	U
Toxaphene (µg/kg)	21	U

Note: All results presented on a wet weight basis, unless otherwise noted.
U: Result qualified as a non-detect (result below MDL)
I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)

Table 3.1-7
Average Snail Tissue Mass at Day 28 of the Bioaccumulation Study

Sediment	Number of Replicates	Tissue Wet Weight (g)			Shell Length (mm)		
		Min	Max	Average	Min	Max	Average
Control	5	10.4	15.6	12.2	11.4	25.7	18.3
CS-8	5	11.9	19.8	15.3	10.8	34.0	19.8
CS-10	4	10.6	18	13.9	14.2	31.5	20.1
Grid 6	4	2	14.8	9.7	13.3	34.0	19.9

Table 3.1-8
Overlying Water Sample Results: Bioaccumulation Phase

Analyte	Days after Bioaccumulation Phase Initiation							
	0		1		13		28	
	Result	Qual	Result	Qual	Result	Qual	Result	Qual
CS-8								
Total Copper (µg/L)	16	---	11	---	11	---	9.1	---
Dissolved Copper (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Zinc (µg/L)	5	I	6	I	5	I	5	I
Dissolved Zinc (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Dissolved Solids (mg/L)	980	---	1000	---	1000	---	1000	---
Total Organic Carbon (mg/L)	3.9	---	4.1	---	6	---	5	---
CS-10								
Total Copper (µg/L)	6.3	---	5.4	---	6	---	6.7	---
Dissolved Copper (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Zinc (µg/L)	4	U	4	I	7	I	5	I
Dissolved Zinc (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Dissolved Solids (mg/L)	990	---	1000	---	1000	---	1000	---
Total Organic Carbon (mg/L)	3.5	---	3	---	5.8	---	5.4	---
Grid 6								
Total Barium (µg/L)	9.90	---	14.0	---	11.0	---	9.90	---
Dissolved Barium (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Cadmium (µg/L)	0.12	U	0.12	U	0.15	I	0.19	I
Dissolved Cadmium (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Chromium (µg/L)	2.20	U	2.90	U	4.00	---	3.60	---
Dissolved Chromium (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Copper (µg/L)	86	---	53	---	53	---	40	---
Dissolved Copper (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Zinc (µg/L)	6	I	10.0	I	9	I	9	I
Dissolved Zinc (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Dissolved Solids (mg/L)	1000	---	1000	---	1100	---	1100	---
Total Organic Carbon (mg/L)	6	---	4.2	---	6.6	---	6.3	---
4,4'-DDD (µg/L)	0.008	UJ	0.009	UJ	0.009	U	0.009	U
4,4'-DDE (µg/L)	0.009	U	0.009	U	0.010	U	0.009	U
4,4'-DDT (µg/L)	0.01	U	0.01	U	0.02	U	0.02	U
a-BHC (µg/L)	0.008	U	0.009	U	0.009	U	0.009	U
a-Chlordane (µg/L)	0.007	U	0.0071	U	0.008	U	0.007	U
Aldrin (µg/L)	0.007	U	0.007	U	0.008	U	0.008	U
b-BHC (µg/L)	0.009	U	0.009	U	0.01	U	0.01	U
d-BHC (µg/L)	0.01	U	0.01	U	0.01	U	0.01	U
Dieldrin (µg/L)	0.008	U	0.008	U	0.008	U	0.008	U
Endosulfan I (µg/L)	0.009	U	0.010	U	0.01	U	0.01	U
Endosulfan II (µg/L)	0.007	U	0.007	U	0.007	U	0.007	U
Endosulfan sulfate (µg/L)	0.01	U	0.01	U	0.01	I	0.01	U
Endrin (µg/L)	0.01	U	0.01	U	0.01	U	0.01	U
Endrin aldehyde (µg/L)	0.009	U	0.009	U	0.01	U	0.01	U
Endrin ketone (µg/L)	0.006	U	0.006	U	0.006	UJ	0.006	UJ
g-BHC (µg/L)	0.009	U	0.009	U	0.009	U	0.009	U
g-Chlordane (µg/L)	0.008	U	0.008	U	0.009	U	0.008	U
Heptachlor (µg/L)	0.01	U	0.01	U	0.01	U	0.01	U
Heptachlor epoxide (µg/L)	0.008	U	0.009	U	0.009	U	0.009	U
Methoxychlor (µg/L)	0.01	U	0.01	U	0.01	U	0.01	U
Toxaphene (µg/L)	0.53	U	0.54	U	0.57	U	0.56	U

Table 3.1-8
Overlying Water Sample Results: Bioaccumulation Phase

Analyte	Days after Bioaccumulation Phase Initiation							
	0		1		13		28	
	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Control								
Total Barium (µg/L)	8.5	---	8.5	---	N/A	N/A	N/A	N/A
Dissolved Barium (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Cadmium (µg/L)	0.12	U	0.12	U	N/A	N/A	N/A	N/A
Dissolved Cadmium (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Chromium (µg/L)	1.3	U	0.9	U	N/A	N/A	N/A	N/A
Dissolved Chromium (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Copper (µg/L)	0.8	I	0.9	I	N/A	N/A	N/A	N/A
Dissolved Copper (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Zinc (µg/L)	5	I	4	U	N/A	N/A	N/A	N/A
Dissolved Zinc (µg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Dissolved Solids (mg/L)	1000	---	1000	---	N/A	N/A	N/A	N/A
Total Organic Carbon (mg/L)	2.3	---	2.3	---	N/A	N/A	N/A	N/A
4,4'-DDD (µg/L)	0.009	UJ	0.009	UJ	N/A	N/A	N/A	N/A
4,4'-DDE (µg/L)	0.009	U	0.009	U	N/A	N/A	N/A	N/A
4,4'-DDT (µg/L)	0.014	U	0.014	U	N/A	N/A	N/A	N/A
a-BHC (µg/L)	0.009	U	0.009	U	N/A	N/A	N/A	N/A
a-Chlordane (µg/L)	0.007	U	0.007	U	N/A	N/A	N/A	N/A
Aldrin (µg/L)	0.007	U	0.007	U	N/A	N/A	N/A	N/A
b-BHC (µg/L)	0.009	U	0.009	U	N/A	N/A	N/A	N/A
d-BHC (µg/L)	0.012	U	0.012	U	N/A	N/A	N/A	N/A
Dieldrin (µg/L)	0.008	U	0.01	U	N/A	N/A	N/A	N/A
Endosulfan I (µg/L)	0.010	U	0.010	U	N/A	N/A	N/A	N/A
Endosulfan II (µg/L)	0.007	U	0.007	U	N/A	N/A	N/A	N/A
Endosulfan sulfate (µg/L)	0.010	U	0.010	U	N/A	N/A	N/A	N/A
Endrin (µg/L)	0.010	U	0.010	U	N/A	N/A	N/A	N/A
Endrin aldehyde (µg/L)	0.009	U	0.009	U	N/A	N/A	N/A	N/A
Endrin ketone (µg/L)	0.006	U	0.006	U	N/A	N/A	N/A	N/A
g-BHC (µg/L)	0.009	U	0.009	U	N/A	N/A	N/A	N/A
g-Chlordane (µg/L)	0.008	U	0.008	U	N/A	N/A	N/A	N/A
Heptachlor (µg/L)	0.01	U	0.01	U	N/A	N/A	N/A	N/A
Heptachlor epoxide (µg/L)	0.009	U	0.009	U	N/A	N/A	N/A	N/A
Methoxychlor (µg/L)	0.01	U	0.01	U	N/A	N/A	N/A	N/A
Toxaphene (µg/L)	0.54	U	0.54	U	N/A	N/A	N/A	N/A

N/A: Not Analyzed

U: Result qualified as a non-detect (result below MDL)

J: Result estimated

I: Result between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)

Table 3.1-9
Summary of 10-day Toxicity Tests

Results of 10-day Toxicity Test with *H. azteca*					
Treatment	**Mean Percent Survival**	**Standard Deviation**	**Mean Growth (mg)**	**Mean Biomass (mg)**	**Standard Deviation**
Control	93.8	7.4	0.267	0.25	0.06
CS-8 Acclimated	93.8	7.4	0.221	0.207	0.026
CS-8 Unacclimated	96.3	7.4	0.313	0.3	0.063
CS-10 Acclimated	91.3	11.3	0.212	0.189	0.047
CS-10 Unacclimated	90	9.3	0.346	0.311	0.037
Grid 6 Acclimated	15*	20	0.671	0.137*	0.083
Grid 6 Unacclimated	3.8*	7.4	0.443	0.052*	0.03
Results of 10-day Toxicity Test with *C. dilutus*					
Treatment	**Mean Percent Survival (larvae and pupae)**	**Standard Deviation**	**Mean Growth (mg)**	**Mean Biomass (mg)**	**Standard Deviation**
Control	81.3	18.8	1.918	1.514	0.502
CS-8 Acclimated	68.8	15.5	2.503	1.46	0.394
CS-8 Unacclimated	77.5	10.4	1.851	1.394	0.369
CS-10 Acclimated	73.8	9.2	2.586	1.535	0.63
CS-10 Unacclimated	83.8	14.1	2.365	1.666	0.418
Grid 6 Acclimated	76.3	10.6	1.158*	0.829*	0.169
Grid 6 Unacclimated	53.8*	11.9	1.344	0.722*	0.224

* Statistically different from control

Table 3.2-1
Expoloratory Sample Results

Analyte	Grid	Depth	Result
Copper	A	Shallow	131
		Deep	6.1
	B	Shallow	166
		Deep	28
	C	Shallow	137
		Deep	14
	D	Shallow	132
		Deep	14
	E	Shallow	135
		Deep	9.5
Zinc	A	Shallow	100
		Deep	15
	B	Shallow	128
		Deep	29
	C	Shallow	98
		Deep	18
	D	Shallow	100
		Deep	19
	E	Shallow	105
		Deep	8.4

Note: All results presented as mg/kg dry weight

Table 3.2-2
Analysis of All Grids and Subgrids

Grid	Sample Location	% Limestone (bare rock)	% Thin Soils (<1 in)	% Thick Soils (>1 in)
A	A-16	50	46	4
B	B-06	48	42	11
C	C-17	41	45	14
D	D-08	33	53	14
E	E-17	23	65	12
All	---	39	50	11

Table 3.2-3
Summary of Exploratory Sample Results by Grid

Grid	Copper Concentration (mg/kg)		SQAG Exceedance [1]	Snail Kite Benchmark Exceedance [2]
	Min	Max		
A	4.2	121	TEC	Yes
B	5	107	TEC	Yes
C	1.6	140	TEC	Yes
D	2.5	85	TEC	Yes
E	3	105	TEC	Yes

[1] SQAG from MacDonald et al., 2003

[2] USFWS Interim Benchmark for the Everglades Snail Kite (85 mg/kg)

Table 3.2-4
Summary of Exploratory Sample Results by Depth

Sample Depth (in bgs)	Copper Concentration (mg/kg)			Total Organic Carbon (mg/kg)		
	Min	Max	Average	Min	Max	Average
0-1	28	140	79.9	27,000	64,000	41,500
1-3	4.2	63	14.4	27,000	65,000	49,286
3-6	1.6	13	5.5	27,000	61,000	45,125
6-8	3	21	7.5	37,000	70,000	50,667
6-12	2.5	14	5.6	26,000	120,000	54,600

Table 4.1-1
Hazard Quotients for Detected COPCs in Grid 6; Default Food Web Model

COPC	Maximum Detection (mg/kg)	Receptor	HQ NOAEL	HQ LOAEL
Barium	32	Clapper rail	9.98E-02	4.87E-02
		White Pelican	6.50E-03	3.17E-03
		Wood Stork	2.35E-02	1.15E-02
		White Ibis	7.98E-02	3.90E-02
		Little blue heron	5.45E-02	2.66E-02
		Tri-colored Heron	2.46E-02	1.20E-02
		Great Blue Heron	1.19E-02	5.80E-03
		Osprey	7.95E-03	3.88E-03
		Snail Kite	1.29E-01	6.28E-02
		Bald Eagle	4.44E-03	2.17E-03
		Mottled Duck	5.24E-02	2.56E-02
Chromium	109.3	Clapper rail	1.37E+00	2.74E-01
		White Pelican	3.94E-02	7.89E-03
		Wood Stork	2.85E-01	5.70E-02
		White Ibis	7.26E-01	1.45E-01
		Little blue heron	5.56E-01	1.11E-01
		Tri-colored Heron	3.96E-01	7.92E-02
		Great Blue Heron	1.54E-01	3.09E-02
		Osprey	9.71E-03	1.94E-03
		Snail Kite	1.16E+00	2.32E-01
		Bald Eagle	3.93E-02	7.87E-03
		Mottled Duck	4.46E-01	8.91E-02
Zinc	189.7	Clapper rail	1.35E+00	1.01E+00
		White Pelican	7.28E-03	5.44E-03
		Wood Stork	2.45E-01	1.83E-01
		White Ibis	1.28E+00	9.59E-01
		Little blue heron	6.82E-01	5.10E-01
		Tri-colored Heron	3.32E-01	2.48E-01
		Great Blue Heron	4.28E-02	3.20E-02
		Osprey	2.11E-02	1.58E-02
		Snail Kite	2.10E+00	1.57E+00
		Bald Eagle	3.90E-02	2.91E-02
		Mottled Duck	7.86E-01	5.87E-01
4,4'-DDD	0.0027	Clapper Rail	1.69E-02	4.89E-03
		White Pelican	1.58E-02	4.56E-03
		Wood Stork	1.31E-02	3.79E-03
		White Ibis	1.40E-02	4.03E-03
		Little Blue Heron	2.69E-02	7.76E-03
		Tri-colored Heron	2.08E-02	6.01E-03
		Great Blue Heron	2.73E-02	7.90E-03
		Osprey	2.53E-02	7.30E-03
		Snail Kite	2.01E-02	5.80E-03
		Bald Eagle	1.44E-02	4.14E-03
		Mottled Duck	1.11E-02	3.21E-03

Table 4.1-1
Hazard Quotients for Detected COPCs in Grid 6; Default Food Web Model

COPC	Maximum Detection (mg/kg)	Receptor	HQ NOAEL	HQ LOAEL
4,4'-DDE	0.0823	Clapper Rail	1.70E+00	4.89E-01
		White Pelican	1.59E+00	4.40E-01
		Wood Stork	1.32E+00	3.66E-01
		White Ibis	1.41E+00	3.89E-01
		Little Blue Heron	2.71E+00	7.48E-01
		Tri-colored Heron	2.10E+00	5.79E-01
		Great Blue Heron	2.76E+00	7.62E-01
		Osprey	2.55E+00	7.05E-01
		Snail Kite	2.02E+00	5.58E-01
		Bald Eagle	1.45E+00	4.00E-01
		Mottled Duck	1.12E+00	3.24E-01
4,4'-DDT	0.0099	Clapper Rail	2.74E-01	7.90E-02
		White Pelican	2.58E-01	7.44E-02
		Wood Stork	2.14E-01	6.17E-02
		White Ibis	2.27E-01	6.56E-02
		Little Blue Heron	4.37E-01	1.26E-01
		Tri-colored Heron	3.39E-01	9.78E-02
		Great Blue Heron	4.45E-01	1.29E-01
		Osprey	4.12E-01	1.19E-01
		Snail Kite	3.26E-01	9.43E-02
		Bald Eagle	2.34E-01	6.75E-02
		Mottled Duck	1.81E-01	5.23E-02
Dieldrin	0.00098	Clapper Rail	2.54E-04	8.88E-05
		White Pelican	1.56E-04	5.47E-05
		Wood Stork	1.48E-04	5.18E-05
		White Ibis	1.55E-04	5.42E-05
		Little Blue Heron	2.90E-04	1.02E-04
		Tri-colored Heron	2.25E-04	7.88E-05
		Great Blue Heron	2.79E-04	9.78E-05
		Osprey	2.43E-04	8.50E-05
		Snail Kite	2.24E-04	7.82E-05
		Bald Eagle	1.38E-04	4.84E-05
		Mottled Duck	1.14E-04	3.97E-05
Endosulfan	0.023	Clapper Rail	1.97E-02	1.97E-03
		White Pelican	1.74E-02	1.74E-03
		Wood Stork	1.47E-02	1.47E-03
		White Ibis	1.56E-02	1.56E-03
		Little Blue Heron	2.99E-02	2.99E-03
		Tri-colored Heron	2.32E-02	2.32E-03
		Great Blue Heron	3.02E-02	3.02E-03
		Osprey	2.78E-02	2.78E-03
		Snail Kite	2.24E-02	2.24E-03
		Bald Eagle	1.58E-02	1.58E-03
		Mottled Duck	1.23E-02	1.23E-03
Endrin	0.0177	Clapper Rail	7.18E-01	7.18E-02
		White Pelican	6.66E-01	6.66E-02
		Wood Stork	5.55E-01	5.55E-02
		White Ibis	5.90E-01	5.90E-02
		Little Blue Heron	1.13E+00	1.13E-01
		Tri-colored Heron	8.79E-01	8.79E-02
		Great Blue Heron	1.15E+00	1.15E-01
		Osprey	1.06E+00	1.06E-01
		Snail Kite	8.47E-01	8.47E-02
		Bald Eagle	6.04E-01	6.04E-02
		Mottled Duck	4.69E-01	4.69E-02

Table 4.1-1
Hazard Quotients for Detected COPCs in Grid 6; Default Food Web Model

COPC	Maximum Detection (mg/kg)	Receptor	HQ NOAEL	HQ LOAEL
S-Chlordane	0.0106	Clapper Rail	1.65E-02	4.62E-03
		White Pelican	1.53E-02	4.29E-03
		Wood Stork	1.28E-02	3.58E-03
		White Ibis	1.35E-02	3.80E-03
		Little Blue Heron	2.61E-02	7.31E-03
		Tri-colored Heron	2.02E-02	5.66E-03
		Great Blue Heron	2.65E-02	7.43E-03
		Osprey	2.45E-02	6.86E-03
		Snail Kite	1.95E-02	5.46E-03
		Bald Eagle	1.39E-02	3.90E-03
		Mottled Duck	1.08E-02	3.02E-03
Heptachlor epoxide	0.0013	Clapper Rail	2.25E-02	2.25E-03
		White Pelican	2.11E-02	2.11E-03
		Wood Stork	1.75E-02	1.75E-03
		White Ibis	1.86E-02	1.86E-03
		Little Blue Heron	3.58E-02	3.58E-03
		Tri-colored Heron	2.77E-02	2.77E-03
		Great Blue Heron	3.65E-02	3.65E-03
		Osprey	3.37E-02	3.37E-03
		Snail Kite	2.67E-02	2.67E-03
		Bald Eagle	1.92E-02	1.92E-03
		Mottled Duck	1.48E-02	1.48E-03

Table 4.1-2
Hazard Quotients for COPCs in Grid 6; Tissue Data

COPC	Average Verification Sample Concentration (mg/kg)	Tissue Concentration (mg/kg)	Receptor	HQ NOAEL	HQ LOAEL
Copper	365	426 (max)	Snail Kite	1.20E+00	1.10E+00
		325 (avg)	Snail Kite	9.00E-01	8.40E-01
Zinc - Default TRV	189.7	437 (max)	Clapper rail	1.58E+00	1.18E+00
		409 (avg)	Clapper rail	1.49E+00	1.11E+00
		501 (max)	Snail Kite	2.86E+00	2.13E+00
		340 (avg)	Snail Kite	1.95E+00	1.46E+00
Zinc - Alternative TRV	189.7	437 (max)	Clapper rail	3.45E-01	N/A
		409 (avg)	Clapper rail	3.30E-01	N/A
		501 (max)	Snail Kite	6.30E-01	N/A
		340 (avg)	Snail Kite	4.30E-01	N/A
4,4'-DDE - Default TRV	0.08	0.15 (max)	Great Blue Heron	1.50E+00	4.09E-01
		0.13 (avg)	Great Blue Heron	1.42E+00	3.92E-01
		0.028 (max)	Snail Kite	1.06E-01	2.90E-02
		0.022 (avg)	Snail Kite	8.40E-02	2.30E-02
4,4'-DDE - Alternative TRV	0.08	0.15 (max)	Great Blue Heron	7.20E-01	N/A
		0.13 (avg)	Great Blue Heron	6.87E-01	N/A
		0.028 (max)	Snail Kite	5.00E-02	N/A
		0.022 (avg)	Snail Kite	4.10E-02	N/A
Endrin aldehyde	0.02	0.003	Great Blue Heron	5.95E-01	5.00E-02

N/A: Not Available

NOTE: Copper and Zinc tissue concentrations shown in dry weight.

4,4'-DDE and Endrin aldehyde tissue concentrations shown in wet weight.

Endrin used as a surrogate for endrin aldehyde in HQ calculation.

Table 4.2-1
Hazard Quotients for Detected COPCs in the Pilot Study Area

Location	COPC	Sediment Concentration (mg/kg)	Apple Snail Tissue Concentration (mg/kg)	Receptor	HQ NOAEL	HQ LOAEL
CS-8	Copper - Default Model	140	778	Snail Kite	2.10E+00	2.00E+00
CS-8	Copper - Tissue Data	140	134	Snail Kite	3.75E-01	3.48E-01
CS-10	Copper - Default Model	97	539	Snail Kite	1.50E+00	1.40E+00
CS-10	Copper - Tissue Data	97	91	Snail Kite	2.55E-01	2.36E-01
CS-8	Zinc - Default Mode	95.7	185	Snail Kite	2.33E-01	N/A
CS-8	Zinc - Tissue Data	95.7	323	Snail Kite	4.00E-01	N/A
CS-10	Zinc - Default Mode	60.3	117	Snail Kite	1.50E-01	N/A
CS-10	Zinc - Tissue Data	60.3	325	Snail Kite	4.00E-01	N/A

N/A: Not Available

Note: Zinc HQs provided only for the USEPA EcoSSL NOAEL TRV.

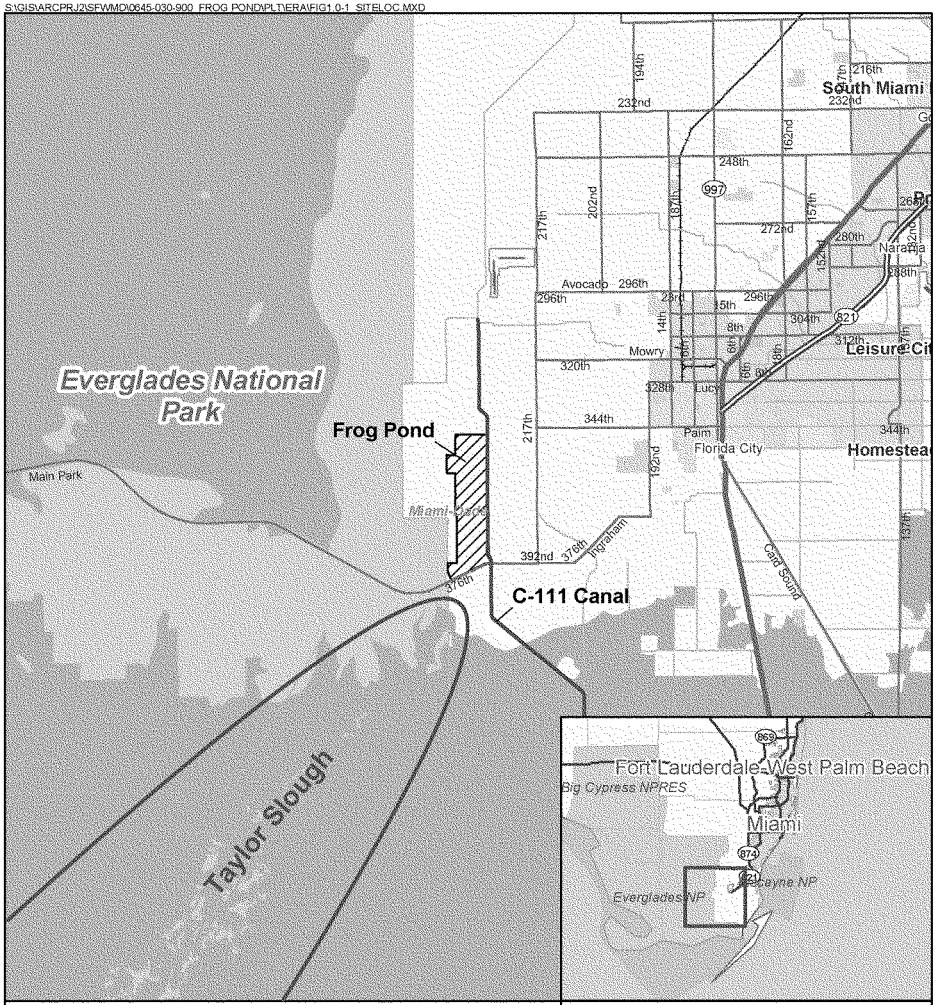
All concentrations provided in dry weight.

Table 4.2-2
Copper Concentrations in the
Top 1 Inch of Soil Following Scraping

0 - 1 Inch Samples	Copper (mg/kg)
A21	28
A22	121
A23	89
B21	107
B22	57
B23	94
B24	69
C21	100
C22	72
C23	140
C24	82
D21	57
D22	34
D23	85
D24	63
E21	86.5
E22	105
E23	43
A	131
B	166
C	137
D	132
E	135
Minimum	28
Maximum	166
Average	92.8
95% UCL	106.1

Figures

S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLT\ERA\FIG1.0-1_SITELOC.MXD



Legend

- Frog Pond Site
- Swamp/Marsh
- Canal

N

0 2 4 Miles

South Florida Water Management District

Ecological Risk Assessment
of Frog Pond Soils

FIGURE 1.0-1

Site Location

PRJ: 0645-030-900	DATE: DEC 30, 2008	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLT\ERA\FIG1.0-2_STUDYAREA.MXD

Legend

Frog Pond Study Area

N

0 0.25 0.5 Miles

South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

FIGURE 1.0-2

Frog Pond Study Area

PRJ: 0645-030-900	DATE: DEC 03, 2008	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLTERA\FIG1.0-3_PSLOC.MXD

Legend

Frog Pond Study Area

Pilot Study Area

N

0 0.25 0.5 Miles

South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

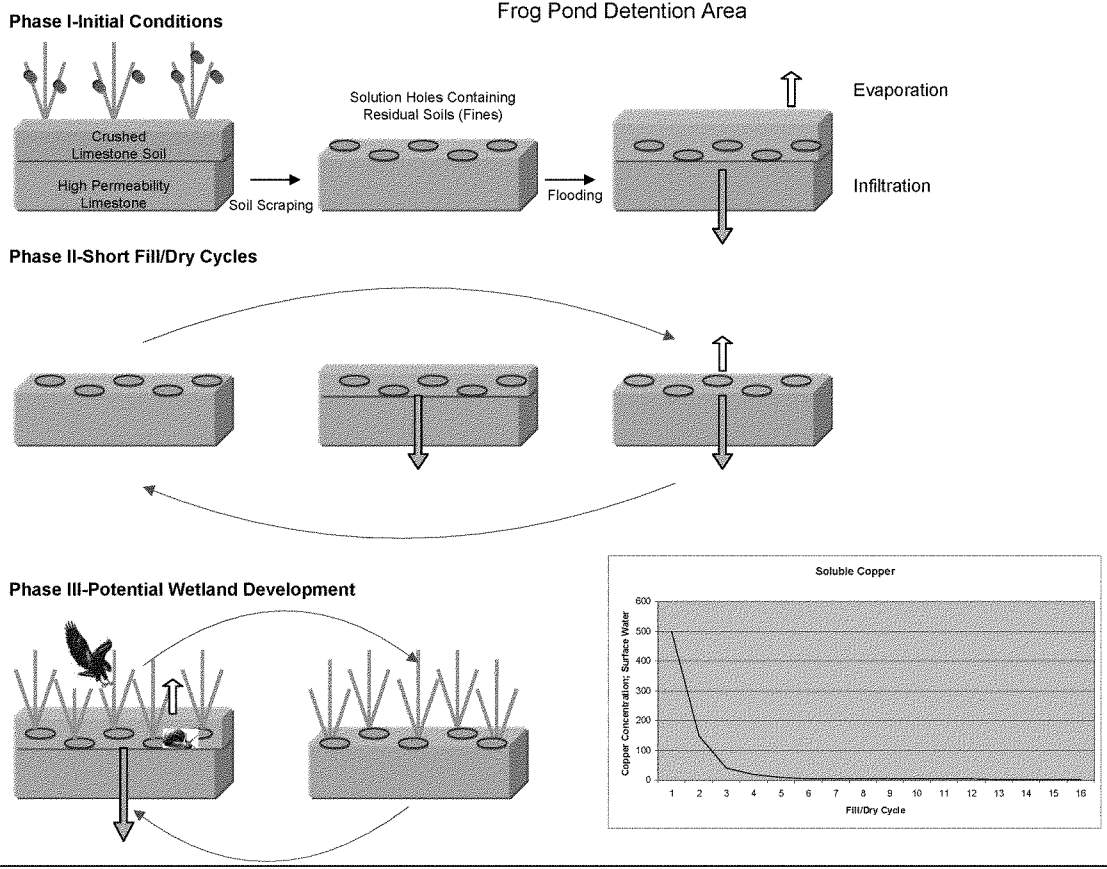
FIGURE 1.0-3

Frog Pond
Pilot Study Location

PRJ: 0645-030-900	DATE: DEC 03, 2008	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

Figure 1.1-1
Conceptual Site Model
Frog Pond Detention Area



S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLT\ERA\FIG2.1-1_BULKSAMPLOCS.MXD

Legend

- Frog Pond Study Area
- Pilot Study Area
- Bulk Sample Locations

N

0 0.25 0.5 Miles

South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

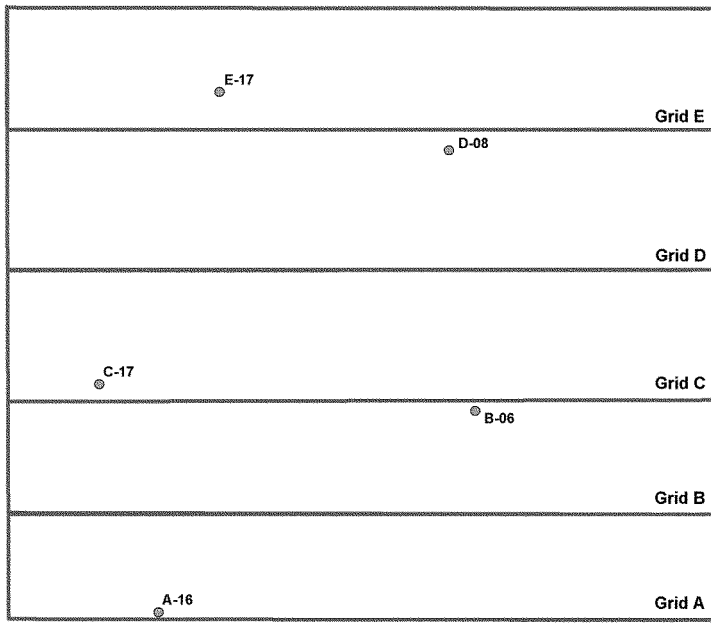
FIGURE 2.1-1

Bulk Sample Locations

PRJ: 0645-030-900	DATE: DEC 03, 2008	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLT\ERA\FIG2.3-1_SAMPLOCS.MXD



Legend

- Pilot Study Area
- Soil Sample Location

N

0 50 100 Feet

South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

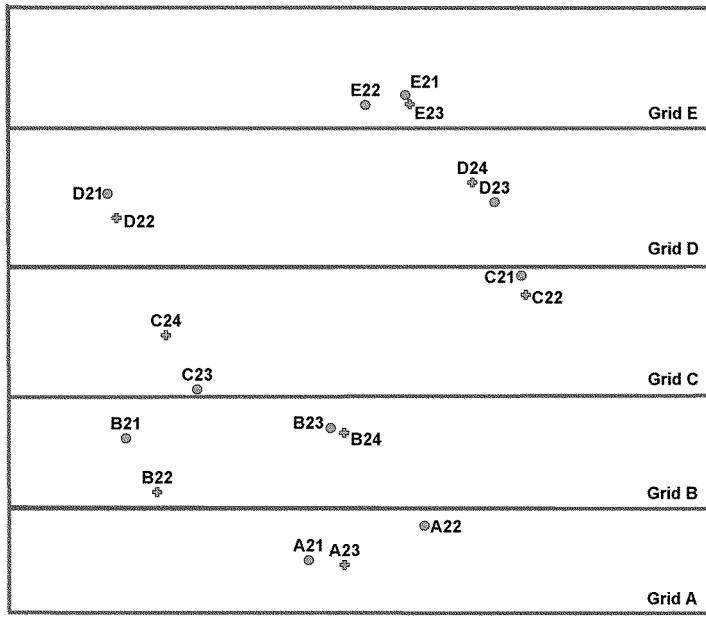
FIGURE 2.3-1

Soil Sample Locations
URS, February 2008

PRJ: 0645-030-900	DATE: DEC 18, 2008	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLT\ERA\FIG2.3-2_SAMPLOCS.MXD



Legend

Pilot Study Area

Number of Soil Layers Sampled

1

4

N

0 50 100 Feet

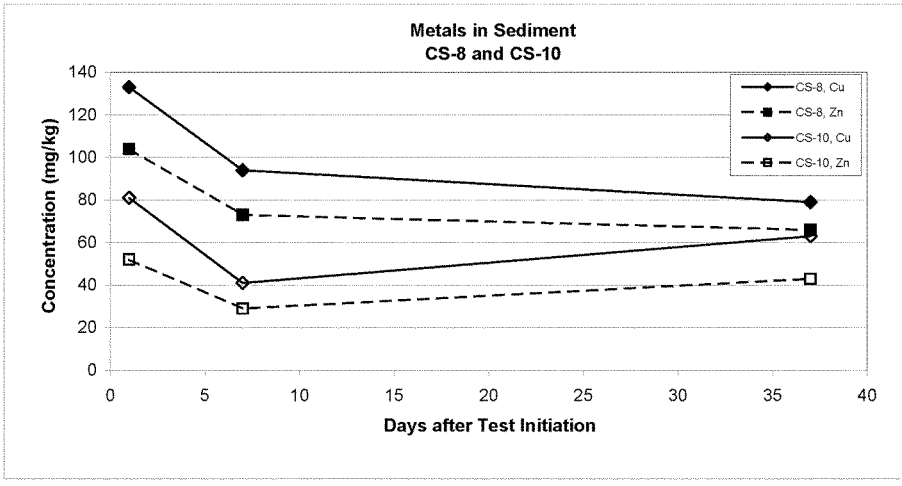
South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

FIGURE 2.3-2

Soil Sample Locations
URS, September 2008

PRJ: 0645-030-900	DATE: DEC 18, 2008	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS



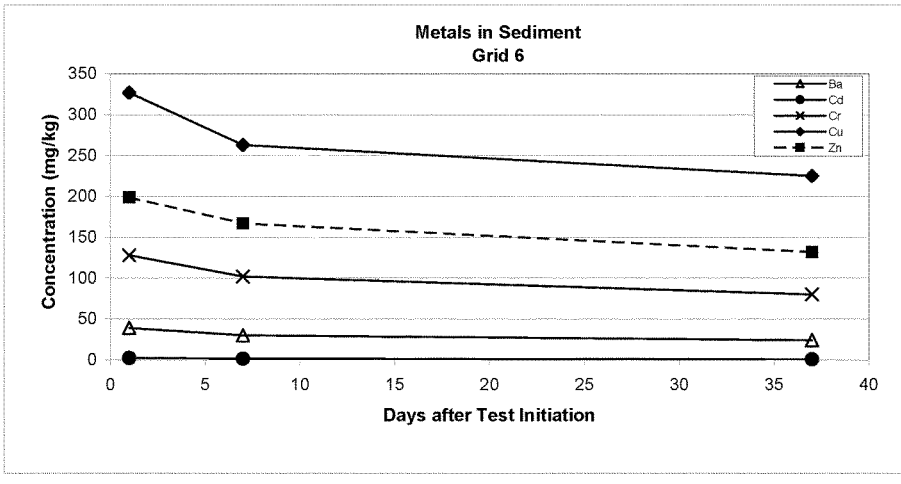


Figure 3.1-1 Metals in Aged Sediment: Acclimation Phase

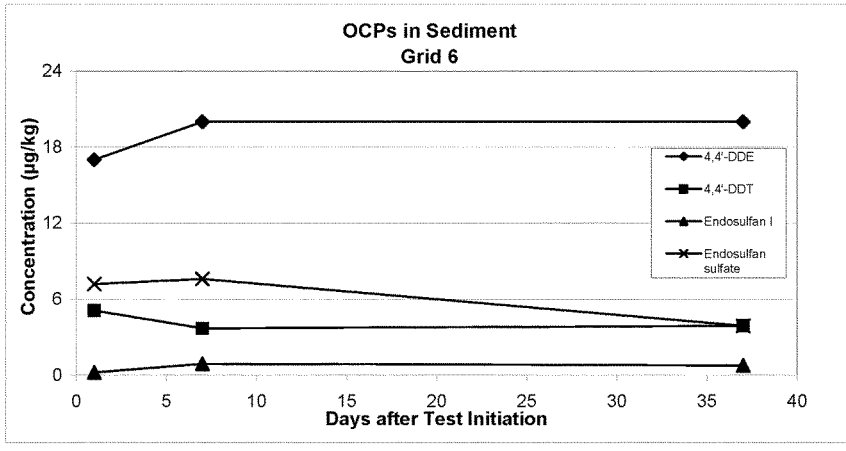


Figure 3.1-2. Organochlorine Pesticides in Aged Sediment: Acclimation Phase

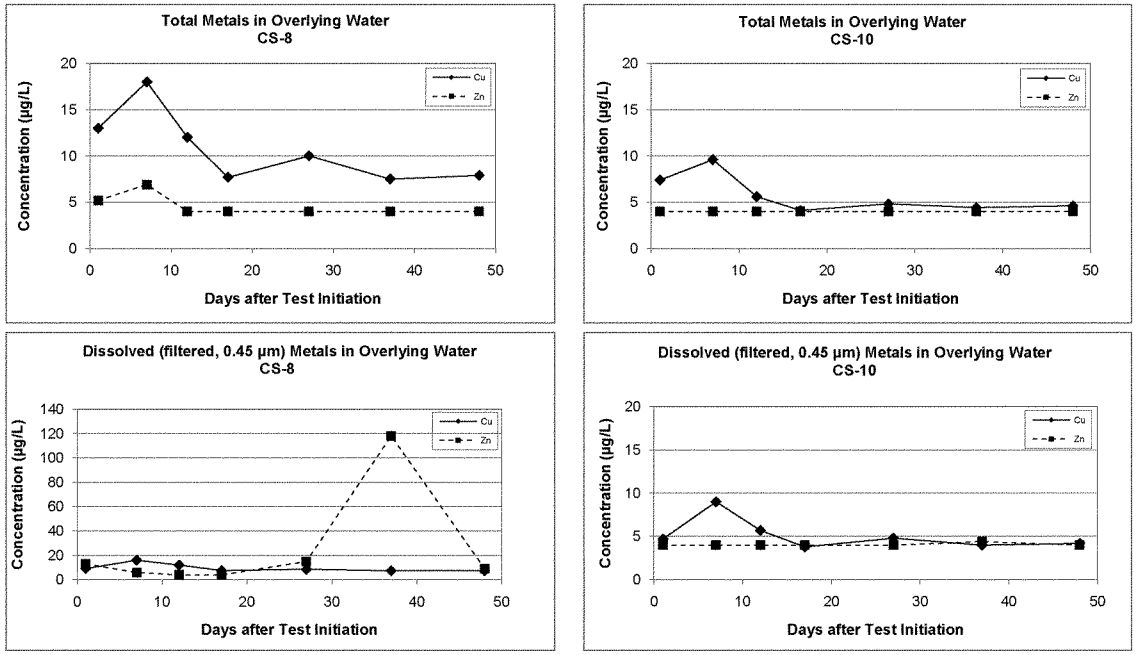
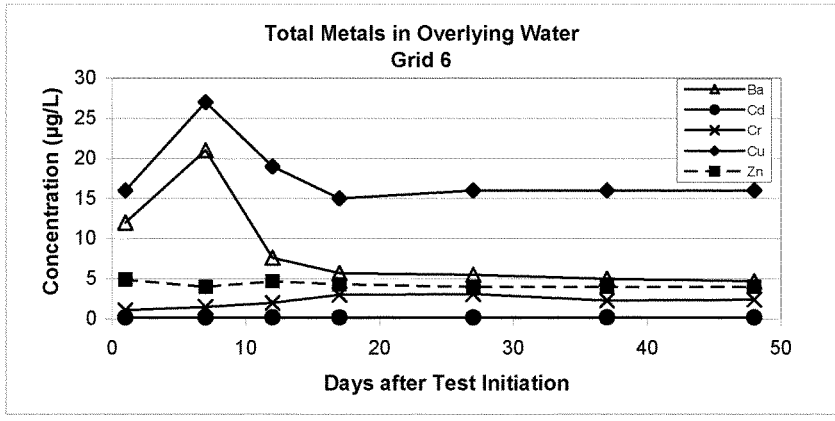
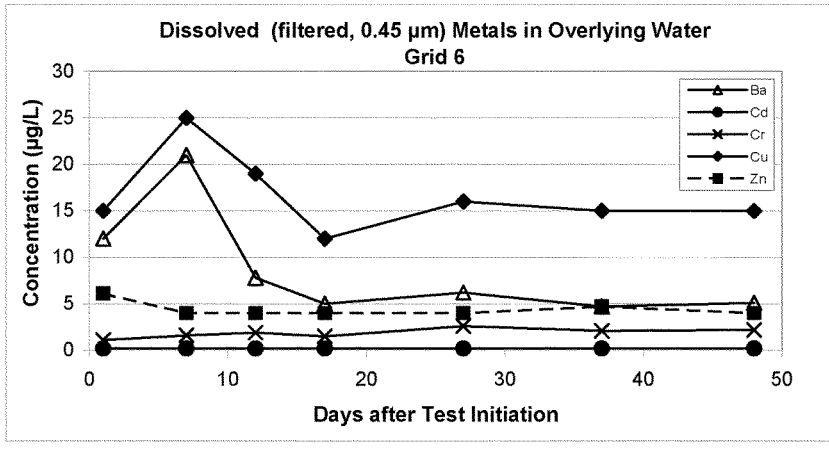


Figure 3.1-3 Total and Dissolved Metals in Overlying Water, CS-8 and CS-10: Acclimation Phase





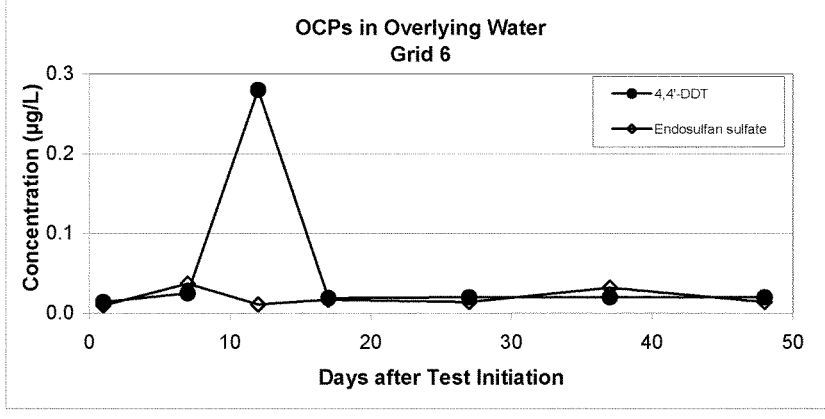
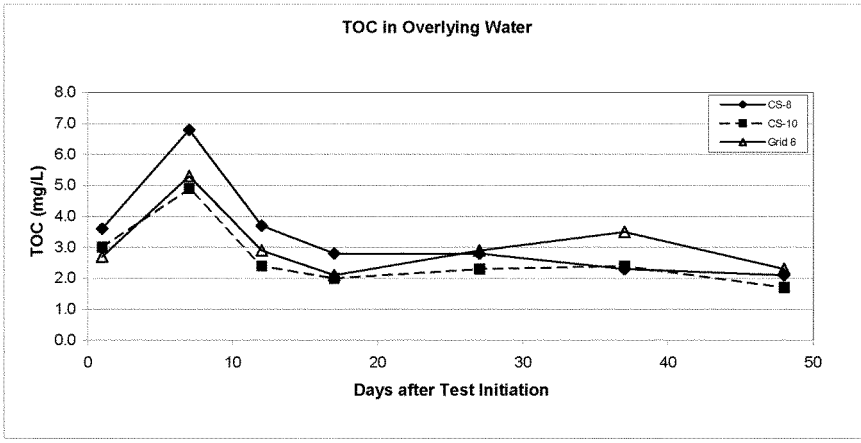


Figure 3.1-4. Metals and Organochlorine Pesticides in Overlying Water, Grid 6: Acclimation Phase



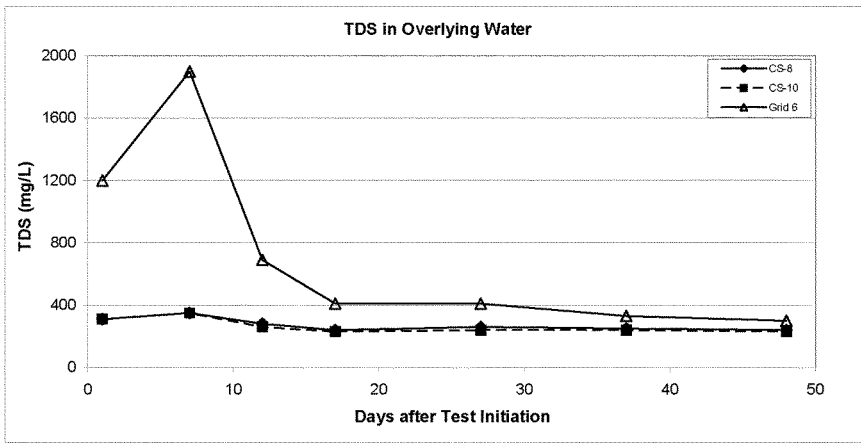
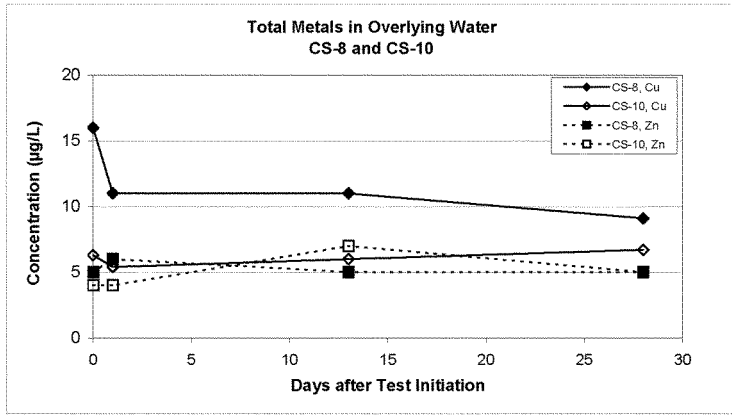
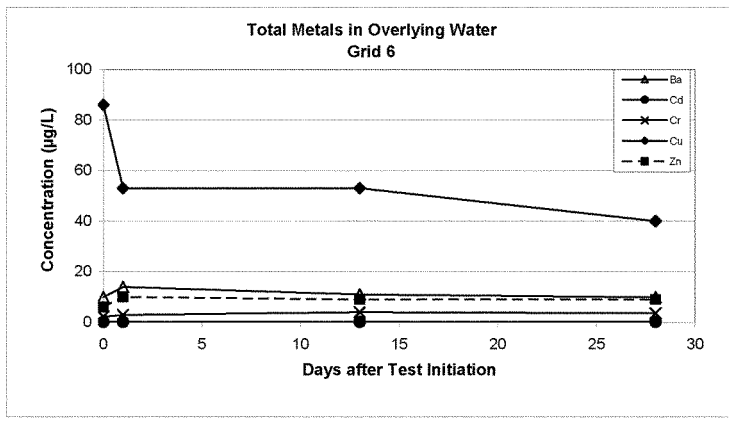
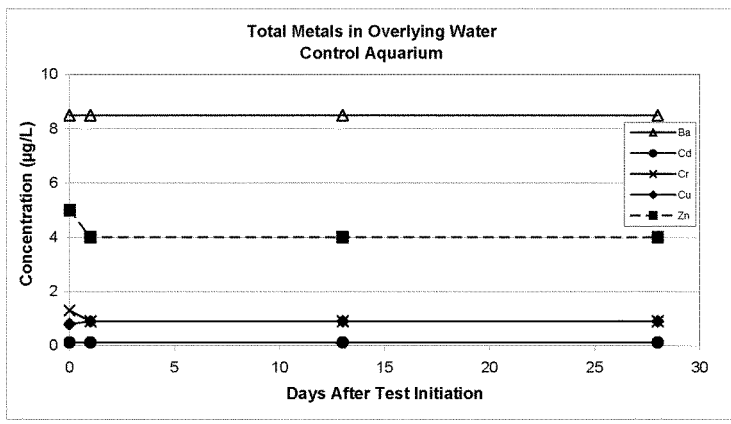


Figure 3.1-5. Total Organic Carbon and Total Dissolved Solids in Overlying Water: Acclimation Phase







Note: Day 13 and Day 28 metals concentrations for the Control sample are assumed to be the concentration detected at Day 1.

Figure 3.1-6. Total Metals in Overlying Water, CS-8, CS-10, Grid 6, and Control: Bioaccumulation Phase

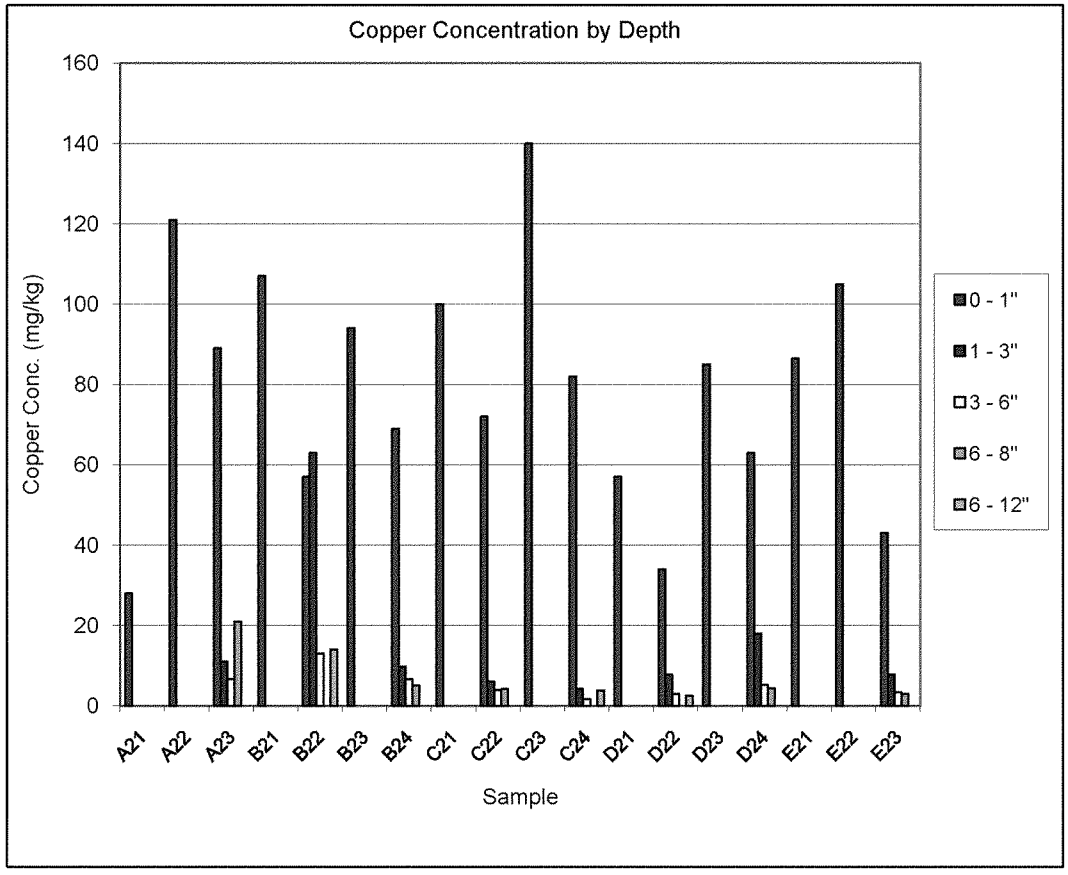


Figure 3.2-1. Copper Concentration by Depth: Exploratory Soil Samples

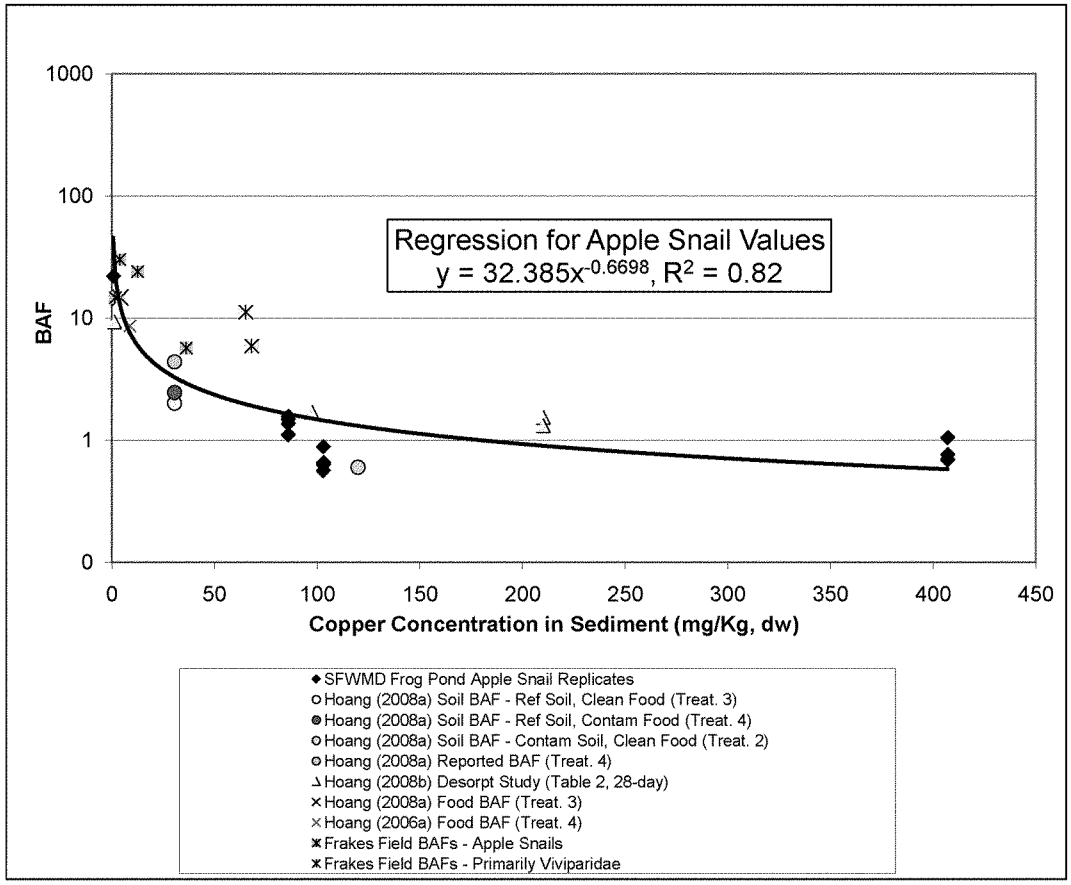


Figure 4.1-1 Copper Bioaccumulation Factors (BAFs) for Apple Snails

S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLT\ERA\FIG5.0-1_REVISEDFPAREALOC.MXD

Legend

- Phase I/II Frog Pond Study Area
- Revised Project Footprint
- Pilot Study Area
- Bulk Sample Locations

N

0 0.25 0.5 Miles

South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

FIGURE 5.0-1

Frog Pond Site
Revised Project Footprint

PRJ: 0645-030-900	DATE: JAN 22, 2009	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

URS

First Year, Second Quarter Hydrologic Evaluation
Frog Pond
Florida City, Miami-Dade, Florida
URS Project # 38617-098

Prepared for:

Mr. Robert J. Taylor
Lead Environmental Engineering Specialist
Land Management and Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

February 6, 2009

Prepared By:

URS Corporation
7800 Congress Avenue, Suite 200
Boca Raton, Florida 33487

URS

February 6, 2009

Mr. Robert J. Taylor
Lead Environmental Engineering Specialist
Land Management and Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Re: First Year, Second Quarter Hydrologic Evaluation
Frog Pond
Florida City, Miami-Dade County, Florida
URS Project # 38617-098

Dear Mr. Taylor:

URS Corporation, (URS), is pleased to submit this report of the First Year, Second Quarter Hydrologic Evaluation for the above referenced site. If you have any questions regarding this report or project, please contact URS at your convenience.

Respectfully Submitted,

URS Corporation

Ed Leding

Edward A. Leding, P.G.
Project Manager

William Marcus
Projects Director

C: Dewey Worth, District
John Schafer, District

URS

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 OBJECTIVES 1
3.0 BACKGROUND 1
4.0 DATA COLLECTION 2
4.1 Level Troll Data Collection 2
4.2 Groundwater Sample Collection 3
5.0 DATA INTERPRETATION 4
5.1 Level Troll Elevation Data 4
5.2 Hydrologic Characteristics 5
5.2.1 Hydraulic Gradient 5
5.2.2 Pore-Water Velocity 6
5.2.3 Travel Time 7
5.3 Groundwater Sample Analysis 7
6.0 FINDINGS AND CONCLUSIONS 8

LIST OF FIGURES

Figure 1 General Site Vicinity Map
Figure 2 Monitor Well Location Map
Figure 3 Weather Station Location Map
Figure 4 Groundwater Elevation Contour Map – October 21, 2008
Figure 5 Groundwater Elevation Contour Map – December 9, 2008
Figure 6 Groundwater Analytical Results Map – October 21, 2008 – Organochlorine Pesticides
Figure 7 Groundwater Analytical Results Map – October 21, 2008 - Metals

LIST OF TABLES

Table 1 Monitor Well Construction Details
Table 2 Summary of Level Troll Information
Table 3 Summary of Field Events and Level Troll Data – September 2008 to December 2008
Table 4 Summary of Groundwater Elevation Data
Table 5 Summary of Groundwater Analytical Results – October 21, 2008

LIST OF APPENDICES

Appendix A Site Specific Rainfall Data
Appendix B Level Troll Water Table Elevation Graphs
Appendix B1 Monitor Well MW-1 Elevation Graph
Appendix B2 Monitor Well MW-2 Elevation Graph
Appendix B3 Monitor Well MW-4 Elevation Graph
Appendix B4 Monitor Well MW-7 Elevation Graph
Appendix B5 Monitor Well MW-8 Elevation Graph
Appendix C FDEP Groundwater Sampling Logs
Appendix D Groundwater Analytical Laboratory Results and Chain-of-Custody Documentation

URS

1.0 INTRODUCTION

URS Corporation (URS) is pleased to present this Hydrologic Evaluation report to the South Florida Water Management District (District) summarizing the groundwater level monitoring and groundwater sample analysis collected during the First Year, Second Quarter sampling events conducted at the Frog Pond. The Frog Pond consists of over 5,000-acres of agricultural land located west of the District C-111 Canal, east of Levee 31 and north of Southwest 392nd Street (County Road 9336) in Miami-Dade County, Florida. The District has plans to construct a 530-acre "leaky reservoir" along the western border of the southern portion of the Frog Pond.

The south portion of the Frog Pond, consisting of approximately 1,400 acres, is currently being cultivated with okra and beans. Historically vegetables have been grown at the Frog Pond which included tomatoes, beans, bananas, corn, onions, cabbage, and squash. A general site vicinity map of the Frog Pond is illustrated on **Figure 1**. **Figure 2** illustrates the proposed footprint of the "leaky reservoir".

2.0 OBJECTIVES

The objective of the Hydrologic Monitoring is to evaluate the groundwater levels and flow directions at the Frog Pond, as well as the groundwater quality with respect to historical applications of agrochemicals and soil addendums.

3.0 BACKGROUND

In 1995, the groundwater quality within the Frog Pond was evaluated by URS (formerly Dames and Moore) during a Limited Phase II Site Assessment. Dames and Moore installed 25 temporary monitor wells, and collected groundwater samples which were analyzed for one or more of the following constituents: volatile aromatics, organochlorine pesticides, organophosphorous pesticides, chlorinated herbicides, triazine herbicides, total recoverable petroleum hydrocarbon (TRPH), ethylene dibromide, and 8 RCRA metals. Atrazine, a chlorinated herbicide, exhibited concentrations exceeding the National Primary Drinking Water Standards – Maximum Contaminant Levels (MCL). Barium and chromium were also detected above laboratory detection limits but below their respective MCLs. All other constituents analyzed were below laboratory detection limits (BDL).

In 2006, URS was contracted to evaluate the soil quality within approximately 1,200 acres of the Frog Pond. The soil samples were collected per the U.S. Fish and Wildlife Service (Service) and District sampling protocol. The soil samples exhibited elevated levels of 4,4-DDE, barium, chromium, copper, and zinc at concentrations above acceptable Sediment Quality Assessment Guidelines (SQAGs). These agrochemicals and soil addendums pose a potential risk to wildlife if the area is flooded.

URS

In response to these potentially harmful constituents, the District requested URS to conduct a hydrologic evaluation study to evaluate the contaminated soil's potential impact on the groundwater quality surrounding the leaky reservoir footprint as well as the groundwater recharge and flow direction within the footprint of the "leaky reservoir".

In June 2008, URS contracted CM2 Drilling Inc., a licensed water well contractor, to install a series of eight groundwater monitor wells, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, and MW-8, around the perimeter of the proposed "leaky reservoir" footprint. The monitor wells were installed to monitor the water quality within the "leaky reservoir". In order to evaluate the site-specific groundwater flow at the site, the monitor wells were surveyed by Scott A. Guzzi and Associates, Inc., a state certified surveyor, on June 23, 2008. **Figure 2** illustrates the monitor well locations. The monitor well construction details are presented in **Table 1**.

In June 2008, URS installed five, In-Situ Level Troll® 500 pressure transducers in monitor wells MW-1, MW-2, MW-4, MW-7 and MW-8. The Level Troll data logger network was established to monitor the groundwater level and flow direction in the vicinity of the "leaky reservoir.

The Level Troll® 500 is a self-contained submersible real-time water level trend recorder. The Level Trolls are programmed to read the pressure generated by the water column in the monitor wells every half-hour. The Level Trolls are suspended from a well dock cable situated on the top of casing (TOC) of the monitor wells. The devices are situated in the well at approximately 10 feet below land surface (bls). The Level Troll serial numbers, present locations, and date of installation are presented in **Table 2**.

The details of monitor well construction and Level Troll installation along with the results of the groundwater monitoring activities conducted from June 2008 through August 2008 were summarized in the First Year, First Quarter Hydrologic Evaluation Report dated November 4, 2008.

4.0 DATA COLLECTION

4.1 Level Troll Data Collection

On October 21, 2008 and December 9, 2008, URS mobilized to the Frog Pond to download the water level data from the Level Trolls. During the events, the depth to water (DTW) was recorded in all eight monitor wells. The Level Troll data was downloaded from the Level Trolls without removing the transducers from the well using a laptop computer. The DTW measurements were collected prior to downloading the data in the field. The Level Troll data was cleared and reprogrammed to collect new data. A summary of the Level Troll field events conducted during the recording period, from September 1 through December 31, 2008, are presented in **Table 3**.

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The Level Troll pressure data was verified with the DTW readings recorded during each site visit. The approximate groundwater surface elevation in feet, referenced to the National Geodetic Vertical Datum (NGVD), was calculated by subtracting the corrected DTW from the TOC elevation.

During the site visit on December 9, 2008, URS identified that the casing of the monitor well MW-7 was disturbed. The integrity of the monitor well was not disturbed and the Level Troll was intact inside the monitor well recording the data. The data was downloaded and the datalogger was reprogrammed to collect the new data for water level changes.

As part of the hydrologic evaluation, rainfall data was obtained. Weather station data including rainfall, pressure, humidity, wind speed, and temperature was collected from Wunderground.com every 30 minutes to relate fluctuations in groundwater elevation to recordable amounts of rainfall in the area. The closest weather station that was used to gather weather data is station KFLHOMES5, located approximately 3.5 miles northeast of MW-1. The weather station location is illustrated on **Figure 3**.

The approximate groundwater elevation data was then graphed along with rainfall data. The rainfall data are included in **Appendix A**. The water table elevation graphs of the Level Troll data are included in **Appendix B**.

4.2 Groundwater Sample Collection

Water level measurements were recorded on October 21, 2008, in order to determine the relative groundwater elevation in each well and develop a site-specific groundwater flow direction. The relative groundwater elevation was calculated by subtracting the DTW measurements from the TOC measurements. Relative water table elevations, DTW measurements, and TOC values are presented in **Table 4**.

On October 21, 2008, groundwater samples were collected for laboratory analysis from monitor wells MW-1 through MW-8. The monitor wells were sampled in accordance with URS' Quality Assurance Manual (QAM) and per the Florida Department of Environmental Protection (FDEP) Standard Operating Procedures (SOP) FDEP-SOP-001/01, FS 2200 guidelines. Each groundwater sample was collected using a low-flow peristaltic pump with dedicated polyethylene tubing. Prior to sampling, water level measurements and total well depth were collected from each of the sampled wells to calculate the well volume. Field parameters including pH, temperature, conductivity, dissolved oxygen, depth to water, and turbidity measurements were collected after one well volume was purged and continued until parameters stabilized or five well volumes were purged. Samples were then placed into laboratory-supplied bottleware and submitted to Columbia analytical Services, Inc. (CAS), a State and District certified laboratory for analysis. Additionally, one split sample was collected from the source well and submitted to Pace Analytical Laboratories, INC. (Pace) formerly ELab, Inc., a State and District

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certified laboratory for analysis. The FDEP groundwater sampling logs are included in **Appendix C**.

The groundwater samples were analyzed for organochlorine pesticides by EPA Method 8081 and barium, chromium, copper, and zinc by EPA Method 6010B. The samples were submitted under chain-of-custody documentation to CAS and Pace for analysis. Groundwater sample results were compared to the FDEP Groundwater Cleanup Target Levels (GCTLs), Table V, per Chapter 62-777 Florida Administrative Code (FAC) and Primary / Secondary Drinking Water Standards per Chapter 62-550, FAC.

5.0 DATA INTERPRETATION

A summary of the Level Troll water level data interpretation for the wells containing a Level Troll is described in the following section followed by the groundwater sample results. The water table elevation graphs of the Level Troll data recorded by the Level Trolls are included in **Appendix B**.

The site specific groundwater flow direction on both October 21, 2008 and December 9, 2008 was to the southeast. This direction is consistent with the groundwater flow direction that was illustrated by the First Year, First Quarter water level data. Relative water table elevations, DTW measurements, and TOC values are presented in **Table 4**. Site specific groundwater flow directions for the October 21, 2008 and December 9, 2008 dates are illustrated on **Figure 4** and **Figure 5**, respectively.

5.1 Level Troll Elevation Data

The graph of groundwater elevation versus time for monitor wells MW-1, MW-2, MW-4, and MW-8 illustrate increases in groundwater elevations corresponding with rainfall events followed by a gradual decrease until the subsequent rainfall event. From November 11, 2008 to December 2, 2008, the plots for MW-1, MW-2, MW-4, and MW-8 illustrate groundwater elevation increases of approximately 0.5 feet. No rainfall was recorded by the weather station during this time. The recorded groundwater elevation increases are probably due to the irrigation of the fields associated with the farming activities in this area and/or due to raising the water levels in the canals.

The plots illustrate an overall increase in the groundwater elevations in MW-1, MW-2, and MW-4, of approximately 0.01 feet, 0.18 feet, and 0.09 feet, respectively. The plot for MW-8 illustrated an overall decrease in the groundwater elevations of approximately 0.22 feet. The average overall increase in the groundwater elevations for MW-1, MW-2, MW-4, and MW-8 was 0.015 feet, during this quarter. No abnormal changes in the water level data were recorded by the Level Trolls in MW-1, MW-2, MW-4, and MW-8 during this recording period.

The graph of groundwater elevation versus time for monitor well MW-7 from September 1, 2008 through November 25, 2008 illustrates typical changes in groundwater elevations, similar to the changes recorded by the other Level Trolls during this time frame.

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However, the Level Troll in monitor well MW-7 recorded abrupt changes in groundwater levels at 19:00 on November 25, 2008, 14:30 on November 26, 2008, and at 15:30 on December 13, 2008. Subsequent to each of these instances, the Level Troll recorded typical changes in water levels. During the site visit on December 9, 2008, the well casing of MW-7 was observed to be offset at a slight angle. The plot illustrated abrupt changes in groundwater elevation on November 25, 2008 and December 13, 2008 which may have been caused by farming equipment coming into contact with the monitor well casing which resulted in casing being offset. When compared to the readings prior to December 13, 2008, the plot illustrates an overall lower groundwater elevation after the second incident on December 13, 2008. This lower elevation reading may be the result of the farming equipment coming into contact with the monitor well casing which caused the position of the Level Troll to be lowered by at least one foot.

The groundwater elevation graphs for monitor wells MW-1, MW-2, MW-4, MW-7, and MW-8 are included in **Appendix B1** through **B5**, respectively.

5.2 Hydrologic Characteristics

5.2.1 Hydraulic Gradient

Observations of site-specific aquifer characteristics, including water level data and flow direction, were accomplished by gauging water levels in the monitor wells. Water level measurements were collected from the north side of the monitor well casings. Water level data collected during the First Year, Second Quarter Hydrologic Evaluation indicated that the general direction of groundwater flow is to the southeast. The hydraulic gradient based on equipotential lines passing through the highest groundwater elevation recorded at MW-8 and the lowest groundwater elevation recorded at MW-4 on October 21, 2008 and December 9, 2008 can be calculated as:

$$I = \left(\frac{h_2 - h_1}{d} \right)$$

Where: I = Hydraulic Gradient

h_2-h_1 = Difference between water elevations or hydraulic head in feet

d = distance between lines of equipotential in feet

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October 21, 2008

$$I = \left(\frac{13.53 - 11.17}{3{,}225}\right)$$

I = 0.00073

December 9, 2008

$$I = \left(\frac{13.13 - 11.01}{3{,}225}\right)$$

I = 0.00066

5.2.2 Pore-Water Velocity

The pore-water velocity based on limestone permeability and the calculated site-specific hydraulic gradient between the highest groundwater elevation recorded at MW-8 and the lowest groundwater elevation recorded at MW-4 on October 21, 2008 and December 9, 2008 can be calculated as:

$$v = \left(\frac{K \bullet i}{porosity}\right)$$

Where: v = velocity

K = estimated conductivity of limestone at Frog Pond

= 16,000 feet per day*

i = hydraulic gradient

porosity = estimated at 10 %

On October 21, 2008

$$v = \left(\frac{16{,}000\, ft/dy \bullet 0.00073}{0.10}\right)$$

v = 117 feet per day

December 9, 2008

$$v = \left(\frac{16{,}000\, ft/dy \bullet 0.00066}{0.10}\right)$$

v = 106 feet per day

* Frog Pond Detention Area Preliminary Design Report, October 2007, Brown and Caldwell.

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5.2.3 Travel Time

The travel time based on the distance from the highest groundwater elevation recorded at MW-8 and the lowest groundwater elevation recorded at MW-4 on October 21, 2008 and December 9, 2008 and the calculated pore-water velocity can be calculated as:

$$TravelTime = \left(\frac{D}{v}\right)$$

Where: D = travel distance in feet

v = velocity in feet per day

On October 21, 2008

$$TravelTime = \left(\frac{3{,}225}{117}\right)$$

Travel Time = 28 days

On October 21, 2008

$$TravelTime = \left(\frac{3{,}225}{106}\right)$$

Travel Time = 30 days

Based on the water level readings recorded during the quarterly monitoring activities, the hydraulic gradient and pore-water velocity values calculated using the Second Quarter water level data are higher than the First Quarter water level data. Also, the Second Quarter travel times are lower than the First Quarter travel times.

5.3 Groundwater Sample Analysis

The groundwater samples collected from monitor wells MW-1 through MW-8 were BDL for the organochlorine pesticides as analyzed by EPA Method 8081. Low concentrations of barium, chromium, copper, and/or zinc were exhibited in one or more samples at concentrations below applicable GCTLs or were BDL.

A summary of the groundwater analytical results are presented in **Table 5**. Organochlorine pesticide groundwater analytical results are illustrated on **Figure 6**. Metal groundwater analytical results are illustrated on **Figure 7**. Copies of the groundwater analytical laboratory results are included in **Appendix D**.

URS utilized the FDEP Automated Data Processing Tool (ADaPT) for data validation of samples that were submitted to the laboratory, and worked with each laboratory in preparing a project-specific library. All laboratory data were verified using the ADaPT program. The ADaPT data validation summaries are included with each groundwater analytical laboratory report in **Appendix D**. Based on URS' review of the data, Quality Assurance/Quality Control (QA/QC) procedures, and performance of the two laboratories, the data is acceptable.

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6.0 FINDINGS AND CONCLUSIONS

- During the First Year, Second Quarter monitoring, URS mobilized to the Frog Pond site on October 21, 2008 and December 9, 2008 to download the water level data collected by five Level Trolls installed in MW-1, MW-2, MW-4, MW-7, and MW-8. During each event, the recorded data was downloaded to the laptop computer and the Level Trolls were reprogrammed to record the water level changes every half-hour.

- Based on the data collected by Level Trolls in MW-1, MW-2, MW-4, and MW-8 collected from September 1, 2008 through December 31, 2008, the fluctuations in groundwater elevations in general correspond to rainfall events.

- From November 11, 2008 to December 2, 2008, the plots for MW-1, MW-2, MW-4, and MW-8 illustrate increases in groundwater elevations of approximately 0.5 feet. No rainfall was recorded by the weather station during this time. The groundwater elevation increases are possibly due to the irrigation of the fields associated with the ongoing farming operations and / or due to raising the water levels in the canals.

- The Level Troll in MW-7 recorded abrupt changes in groundwater levels on November 25, November 26, and December 13, 2008. On December 9, 2008, the well casing was observed to be offset at an angle. The structural integrity of the monitor well did not appear to be affected. The abrupt changes recorded by the Level Troll might are probably due to impacts from the farming equipment on the monitor well casing.

- During the First Year, Second Quarter hydrologic monitoring, the overall increase in the groundwater elevations in MW-1, MW-2, and MW-4 were approximately 0.01 feet, 0.18 feet, and 0.09 feet, respectively. The groundwater elevations of MW-8 illustrated an overall decrease of approximately 0.22 feet. The average overall increase in the groundwater elevations of MW-1, MW-2, MW-4, and MW-8 during this quarter is 0.015 feet. The changes in groundwater elevations of MW-7 were not included in the calculations for the overall average change.

- The site specific groundwater flow direction on October 21, 2008 and on December 9, 2008 was to the southeast, towards the C-111 Canal.

- The hydraulic gradient at the site was 0.00073 feet per foot to the southeast on October 21, 2008 and 0.00066 feet per foot to the southeast on December 9, 2008.

- The pore-water velocity was calculated as 117 feet per day with travel time of 28 days on October 21, 2008 and 106 feet per day with travel time of 30 days on December 9, 2008 from the highest to the lowest groundwater elevation.

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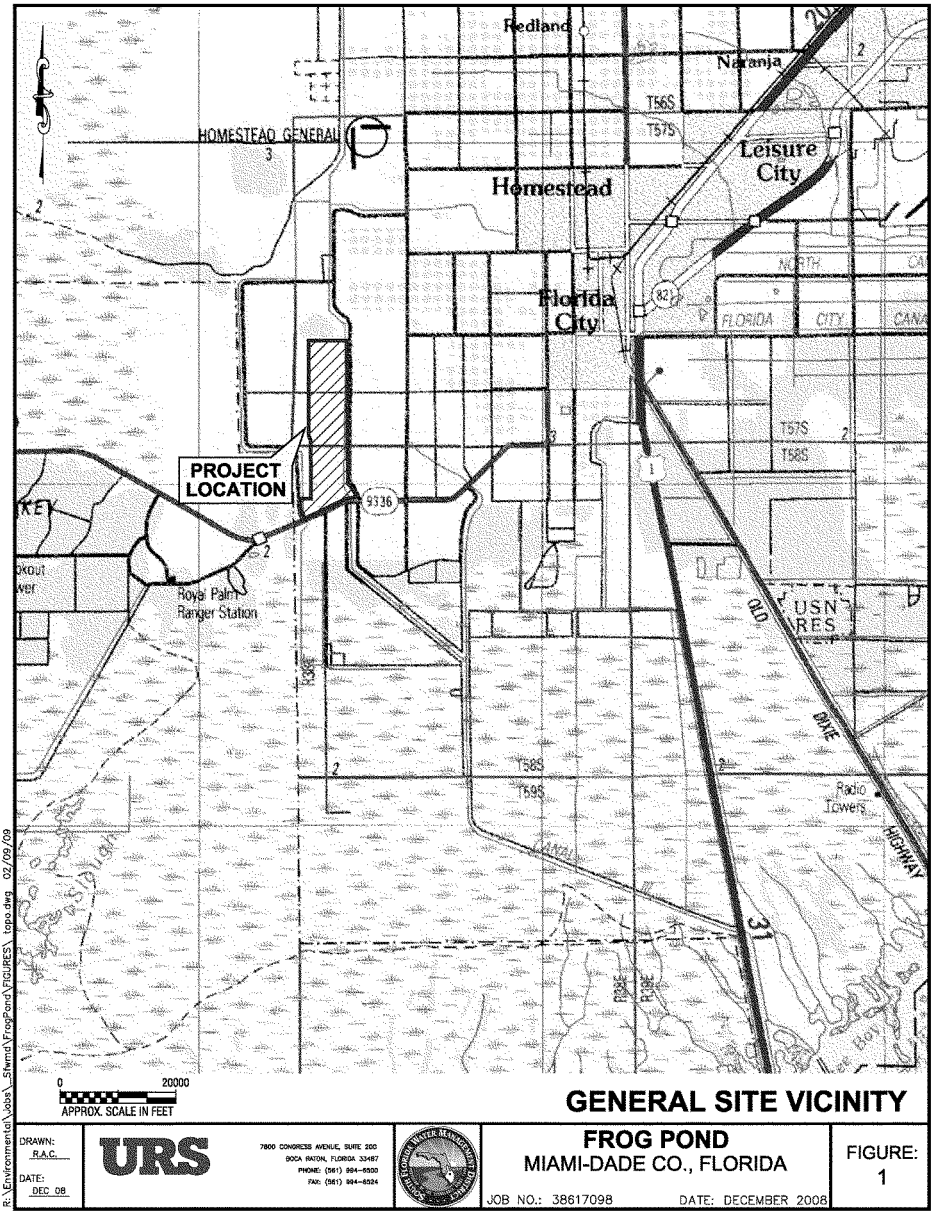
- Groundwater samples were collected and analyzed for organochlorine pesticides by EPA Method 8081 and metals (barium, chromium, copper, and zinc) by EPA Method 6010B from monitor wells MW-1 through MW-8 on October 21, 2008. Organochlorine pesticides were below laboratory detection limits for all constituents analyzed. Low concentrations of barium, chromium, copper, and zinc were exhibited below applicable GCTLs or were below laboratory detection limits.

- Current groundwater analytical data indicates that the historical organochlorine pesticides or metals detected in soil samples within the "leaky reservoir footprint" are not leaching into the groundwater above applicable GCTLs.

- The First Year, Third Quarter sampling event is scheduled to be conducted in January 2009.

FIGURES



GENERAL SITE VICINITY

DRAWN: R.A.C.
DATE: DEC 08

URS

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FROG POND
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617098 DATE: DECEMBER 2008

FIGURE: 1

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CHECKED: E.L.			
DATE: OCT 08			

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FROG POND
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-098 DATE: DECEMBER 2008

SITE MAP

FIGURE: 2

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FROG POND
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-098 DATE: DECEMBER 2008

WEATHER STATION LOCATION MAP

FIGURE: 3

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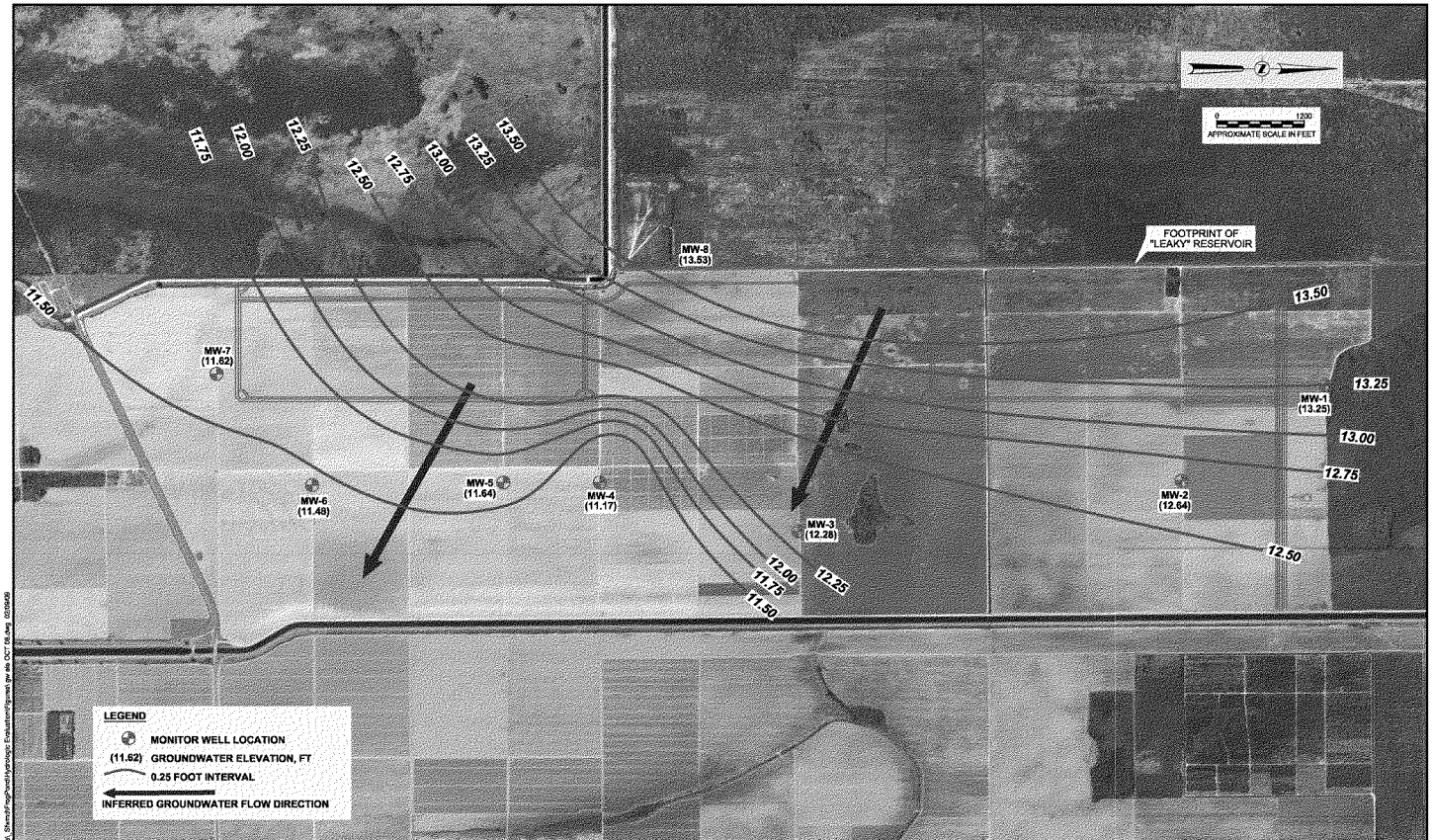

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FROG POND
MIAMI-DADE CO., FLORIDA

JOB NO.: 38817-098 DATE: DECEMBER 2008

GROUNDWATER ELEVATION CONTOUR MAP
OCTOBER 21, 2008

FIGURE: 4

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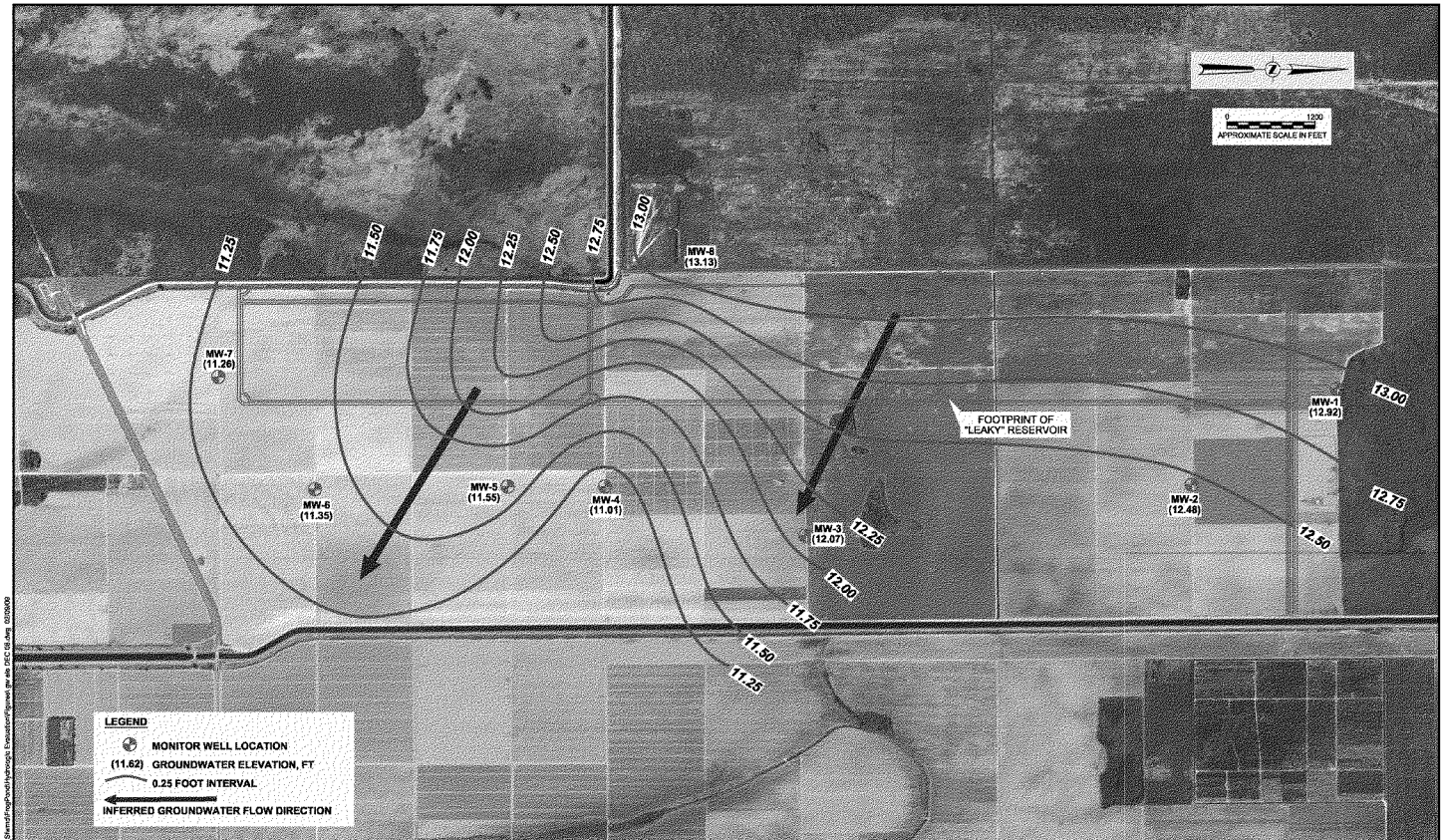

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DATE: DEC 08			

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FROG POND
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-098 DATE: DECEMBER 2008

GROUNDWATER ELEVATION CONTOUR MAP
DECEMBER 9, 2008

FIGURE: 5

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JOB NO.: 38617-098

DATE: DECEMBER 2008

FROG POND
MIAMI-DADE CO., FLORIDA

GROUNDWATER ANALYTICAL RESULTS MAP
ORGANOCHLORINE PESTICIDES
OCTOBER 21, 2008

FIGURE: 6

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DATE: DEC 08			

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FROG POND
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-098 DATE: DECEMBER 2008

GROUNDWATER ANALYTICAL RESULTS MAP
METALS - OCTOBER 21, 2008

FIGURE: 7

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TABLES

TABLE 1

WELL CONSTRUCTION DETAILS
FROG POND - HYDROLOGIC EVALUATION
Florida City, Miami-Dade County, Florida
South Florida Water Management District
URS Job # 38617-098

WELL NO.	DATE INSTALLED	GPS LOCATION*	METHOD	TOP OF CASING ELEVATION (NGVD)	DEPTH (FEET)	INTERVAL (FBLS)	DIAMETER (INCHES)	LITHOLOGY OF SCREENED INTERVAL
MW-1	6/12/08	25.44571° N 80.56929° W	Hollow Stem Auger	8.12	15.15	5.15-15.15	2.0	Light gray sandy clay with limestone rocks followed by brownish orange sandy clay with limestone fragments followed by light brown to tan sandy clay with limestone fragments followed by white solid limestone
MW-2	6/12/08	25.44023° N 80.56531° W	Hollow Stem Auger	7.74	15.15	5.15-15.15	2.0	Dark gray sandy clay with limestone rocks followed by light gray sandy clay with limestone rocks followed by white solid limestone
MW-3	6/12/08	25.42536° N 80.56326° W	Hollow Stem Auger	6.43	15.15	5.15-15.15	2.0	Dark gray sandy clay with limestone rocks followed by light gray sandy clay followed by light gray to white sandy clay with limestone fragments followed by white solid limestone
MW-4	6/12/08	25.41819 °N 80.56532 ° W	Hollow Stem Auger	7.33	15.15	5.15-15.15	2.0	Light to medium gray sandy clay with limestone fragments followed by light gray sandy clay with limestone fragments followed by white solid limestone
MW-5	6/13/08	25.41453° N 80.56533° W	Hollow Stem Auger	7.35	15.15	5.15-15.15	2.0	Medium gray sandy clay with limestone rocks followed by light gray sandy clay with limestone fragments followed by white solid limestone
MW-6	6/13/08	25.40727° N 80.56531° W	Hollow Stem Auger	7.85	15.15	5.15-15.15	2.0	Medium gray sandy clay with limestone rocks followed by light gray sandy clay with limestone fragments followed by white solid limestone
MW-7	6/13/08	25.40369° N 80.56999° W	Hollow Stem Auger	6.67	15.15	5.15-15.15	2.0	Medium to light gray sandy clay with limestone rocks followed by light gray to white sandy clay with limestone fragments followed by white solid limestone
MW-8	6/12/08	25.42100°N 80.57449° W	Hollow Stem Auger	7.34	15.08	5.08 - 15.08	2.0	Medium gray sandy clay with limestone fragments followed by light gray sandy clay with limestone fragments followed by very hard limestone followed by white solid limestone

NOTES:

Monitor wells installed on June 12th and 13th, 2008 by CM2 Drilling, Inc..

Monitor wells surveyed on June 23rd, 2008 by Scott A. Guzzi & Associates, Inc.

NGVD - National Geodetic Vertical Datum

FBLS - feet below land surface

* GPS Locations recorded in decimal degrees Latitude and Longitude NAD 83

TABLE 2

SUMMARY OF LEVEL TROLL INFORMATION
FROG POND - HYDROLOGIC EVALUATION
Florida City, Miami-Dade County, Florida
South Florida Water Management District
URS Job # 38617-098

	FROG POND							
Well ID	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8
Device	Level Troll® 500	Level Troll® 500	---	Level Troll® 500	---	---	Level Troll® 500	Level Troll® 500
Troll Serial No	129279 (V)	131513 (V)	---	131572 (V)	---	---	131532 (V)	131530 (V)
Date Installed/Reinstalled	6/23/2008	6/23/2008	---	6/23/2008	---	---	6/23/2008	6/23/2008
GPS Location *	25.44571° N 80.56929° W	25.44023° N 80.56531° W	25.42536° N 80.56326° W	25.41819 °N 80.56532 ° W	25.41453° N 80.56533° W	25.40727° N 80.56531° W	25.40369° N 80.56999° W	25.42100°N 80.57449° W
Depth to Water [feet]	5.42	5.30	---	5.24	---	---	5.41	4.96
Total Well Depth [feet]	15.15	15.15	15.15	15.15	15.15	15.15	15.15	15.08
Screen Interval [feet]	5.15 - 15.15	5.15 - 15.15	5.15 - 15.15	5.15 - 15.15	5.15 - 15.15	5.15 - 15.15	5.15 - 15.15	5.08 - 15.08
TOC Elevation [feet]	18.12	17.74	16.43	16.43	17.35	17.85	16.67	17.34
Well Diameter (inches)	2	2	2	2	2	2	2	2
Time Intervals [minutes]	30	30	---	30	---	---	30	30
Sensor Range [psi]	30	30	---	30	---	---	30	30
Desicant Condition **	Replaced on 7/3/08 and 7/22/08	Replaced on 7/3/08 and 7/22/08	---	Replaced on 7/3/08 and 7/22/08	---	---	Replaced on 7/3/08 and 7/22/08	Replaced on 7/3/08 and 7/22/08
Cord Condition	Good	Good	---	Good	---	---	Good	Good

NOTES:
[1] Level Troll data is compared to weather stationrainfall data collected at the KFLHOMES5 site located approximately 3.5 miles northeast of MW-1 at 25.47° N and 80.52° W NAD 83
(V): Vented, pounds per square inch (gauged)
TOC Elevation: Top of Casing Elevation
psi: pounds per square inch
Monitor wells surveyed on June 23rd, 2008 by Scott A. Guzzi & Associates, Inc.
--- = Level Troll® 500's were not initially installed in monitor wells MW-3, MW-5, and MW-6
* GPS Locations recorded in decimal degrees Latitude and Longitude NAD 83
** Larger Level Troll desicants were installed on July 22, 2008 to replace the smaller standard Level Troll desicants which were initially used.

TABLE 3

SUMMARY OF FIELD EVENTS AND DATALOGGER INFORMATION
FROG POND - HYDROLOGIC EVALUATION
Florida City, Miami-Dade County, Florida
South Florida Water Management District
URS Job # 38617-098

Date	Activity Description
6/23/08	Recorded DTW measurments at all monitor well locations. Installation of five (5) Level Troll® 500's in monitor wells MW-1, MW-2, MW-4, MW-7, and MW-8.
7/3/08	Recorded DTW measurments at all monitor well locations. Download Level Troll® 500 data from monitor wells MW-1, MW-2, MW-4, MW-7, and MW-8. All desicants were changed once the Level Troll® 500 data was downloaded.
7/22/08	Recorded DTW measurments at all monitor well locations. Download Level Troll® 500 data from monitor wells MW-1, MW-2, MW-4, MW-7, and MW-8. All desicants were changed once the Level Troll® 500 data was downloaded.
10/21/08	Recorded DTW measurments at all monitor well locations. Download Level Troll® 500 data from monitor wells MW-1, MW-2, MW-4, MW-7, and MW-8.
12/9/08	Recorded DTW measurments at all monitor well locations. Download Level Troll® 500 data from monitor wells MW-1, MW-2, MW-4, MW-7, and MW-8. The MW-7 monitor well casing was observed to be disturbed. The integrity of the monitor well was not disturbed and the Level Troll was intact inside the monitor well recording the data.

NOTES:

Depth to Water (DTW) was measured during all onsite visits to download Level Troll® 500 data

TABLE 4

SUMMARY OF GROUNDWATER ELEVATION DATA
FROG POND - HYDROLOGIC EVALUATION
Florida City, Miami-Dade County, Florida
South Florida Water Management District
URS Job # 38617-098

Location	Date	Well Diameter	Top of Casing Elevation (TOC) * (ft)	Depth to Water (ft)	Relative Water Table Elevation (ft)
MW-1	6/16/2008	2"	18.12	7.01	11.11
	6/23/2008			5.42	12.70
	7/3/2008			5.60	12.52
	7/22/2008			5.75	12.37
	10/21/2008			4.87	13.25
	12/9/2008			5.20	12.92
MW-2	6/16/2008	2"	17.74	6.63	11.11
	6/23/2008			5.30	12.44
	7/3/2008			5.43	12.31
	7/22/2008			5.55	12.19
	10/21/2008			5.10	12.64
	12/9/2008			5.26	12.48
MW-3	6/16/2008	2"	16.43	5.56	10.87
	6/23/2008			4.26	12.17
	7/3/2008			4.44	11.99
	7/22/2008			4.57	11.86
	10/21/2008			4.15	12.28
	12/9/2008			4.36	12.07
MW-4	6/16/2008	2"	16.43	6.64	9.79
	6/23/2008			5.24	11.19
	7/3/2008			5.53	10.90
	7/22/2008			5.70	10.73
	10/21/2008			5.26	11.17
	12/9/2008			5.42	11.01
MW-5	6/16/2008	2"	17.35	6.72	10.63
	6/23/2008			5.44	11.91
	7/3/2008			5.68	11.67
	7/22/2008			5.84	11.51
	10/21/2008			5.71	11.64
	12/9/2008			5.80	11.55
MW-6	6/16/2008	2"	17.85	7.52	10.33
	6/23/2008			6.41	11.44
	7/3/2008			6.60	11.25
	7/22/2008			6.74	11.11
	10/21/2008			6.37	11.48
	12/9/2008			6.50	11.35
MW-7	6/16/2008	2"	16.67	6.74	9.93
	6/23/2008			5.41	11.26
	7/3/2008			5.51	11.16
	7/22/2008			5.65	11.02
	10/21/2008			5.05	11.62
	12/9/2008			5.41	11.26
MW-8	6/16/2008	2"	17.34	6.73	10.61
	6/23/2008			4.96	12.38
	7/3/2008			5.10	12.24
	7/22/2008			5.34	12.00
	10/21/2008			3.81	13.53
	12/9/2008			4.21	13.13

NOTES:
ft = feet
* TOC elevations were surveyed by Scott A. Guzzi and Associates, Inc. on June 23, 2006
* 10 feet was added to each of the recorded NGVD TOC elevations.

TABLE 5

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
FROG POND - HYDROLOGIC EVALUATION
Florida City, Miami-Dade County, Florida
South Florida Water Management District
URS Job # 38617-098
October 21, 2008

SAMPLE IDENTIFICATION		Sample ID										
		MW-1	MW-2	MW-3	DUP-1	MW-3(SPLIT) [4]	MW-4	MW-5	MW-6	MW-7	MW-8	EQUIPMENT BLANK
Laboratory Analysis	GCTL[1]											
EPA Method 8081 (µg/L)												
4,4-DDD	0.1	0.0081 U	0.0081 U	0.0084 U	0.0083 U	0.0018 U	0.0081 U	0.0081 U	0.0081 U	0.0085 U	0.0081 U	0.0081 U
4,4-DDE	0.1	0.0086 U	0.0086 U	0.0089 U	0.0088 U	0.00085 U	0.0086 U	0.0086 U	0.0086 U	0.0090 U	0.0086 U	0.0086 U
4,4-DDT	0.1	0.014 U	0.014 U	0.014 U	0.014 U	0.0034 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U
Aldrin	0.002	0.0070 U	0.0070 U	0.0072 U	0.0071 U	0.00047 U	0.0070 U	0.0070 U	0.0070 U	0.0073 U	0.0070 U	0.0070 U
Dieldrin	0.002	0.0075 U	0.0075 U	0.0077 U	0.0077 U	0.00047 U	0.0075 U	0.0075 U	0.0075 U	0.0078 U	0.0075 U	0.0075 U
Endrin	2 [2]	0.0092 U	0.0092 U	0.0095 U	0.0094 U	0.0016 U	0.0092 U	0.0092 U	0.0092 U	0.0096 U	0.0092 U	0.0092 U
Endrin Aldehyde	---	0.0087 U	0.0087 U	0.0090 U	0.0089 U	0.0067 U	0.0087 U	0.0087 U	0.0087 U	0.0091 U	0.0087 U	0.0087 U
Endrin Ketone	---	0.0055 U	0.0055 U	0.0056 U	0.0056 U	0.0010 U	0.0055 U	0.0055 U	0.0055 U	0.0057 U	0.0055 U	0.0055 U
Heptachlor	0.4 [2]	0.0098 U	0.0098 U	0.011 U	0.010 U	0.0014 U	0.0098 U	0.0098 U	0.0098 U	0.011 U	0.0098 U	0.0098 U
Heptachlor Epoxide	0.2 [2]	0.0081 U	0.0081 U	0.0084 U	0.0083 U	0.00038 U	0.0081 U	0.0081 U	0.0081 U	0.0085 U	0.0081 U	0.0081 U
Alpha-BHC	0.006	0.0081 U	0.0081 U	0.0084 U	0.0083 U	0.00028 U	0.0081 U	0.0081 U	0.0081 U	0.0085 U	0.0081 U	0.0081 U
Beta-BHC	0.02	0.0087 U	0.0087 U	0.0090 U	0.0089 U	0.00047 U	0.0087 U	0.0087 U	0.0087 U	0.0091 U	0.0087U	0.0087 U
Gamma-BHC (Lindane)	0.2 [2]	0.0084 U	0.0084 U	0.0087 U	0.0086 U	0.00019 U	0.0084 U	0.0084 U	0.0084 U	0.0088 U	0.0084 U	0.0084 U
Delta-BHC	2.1	0.012 U	0.012 U	0.012 U	0.012 U	0.00038 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Endosulfan I	42	0.0091 U	0.0091 U	0.0094 U	0.0093 U	0.00066 U	0.0091 U	0.0091 U	0.0091 U	0.0095 U	0.0091 U	0.0091 U
Endosulfan II	42	0.0066 U	0.0066 U	0.0068 U	0.0067 U	0.00066 U	0.0066 U	0.0066 U	0.0066 U	0.0069 U	0.0066 U	0.0066 U
Endosulfan Sulfate	42	0.0094 U	0.0094 U	0.014 I	0.0095 U	0.016	0.0094 U	0.0094 U	0.0094 U	0.0096 U	0.0094 U	0.0094 U
Endosulfan (alpha+beta+sulfate)	42	0.0251 U	0.0251 U	0.014 I	0.0256 U	0.016	0.0251 U	0.0251 U	0.0251 U	0.0262 U	0.0251 U	0.0251 U
Methoxychlor	40 [2]	0.012 U	0.012 U	0.012 U	0.012 U	0.0066 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Alpha-Chlordane	2 [2]	0.0068 U	0.0068 U	0.0070 U	0.0069 U	0.0012 U	0.0068 U	0.0068 U	0.0068 U	0.0071 U	0.0068 U	0.0068 U
Gamma-Chlordane	2 [2]	0.0077 U	0.0077 U	0.0079 U	0.0079 U	0.0015 U	0.0077 U	0.0077 U	0.0077 U	0.0080 U	0.0077 U	0.0077 U
Chlordane, Total	2 [2]	0.0145 U	0.0145 U	0.0092 U	0.0148 U	0.0027 U	0.0145 U	0.0145 U	0.0145 U	0.0151 U	0.0145 U	0.0145 U
Toxaphene	3 [2]	0.52 U	0.52 U	0.53 U	0.53 U	0.27 U	0.52 U	0.52 U	0.52 U	0.54 U	0.52 U	0.52 U
METALS (µg/L)												
Barium	2000 [2]	15	17	17	17	20	20	26	31	18	11	0.9 I
Chromium	100 [2]	0.8 U	0.8 U	0.8 U	0.8 U	2.5 U	0.8 U	4.7	4.9	0.8 U	0.8 U	0.8 U
Copper	1000 [3]	0.3 U	3.7	1.6 I	1.0 I	2.5 U	0.7 I	33	19	3.2	0.5 I	1.5 I
Zinc	5000 [3]	4 U	4 U	4 U	4 U	10 U	4 U	22	9 I	4 U	4 I	4 U

NOTES:

[1] Chapter 62-777, Florida Administrative Code (FAC), Table I, Groundwater Cleanup Target Levels (GCTLs)

[2] Chapter 62-550, Florida Administrative Code (FAC), Table I, Primary Drinking Water Standards

[3] Chapter 62-550, Florida Administrative Code (FAC), Table I, Secondary Drinking Water Standards

[4] SPLIT sample submitted to PAS, Inc. (formerly ELAB, Inc.) for analysis

µg/L= micrograms per kilogram

-- = GCTL Not Developed

U - Below laboratory method detection limit

I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit or analyte detected below quantitation limits

J - Estimated value - The reported value failed to meet the established quality control criteria for either precision or accuracy

752

TABLE 6

Summary of Historical Groundwater Analytical Results
FROG POND - HYDROLOGIC EVALUATION
Miami-Dade County, Florida
South Florida Water Management District
Job No. 38617-093

SAMPLE IDENTIFICATION		SAMPLE ID									
		MW-1		MW-2		MW-3	MW-3	DUP-1	MW-3(SPLIT)[4]	MW-4	
	Date	6/16/2008	10/21/2008	6/16/2008	10/21/2008	6/16/2008	10/21/2008	10/21/2008	10/21/2008	6/16/2008	10/21/2008
Laboratory Analysis	**GCTL[1]**										
EPA Method 8081 (µg/L)											
4,4-DDD	0.1	0.0081 UJ	0.0081 U	0.0081 UJ	0.0081 U	0.0081 UJ	0.0084 U	0.0083 U	0.0018 U	0.0079 UJ	0.0081 U
4,4-DDE	0.1	0.0086 U	0.0086 U	0.0086 U	0.0086 U	0.0086 U	0.0089 U	0.0088 U	0.00085 U	0.0084 U	0.0086 U
4,4-DDT	0.1	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.0034 U	0.013 U	0.014 U
Aldrin	0.002	0.0070 U	0.0070 U	0.0070 U	0.0070 U	0.0070 U	0.0072 U	0.0071 U	0.00047 U	0.0068 U	0.0070 U
Dieldrin	0.002	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0077 U	0.0077 U	0.00047 U	0.0073 U	0.0075 U
Endrin	2[2]	0.0092 U	0.0092 U	0.0092 U	0.0092 U	0.0092 U	0.0095 U	0.0094 U	0.0018 U	0.0090 U	0.0092 U
Endrin Aldehyde	--	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.0090 U	0.0089 U	0.0067 U	0.0085 U	0.0087 U
Endrin Ketone	--	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0056 U	0.0056 U	0.0010 U	0.0053 U	0.0055 U
Heptachlor	0.4[2]	0.0098 U	0.0098 U	0.0098 U	0.0098 U	0.0098 U	0.011 U	0.010 U	0.0014 U	0.0096 U	0.0098 U
Heptachlor Epoxide	0.2[2]	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0084 U	0.0083 U	0.00038 U	0.0079 U	0.0081 U
Alpha-BHC	0.006	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0084 U	0.0083 U	0.00028 U	0.0079 U	0.0081 U
Beta-BHC	0.02	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.0090 U	0.0089 U	0.00047 U	0.0085 U	0.0087 U
Gamma-BHC (Lindane)	0.2[2]	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0087 U	0.0086 U	0.00019 U	0.0082 U	0.0084 U
Delta-BHC	2.1	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.00038 U	0.011 U	0.012 U
Endosulfan I	42	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0094 U	0.0093 U	0.00066 U	0.0089 U	0.0091 U
Endosulfan II	42	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0068 U	0.0067 U	0.00066 U	0.0064 U	0.0066 U
Endosulfan Sulfate	42	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0141	0.0096 U	0.016	0.0092 U	0.0094 U
Endosulfan (alpha+beta+sulfate)	42	0.0251 U	0.0251 U	0.0251 U	0.0251 U	0.0251 U	0.0141	0.0256 U	0.016	0.0245 U	0.0251 U
Methoxychlor	40[2]	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.0066 U	0.011 U	0.012 U
Alpha-Chlordane	2[2]	0.0068 U	0.0068 U	0.0068 U	0.0068 U	0.0068 U	0.0070 U	0.0069 U	0.0012 U	0.0066 U	0.0068 U
Gamma-Chlordane	2[2]	0.0077 U	0.0077 U	0.0077 U	0.0077 U	0.0077 U	0.0079 U	0.0079 U	0.0015 U	0.0075 U	0.0077 U
Chlordane, Total	2[2]	0.0145 U	0.0145 U	0.0145 U	0.0145 U	0.0145 U	0.0149 U	0.0148 U	0.0027 U	0.0141 U	0.0145 U
Toxaphene	3[2]	0.52 U	0.52 U	0.52 U	0.52 U	0.52 U	0.53 U	0.53 U	0.27 U	0.50 U	0.52 U
METALS (µg/L)											
Barium	2000[3]	16	15	15	17	26	17	17	20	17	20
Chromium	100[3]	0.5 I	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	2.5 U	0.8 U	0.8 U
Copper	1000[3]	0.3 U	0.3 U	0.4 I	3.7	0.6 I	1.8 I	1.0 I	2.5 U	0.3 I	0.7 I
Zinc	5000[3]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	10 U	4 U	4 U

NOTE:

[1] Chapter 62-777, Florida Administrative Code (FAC), Table I, Groundwater Cleanup Target Levels (GCTLs)

[2] Chapter 62-550, Florida Administrative Code (FAC), Table I, Primary Drinking Water Standards

[3] Chapter 62-550, Florida Administrative Code (FAC), Table I, Secondary Drinking Water Standards

[4] SPLIT samples submitted to FAS, Inc. (formerly ELAB, Inc.) for analysis

µg/L= micrograms per kilogram

-- =GCTL Not Developed

U - Below laboratory method detection limit

I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit or analyte detected below quantitation limits

J- Estimated value - The reported value failed to meet the established quality control criteria for either precision or accuracy

* - Groundwater sample MW-5(SPLIT) exhibited 0.0082 IV µg/L or endrin ketone in which no GCTL developed.

V - Analyte detected in the associated Method Blank

TABLE 6 (*continued*)

Summary of Historical Groundwater Analytical Results
FROG POND - HYDROLOGIC EVALUATION
Miami-Dade County, Florida
South Florida Water Management District
Job No. 38617-098

SAMPLE IDENTIFICATION		SAMPLE ID									
		MW-5	DUP-1	MW-5(SPLIT) [4]	MW-5	MW-6		MW-7		MW-8	
	Date	6/16/2008	6/16/2008	6/16/2008	10/21/2008	6/16/2008	10/21/2008	6/16/2008	10/21/2008	6/16/2008	10/21/2008
Laboratory Analysis	**GCTL[1]**										
EPA Method 8081 (µg/L)											
4,4-DDD	0.1	0.0081 UJ	0.0079 UJ	0.0028 U	0.0081 U	0.0081 UJ	0.0081 U	0.0081 UJ	0.0085 U	0.0079 UJ	0.0081 U
4,4-DDE	0.1	0.0086 U	0.0084 U	0.0023 U	0.0086 U	0.0086 U	0.0086 U	0.0086 U	0.0090 U	0.0084 U	0.0086 U
4,4-DDT	0.1	0.014 U	0.013 U	0.0031 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.013 U	0.014 U
Aldrin	0.002	0.0070 U	0.0068 U	0.0014 U	0.0070 U	0.0070 U	0.0070 U	0.0070 U	0.0073 U	0.0068 U	0.0070 U
Dieldrin	0.002	0.0075 U	0.0073 U	0.0048 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0078 U	0.0073 U	0.0075 U
Endrin	2 [2]	0.0092 U	0.0090 U	0.0018 U	0.0092 U	0.0092 U	0.0092 U	0.0092 U	0.0096 U	0.0090 U	0.0092 U
Endrin Aldehyde	---	0.0087 U	0.0085 U	0.0019 U	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.0091 U	0.0085 U	0.0087 U
Endrin Ketone	---	0.0055 U	0.0053 U	0.0032 IV *	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0057 U	0.0053 U	0.0055 U
Heptachlor	0.4 [2]	0.0098 U	0.0096 U	0.0024 U	0.0098 U	0.0098 U	0.0098 U	0.0098 U	0.011 U	0.0096 U	0.0098 U
Heptachlor Epoxide	0.2 [2]	0.0081 U	0.0079 U	0.0098 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0085 U	0.0079 U	0.0081 U
Alpha-BHC	0.006	0.0081 U	0.0079 U	0.0096 U	0.0081 U	0.0081 U	0.0081 U	0.0081 U	0.0085 U	0.0079 U	0.0081 U
Beta-BHC	0.02	0.0087 U	0.0085 U	0.0057 U	0.0087 U	0.0087 U	0.0087 U	0.0087 U	0.0091 U	0.0085 U	0.0087U
Gamma-BHC (Lindane)	0.2 [2]	0.0077 U	0.0082 U	0.0013 U	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0088 U	0.0082 U	0.0084 U
Delta-BHC	2.1	0.012 U	0.011 U	0.033	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.011 U	0.012 U
Endosulfan I	42	0.0091 U	0.0089 U	0.0076 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0095 U	0.0089 U	0.0091 U
Endosulfan II	42	0.0066 U	0.0084 U	0.0019 U	0.0066 U	0.0066 U	0.0066 U	0.0066 U	0.0069 U	0.0064 U	0.0066 U
Endosulfan Sulfate	42	0.0094 U	0.0092 U	0.0017 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0098 U	0.0092 U	0.0094 U
Endosulfan (alpha+beta+sulfate)	42	0.0251 U	0.0245 U	0.0112 U	0.0251 U	0.0251 U	0.0251 U	0.0251 U	0.0262 U	0.0245 U	0.0251 U
Methoxychlor	40 [2]	0.012 U	0.011 U	0.0078 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.011 U	0.012 U
Alpha-Chlordane	2 [2]	0.0068 U	0.0066 U	0.0014 U	0.0068 U	0.0068 U	0.0068 U	0.0068 U	0.0071 U	0.0066 U	0.0068 U
Gamma-Chlordane	2 [2]	0.0077 U	0.0075 U	0.0012 U	0.0077 U	0.0077 U	0.0077 U	0.0077 U	0.0080 U	0.0075 U	0.0077 U
Chlordane, Total	2 [2]	0.0145 U	0.0141 U	0.0026 U	0.0145 U	0.0145 U	0.0145 U	0.0145 U	0.0151 U	0.0141 U	0.0145 U
Toxaphene	3 [2]	0.52 U	0.50 U	0.27 U	0.52 U	0.52 U	0.52 U	0.52 U	0.54 U	0.50 U	0.52 U
METALS (µg/L)											
Barium	2000 [2]	15	15	16	26	18	31	17	18	15	11
Chromium	100 [1]	0.8 U	0.8 U	2.5 U	4.7	2.3	4.9	0.8 U	0.8 U	1.1 I	0.8 U
Copper	1000 [3]	2.9	3	3.9 I	33	5.9	19	1.6 I	3.2	0.3 U	0.5 I
Zinc	5000 [3]	4 U	4 U	10 U	22	10 I	9 I	4 U	4 U	4 U	4 I

NOTE:

[1] Chapter 62-777, Florida Administrative Code (FAC), Table I, Groundwater Cleanup Target Levels (GCTLs)

[2] Chapter 62-550, Florida Administrative Code (FAC), Table I, Primary Drinking Water Standards

[3] Chapter 62-550, Florida Administrative Code (FAC), Table I, Secondary Drinking Water Standards

[4] SPLIT samples submitted to PAS, Inc. (formerly ELAB, Inc.) for analysis

µg/L= micrograms per liltograms

-- =GCTL Not Developed

U - Below laboratory method detection limit

I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit or analyte detected below quantitation limits

J- Estimated value - The reported value failed to meet the established quality control criteria for either precision or accuracy

* - Groundwater sample MW-5(SPLIT) exhibited 0.0082 IV µg/L or endrin ketone in which no GCTL developed.

V - Analyte detected in the associated Method Blank

TABLE 6 (*continued*)

Summary of Historical Groundwater Analytical Results
FROG POND - HYDROLOGIC EVALUATION
Miami-Dade County, Florida
South Florida Water Management District
Job No. 38617-098

SAMPLE IDENTIFICATION		SAMPLE ID	
		EQUIPMENT BLANK	
	Date	6/16/2008	10/21/2008
Laboratory Analysis	GCTL[1]		
EPA Method 8081 (µg/L)			
4,4-DDD	0.1	0.0081 UJ	0.0081 U
4,4-DDE	0.1	0.0086 U	0.0086 U
4,4-DDT	0.1	0.014 U	0.014 U
Aldrin	0.002	0.0079 U	0.0079 U
Dieldrin	0.002	0.0075 U	0.0075 U
Endrin	2 [2]	0.0092 U	0.0092 U
Endrin Aldehyde	---	0.0087 U	0.0087 U
Endrin Ketone	---	0.0055 U	0.0055 U
Heptachlor	0.4 [2]	0.0098 U	0.0098 U
Heptachlor Epoxide	0.2 [2]	0.0081 U	0.0081 U
Alpha-BHC	0.006	0.0061 U	0.0061 U
Beta-BHC	0.02	0.0087 U	0.0087 U
Gamma-BHC (Lindane)	0.2 [2]	0.0084 U	0.0084 U
Delta-BHC	2.1	0.012 U	0.012 U
Endosulfan I	42	0.0091 U	0.0091 U
Endosulfan II	42	0.0066 U	0.0066 U
Endosulfan Sulfate	42	0.0094 U	0.0094 U
Endosulfan (alpha+beta+sulfate)	42	0.0251 U	0.0251 U
Methoxychlor	40 [2]	0.012 U	0.012 U
Alpha-Chlordane	2 [2]	0.0068 U	0.0068 U
Gamma-Chlordane	2 [2]	0.0077 U	0.0077 U
Chlordane, Total	2 [2]	0.0145 U	0.0145 U
Toxaphene	3 [2]	0.52 U	0.52 U
METALS (µg/L)			
Barium	2000 [2]	1.3 I	0.9 I
Chromium	100 [2]	0.8 U	0.8 U
Copper	1000 [3]	2.2	1.5 I
Zinc	5000 [3]	4 U	4 U

NOTE:

[1] Chapter 62-777, Florida Administrative Code (FAC), Table I, Groundwater Cleanup Target Levels (GCTLs)

[2] Chapter 62-550, Florida Administrative Code (FAC), Table I, Primary Drinking Water Standards

[3] Chapter 62-550, Florida Administrative Code (FAC), Table I, Secondary Drinking Water Standards

[4] SPLIT samples submitted to PAS, Inc. (formerly ELAB, Inc.) for analysis

µg/L= micrograms per kilograms

-- =GCTL Not Developed

U - Below laboratory method detection limit

I - The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit or analyte detected below quantitation limits

J- Estimated value - The reported value failed to meet the established quality control criteria for either precision or accuracy

* - Groundwater sample MW-5(SPLIT) exhibited 0.0062 IV µg/L of endrin ketone in which no GCTL developed.

V - Analyte detected in the associated Method Blank

APPENDIX A

SITE SPECIFIC RAINFALL DATA

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
9/1/2008 0:00	0.00
9/1/2008 0:30	0.00
9/1/2008 1:00	0.00
9/1/2008 1:30	0.00
9/1/2008 2:00	0.00
9/1/2008 2:30	0.00
9/1/2008 3:00	0.00
9/1/2008 3:30	0.00
9/1/2008 4:00	0.00
9/1/2008 4:30	0.00
9/1/2008 5:00	0.00
9/1/2008 5:30	0.00
9/1/2008 6:00	0.00
9/1/2008 6:30	0.00
9/1/2008 7:00	0.00
9/1/2008 7:30	0.00
9/1/2008 8:00	0.00
9/1/2008 8:30	0.00
9/1/2008 9:00	0.00
9/1/2008 9:30	0.00
9/1/2008 10:00	0.00
9/1/2008 10:30	0.00
9/1/2008 11:00	0.00
9/1/2008 11:30	0.00
9/1/2008 12:00	0.00
9/1/2008 12:30	0.00
9/1/2008 13:00	0.00
9/1/2008 13:30	0.00
9/1/2008 14:00	0.00
9/1/2008 14:30	0.00
9/1/2008 15:00	0.00
9/1/2008 15:30	0.00
9/1/2008 16:00	0.00
9/1/2008 16:30	0.00
9/1/2008 17:00	0.00
9/1/2008 17:30	0.00
9/1/2008 18:00	0.00
9/1/2008 18:30	0.00
9/1/2008 19:00	0.00
9/1/2008 19:30	0.00
9/1/2008 20:00	0.00
9/1/2008 20:30	0.00
9/1/2008 21:00	0.00
9/1/2008 21:30	0.00
9/1/2008 22:00	0.00
9/1/2008 22:30	0.00
9/1/2008 23:00	0.00
9/1/2008 23:30	0.00
9/2/2008 0:00	0.00
9/2/2008 0:30	0.00
9/2/2008 1:00	0.00
9/2/2008 1:30	0.00
9/2/2008 2:00	0.00
9/2/2008 2:30	0.00
9/2/2008 3:00	0.00
9/2/2008 3:30	0.00
9/2/2008 4:00	0.00
9/2/2008 4:30	0.00
9/2/2008 5:00	0.00
9/2/2008 5:30	0.02
9/2/2008 6:00	0.01
9/2/2008 6:30	0.00
9/2/2008 7:00	0.01
9/2/2008 7:30	0.00
9/2/2008 8:00	0.00
9/2/2008 8:30	0.00
9/2/2008 9:00	0.00
9/2/2008 9:30	0.00
9/2/2008 10:00	0.00
9/2/2008 10:30	0.00
9/2/2008 11:00	0.00
9/2/2008 11:30	0.00
9/2/2008 12:00	0.01
9/2/2008 12:30	0.01
9/2/2008 13:00	0.00
9/2/2008 13:30	0.00
9/2/2008 14:00	0.00
9/2/2008 14:30	0.00
9/2/2008 15:00	0.00
9/2/2008 15:30	0.00
9/2/2008 16:00	0.00
9/2/2008 16:30	0.00
9/2/2008 17:00	0.00
9/2/2008 17:30	0.00
9/2/2008 18:00	0.00
9/2/2008 18:30	0.00
9/2/2008 19:00	0.00
9/2/2008 19:30	0.00
9/2/2008 20:00	0.00
9/2/2008 20:30	0.00
9/2/2008 21:00	0.00
9/2/2008 21:30	0.00
9/2/2008 22:00	0.00
9/2/2008 22:30	0.00
9/2/2008 23:00	0.00
9/2/2008 23:30	0.00

Date Time	Rainfall (inches)
9/3/2008 0:00	0.10
9/3/2008 0:30	0.02
9/3/2008 1:00	0.00
9/3/2008 1:30	0.01
9/3/2008 2:00	0.01
9/3/2008 2:30	0.00
9/3/2008 3:00	0.00
9/3/2008 3:30	0.00
9/3/2008 4:00	0.00
9/3/2008 4:30	0.00
9/3/2008 5:00	0.00
9/3/2008 5:30	0.00
9/3/2008 6:00	0.00
9/3/2008 6:30	0.00
9/3/2008 7:00	0.00
9/3/2008 7:30	0.00
9/3/2008 8:00	0.00
9/3/2008 8:30	0.00
9/3/2008 9:00	0.00
9/3/2008 9:30	0.00
9/3/2008 10:00	0.00
9/3/2008 10:30	0.00
9/3/2008 11:00	0.01
9/3/2008 11:30	0.01
9/3/2008 12:00	0.00
9/3/2008 12:30	0.00
9/3/2008 13:00	0.00
9/3/2008 13:30	0.00
9/3/2008 14:00	0.00
9/3/2008 14:30	0.00
9/3/2008 15:00	0.00
9/3/2008 15:30	0.00
9/3/2008 16:00	0.00
9/3/2008 16:30	0.00
9/3/2008 17:00	0.00
9/3/2008 17:30	0.00
9/3/2008 18:00	0.00
9/3/2008 18:30	0.00
9/3/2008 19:00	0.00
9/3/2008 19:30	0.00
9/3/2008 20:00	0.00
9/3/2008 20:30	0.00
9/3/2008 21:00	0.00
9/3/2008 21:30	0.00
9/3/2008 22:00	0.00
9/3/2008 22:30	0.00
9/3/2008 23:00	0.00
9/3/2008 23:30	0.00
9/4/2008 0:00	0.00
9/4/2008 0:30	0.00
9/4/2008 1:00	0.00
9/4/2008 1:30	0.00
9/4/2008 2:00	0.00
9/4/2008 2:30	0.00
9/4/2008 3:00	0.00
9/4/2008 3:30	0.00
9/4/2008 4:00	0.00
9/4/2008 4:30	0.00
9/4/2008 5:00	0.00
9/4/2008 5:30	0.00
9/4/2008 6:00	0.00
9/4/2008 6:30	0.00
9/4/2008 7:00	0.00
9/4/2008 7:30	0.00
9/4/2008 8:00	0.00
9/4/2008 8:30	0.00
9/4/2008 9:00	0.00
9/4/2008 9:30	0.00
9/4/2008 10:00	0.00
9/4/2008 10:30	0.00
9/4/2008 11:00	0.00
9/4/2008 11:30	0.00
9/4/2008 12:00	0.00
9/4/2008 12:30	0.00
9/4/2008 13:00	0.00
9/4/2008 13:30	0.00
9/4/2008 14:00	0.00
9/4/2008 14:30	0.00
9/4/2008 15:00	0.00
9/4/2008 15:30	0.00
9/4/2008 16:00	0.00
9/4/2008 16:30	0.00
9/4/2008 17:00	0.00
9/4/2008 17:30	0.00
9/4/2008 18:00	0.00
9/4/2008 18:30	0.00
9/4/2008 19:00	0.00
9/4/2008 19:30	0.00
9/4/2008 20:00	0.00
9/4/2008 20:30	0.00
9/4/2008 21:00	0.00
9/4/2008 21:30	0.00
9/4/2008 22:00	0.00
9/4/2008 22:30	0.00
9/4/2008 23:00	0.00
9/4/2008 23:30	0.00
9/5/2008 0:00	0.00

Date Time	Rainfall (inches)
9/5/2008 0:30	0.00
9/5/2008 1:00	0.00
9/5/2008 1:30	0.00
9/5/2008 2:00	0.00
9/5/2008 2:30	0.00
9/5/2008 3:00	0.00
9/5/2008 3:30	0.02
9/5/2008 4:00	0.02
9/5/2008 4:30	0.02
9/5/2008 5:00	0.01
9/5/2008 5:30	0.01
9/5/2008 6:00	0.01
9/5/2008 6:30	0.02
9/5/2008 7:00	0.02
9/5/2008 7:30	0.03
9/5/2008 8:00	0.02
9/5/2008 8:30	0.00
9/5/2008 9:00	0.00
9/5/2008 9:30	0.00
9/5/2008 10:00	0.00
9/5/2008 10:30	0.00
9/5/2008 11:00	0.00
9/5/2008 11:30	0.00
9/5/2008 12:00	0.00
9/5/2008 12:30	0.00
9/5/2008 13:00	0.00
9/5/2008 13:30	0.00
9/5/2008 14:00	0.00
9/5/2008 14:30	0.00
9/5/2008 15:00	0.00
9/5/2008 15:30	0.00
9/5/2008 16:00	0.00
9/5/2008 16:30	0.00
9/5/2008 17:00	0.00
9/5/2008 17:30	0.00
9/5/2008 18:00	0.00
9/5/2008 18:30	0.00
9/5/2008 19:00	0.00
9/5/2008 19:30	0.00
9/5/2008 20:00	0.00
9/5/2008 20:30	0.00
9/5/2008 21:00	0.00
9/5/2008 21:30	0.00
9/5/2008 22:00	0.00
9/5/2008 22:30	0.00
9/5/2008 23:00	0.00
9/5/2008 23:30	0.00
9/6/2008 0:00	0.00
9/6/2008 0:30	0.00
9/6/2008 1:00	0.00
9/6/2008 1:30	0.00
9/6/2008 2:00	0.00
9/6/2008 2:30	0.00
9/6/2008 3:00	0.00
9/6/2008 3:30	0.00
9/6/2008 4:00	0.00
9/6/2008 4:30	0.00
9/6/2008 5:00	0.00
9/6/2008 5:30	0.00
9/6/2008 6:00	0.00
9/6/2008 6:30	0.00
9/6/2008 7:00	0.00
9/6/2008 7:30	0.00
9/6/2008 8:00	0.00
9/6/2008 8:30	0.00
9/6/2008 9:00	0.00
9/6/2008 9:30	0.00
9/6/2008 10:00	0.00
9/6/2008 10:30	0.00
9/6/2008 11:00	0.00
9/6/2008 11:30	0.00
9/6/2008 12:00	0.00
9/6/2008 12:30	0.00
9/6/2008 13:00	0.00
9/6/2008 13:30	0.00
9/6/2008 14:00	0.00
9/6/2008 14:30	0.00
9/6/2008 15:00	0.00
9/6/2008 15:30	0.00
9/6/2008 16:00	0.00
9/6/2008 16:30	0.00
9/6/2008 17:00	0.00
9/6/2008 17:30	0.00
9/6/2008 18:00	0.00
9/6/2008 18:30	0.00
9/6/2008 19:00	0.00
9/6/2008 19:30	0.00
9/6/2008 20:00	0.00
9/6/2008 20:30	0.00
9/6/2008 21:00	0.00
9/6/2008 21:30	0.00
9/6/2008 22:00	0.00
9/6/2008 22:30	0.00
9/6/2008 23:00	0.00
9/6/2008 23:30	0.00
9/7/2008 0:00	0.00

Date Time	Rainfall (inches)
9/7/2008 0:30	0.00
9/7/2008 1:00	0.00
9/7/2008 1:30	0.00
9/7/2008 2:00	0.00
9/7/2008 2:30	0.00
9/7/2008 3:00	0.00
9/7/2008 3:30	0.00
9/7/2008 4:00	0.00
9/7/2008 4:30	0.00
9/7/2008 5:00	0.00
9/7/2008 5:30	0.00
9/7/2008 6:00	0.00
9/7/2008 6:30	0.00
9/7/2008 7:00	0.00
9/7/2008 7:30	0.00
9/7/2008 8:00	0.00
9/7/2008 8:30	0.00
9/7/2008 9:00	0.00
9/7/2008 9:30	0.00
9/7/2008 10:00	0.00
9/7/2008 10:30	0.00
9/7/2008 11:00	0.00
9/7/2008 11:30	0.00
9/7/2008 12:00	0.00
9/7/2008 12:30	0.00
9/7/2008 13:00	0.00
9/7/2008 13:30	0.00
9/7/2008 14:00	0.00
9/7/2008 14:30	0.00
9/7/2008 15:00	0.00
9/7/2008 15:30	0.00
9/7/2008 16:00	0.00
9/7/2008 16:30	0.00
9/7/2008 17:00	0.00
9/7/2008 17:30	0.00
9/7/2008 18:00	0.00
9/7/2008 18:30	0.00
9/7/2008 19:00	0.00
9/7/2008 19:30	0.00
9/7/2008 20:00	0.00
9/7/2008 20:30	0.00
9/7/2008 21:00	0.00
9/7/2008 21:30	0.00
9/7/2008 22:00	0.00
9/7/2008 22:30	0.00
9/7/2008 23:00	0.00
9/7/2008 23:30	0.00
9/8/2008 0:00	0.00
9/8/2008 0:30	0.00
9/8/2008 1:00	0.00
9/8/2008 1:30	0.00
9/8/2008 2:00	0.00
9/8/2008 2:30	0.00
9/8/2008 3:00	0.00
9/8/2008 3:30	0.00
9/8/2008 4:00	0.00
9/8/2008 4:30	0.00
9/8/2008 5:00	0.00
9/8/2008 5:30	0.00
9/8/2008 6:00	0.00
9/8/2008 6:30	0.00
9/8/2008 7:00	0.00
9/8/2008 7:30	0.00
9/8/2008 8:00	0.00
9/8/2008 8:30	0.00
9/8/2008 9:00	0.00
9/8/2008 9:30	0.00
9/8/2008 10:00	0.00
9/8/2008 10:30	0.00
9/8/2008 11:00	0.00
9/8/2008 11:30	0.00
9/8/2008 12:00	0.00
9/8/2008 12:30	0.00
9/8/2008 13:00	0.00
9/8/2008 13:30	0.00
9/8/2008 14:00	0.00
9/8/2008 14:30	0.00
9/8/2008 15:00	0.00
9/8/2008 15:30	0.00
9/8/2008 16:00	0.00
9/8/2008 16:30	0.00
9/8/2008 17:00	0.00
9/8/2008 17:30	0.00
9/8/2008 18:00	0.07
9/8/2008 18:30	0.07
9/8/2008 19:00	0.01
9/8/2008 19:30	0.01
9/8/2008 20:00	0.00
9/8/2008 20:30	0.00
9/8/2008 21:00	0.00
9/8/2008 21:30	0.00
9/8/2008 22:00	0.00
9/8/2008 22:30	0.00
9/8/2008 23:00	0.00
9/8/2008 23:30	0.00
9/9/2008 0:00	0.00

Date Time	Rainfall (inches)
9/9/2008 0:30	0.00
9/9/2008 1:00	0.00
9/9/2008 1:30	0.00
9/9/2008 2:00	0.00
9/9/2008 2:30	0.00
9/9/2008 3:00	0.00
9/9/2008 3:30	0.00
9/9/2008 4:00	0.00
9/9/2008 4:30	0.00
9/9/2008 5:00	0.00
9/9/2008 5:30	0.00
9/9/2008 6:00	0.00
9/9/2008 6:30	0.00
9/9/2008 7:00	0.00
9/9/2008 7:30	0.00
9/9/2008 8:00	0.00
9/9/2008 8:30	0.00
9/9/2008 9:00	0.00
9/9/2008 9:30	0.03
9/9/2008 10:00	0.03
9/9/2008 10:30	0.00
9/9/2008 11:00	0.00
9/9/2008 11:30	0.00
9/9/2008 12:00	0.00
9/9/2008 12:30	0.00
9/9/2008 13:00	0.00
9/9/2008 13:30	0.02
9/9/2008 14:00	0.20
9/9/2008 14:30	0.18
9/9/2008 15:00	0.00
9/9/2008 15:30	0.00
9/9/2008 16:00	0.00
9/9/2008 16:30	0.02
9/9/2008 17:00	0.03
9/9/2008 17:30	0.31
9/9/2008 18:00	0.28
9/9/2008 18:30	0.01
9/9/2008 19:00	0.01
9/9/2008 19:30	0.00
9/9/2008 20:00	0.00
9/9/2008 20:30	0.00
9/9/2008 21:00	0.00
9/9/2008 21:30	0.00
9/9/2008 22:00	0.19
9/9/2008 22:30	0.19
9/9/2008 23:00	0.00
9/9/2008 23:30	0.02
9/10/2008 0:00	0.05
9/10/2008 0:30	0.03
9/10/2008 1:00	0.00
9/10/2008 1:30	0.00
9/10/2008 2:00	0.00
9/10/2008 2:30	0.00
9/10/2008 3:00	0.00
9/10/2008 3:30	0.00
9/10/2008 4:00	0.00
9/10/2008 4:30	0.00
9/10/2008 5:00	0.00
9/10/2008 5:30	0.00
9/10/2008 6:00	0.00
9/10/2008 6:30	0.00
9/10/2008 7:00	0.00
9/10/2008 7:30	0.00
9/10/2008 8:00	0.00
9/10/2008 8:30	0.00
9/10/2008 9:00	0.00
9/10/2008 9:30	0.00
9/10/2008 10:00	0.00
9/10/2008 10:30	0.00
9/10/2008 11:00	0.00
9/10/2008 11:30	0.00
9/10/2008 12:00	0.00
9/10/2008 12:30	0.00
9/10/2008 13:00	0.00
9/10/2008 13:30	0.00
9/10/2008 14:00	0.00
9/10/2008 14:30	0.00
9/10/2008 15:00	0.00
9/10/2008 15:30	0.00
9/10/2008 16:00	0.00
9/10/2008 16:30	0.00
9/10/2008 17:00	0.00
9/10/2008 17:30	0.00
9/10/2008 18:00	0.00
9/10/2008 18:30	0.00
9/10/2008 19:00	0.00
9/10/2008 19:30	0.00
9/10/2008 20:00	0.00
9/10/2008 20:30	0.00
9/10/2008 21:00	0.00
9/10/2008 21:30	0.00
9/10/2008 22:00	0.00
9/10/2008 22:30	0.00
9/10/2008 23:00	0.00
9/10/2008 23:30	0.00
9/11/2008 0:00	0.00

Note:
Weather Station KFLHOMES5 is locate approximately 3.5 miles northeast of monitor well MW-1.
KFLHOMES5 is located at Latitude 25.498 N , Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOME55

Farmland Estates, Homestead, FL

South Florida Water Management District

UR5 Job # 39617-098

Date Time	Rainfall (inches)
9/11/2008 0:30	0.00
9/11/2008 1:00	0.00
9/11/2008 1:30	0.00
9/11/2008 2:00	0.00
9/11/2008 2:30	0.00
9/11/2008 3:00	0.00
9/11/2008 3:30	0.00
9/11/2008 4:00	0.00
9/11/2008 4:30	0.00
9/11/2008 5:00	0.00
9/11/2008 5:30	0.00
9/11/2008 6:00	0.00
9/11/2008 6:30	0.00
9/11/2008 7:00	0.00
9/11/2008 7:30	0.00
9/11/2008 8:00	0.00
9/11/2008 8:30	0.00
9/11/2008 9:00	0.00
9/11/2008 9:30	0.00
9/11/2008 10:00	0.00
9/11/2008 10:30	0.00
9/11/2008 11:00	0.00
9/11/2008 11:30	0.00
9/11/2008 12:00	0.00
9/11/2008 12:30	0.00
9/11/2008 13:00	0.00
9/11/2008 13:30	0.00
9/11/2008 14:00	0.00
9/11/2008 14:30	0.00
9/11/2008 15:00	0.00
9/11/2008 15:30	0.00
9/11/2008 16:00	0.00
9/11/2008 16:30	0.00
9/11/2008 17:00	0.00
9/11/2008 17:30	0.00
9/11/2008 18:00	0.00
9/11/2008 18:30	0.00
9/11/2008 19:00	0.00
9/11/2008 19:30	0.00
9/11/2008 20:00	0.00
9/11/2008 20:30	0.00
9/11/2008 21:00	0.00
9/11/2008 21:30	0.00
9/11/2008 22:00	0.00
9/11/2008 22:30	0.00
9/11/2008 23:00	0.00
9/11/2008 23:30	0.00
9/12/2008 0:00	0.00
9/12/2008 0:30	0.00
9/12/2008 1:00	0.00
9/12/2008 1:30	0.00
9/12/2008 2:00	0.00
9/12/2008 2:30	0.00
9/12/2008 3:00	0.00
9/12/2008 3:30	0.00
9/12/2008 4:00	0.00
9/12/2008 4:30	0.00
9/12/2008 5:00	0.00
9/12/2008 5:30	0.00
9/12/2008 6:00	0.00
9/12/2008 6:30	0.00
9/12/2008 7:00	0.00
9/12/2008 7:30	0.00
9/12/2008 8:00	0.00
9/12/2008 8:30	0.00
9/12/2008 9:00	0.00
9/12/2008 9:30	0.00
9/12/2008 10:00	0.00
9/12/2008 10:30	0.00
9/12/2008 11:00	0.00
9/12/2008 11:30	0.00
9/12/2008 12:00	0.00
9/12/2008 12:30	0.00
9/12/2008 13:00	0.00
9/12/2008 13:30	0.00
9/12/2008 14:00	0.00
9/12/2008 14:30	0.00
9/12/2008 15:00	0.00
9/12/2008 15:30	0.00
9/12/2008 16:00	0.00
9/12/2008 16:30	0.00
9/12/2008 17:00	0.00
9/12/2008 17:30	0.00
9/12/2008 18:00	0.00
9/12/2008 18:30	0.00
9/12/2008 19:00	0.00
9/12/2008 19:30	0.00
9/12/2008 20:00	0.00
9/12/2008 20:30	0.00
9/12/2008 21:00	0.00
9/12/2008 21:30	0.00
9/12/2008 22:00	0.00
9/12/2008 22:30	0.00
9/12/2008 23:00	0.00
9/12/2008 23:30	0.00
9/13/2008 0:00	0.00

Date Time	Rainfall (inches)
9/13/2008 0:30	0.00
9/13/2008 1:00	0.00
9/13/2008 1:30	0.00
9/13/2008 2:00	0.00
9/13/2008 2:30	0.00
9/13/2008 3:00	0.00
9/13/2008 3:30	0.00
9/13/2008 4:00	0.00
9/13/2008 4:30	0.00
9/13/2008 5:00	0.00
9/13/2008 5:30	0.00
9/13/2008 6:00	0.00
9/13/2008 6:30	0.00
9/13/2008 7:00	0.00
9/13/2008 7:30	0.00
9/13/2008 8:00	0.00
9/13/2008 8:30	0.00
9/13/2008 9:00	0.00
9/13/2008 9:30	0.00
9/13/2008 10:00	0.00
9/13/2008 10:30	0.00
9/13/2008 11:00	0.00
9/13/2008 11:30	0.00
9/13/2008 12:00	0.00
9/13/2008 12:30	0.00
9/13/2008 13:00	0.00
9/13/2008 13:30	0.00
9/13/2008 14:00	0.00
9/13/2008 14:30	0.00
9/13/2008 15:00	0.00
9/13/2008 15:30	0.00
9/13/2008 16:00	0.00
9/13/2008 16:30	0.00
9/13/2008 17:00	0.00
9/13/2008 17:30	0.00
9/13/2008 18:00	0.00
9/13/2008 18:30	0.00
9/13/2008 19:00	0.00
9/13/2008 19:30	0.00
9/13/2008 20:00	0.00
9/13/2008 20:30	0.00
9/13/2008 21:00	0.00
9/13/2008 21:30	0.00
9/13/2008 22:00	0.00
9/13/2008 22:30	0.00
9/13/2008 23:00	0.00
9/13/2008 23:30	0.00
9/14/2008 0:00	0.00
9/14/2008 0:30	0.00
9/14/2008 1:00	0.00
9/14/2008 1:30	0.00
9/14/2008 2:00	0.00
9/14/2008 2:30	0.00
9/14/2008 3:00	0.00
9/14/2008 3:30	0.00
9/14/2008 4:00	0.00
9/14/2008 4:30	0.00
9/14/2008 5:00	0.00
9/14/2008 5:30	0.00
9/14/2008 6:00	0.00
9/14/2008 6:30	0.00
9/14/2008 7:00	0.00
9/14/2008 7:30	0.00
9/14/2008 8:00	0.00
9/14/2008 8:30	0.00
9/14/2008 9:00	0.00
9/14/2008 9:30	0.00
9/14/2008 10:00	0.00
9/14/2008 10:30	0.00
9/14/2008 11:00	0.00
9/14/2008 11:30	0.00
9/14/2008 12:00	0.00
9/14/2008 12:30	0.00
9/14/2008 13:00	0.00
9/14/2008 13:30	0.00
9/14/2008 14:00	0.00
9/14/2008 14:30	0.00
9/14/2008 15:00	0.00
9/14/2008 15:30	0.00
9/14/2008 16:00	0.00
9/14/2008 16:30	0.00
9/14/2008 17:00	0.00
9/14/2008 17:30	0.00
9/14/2008 18:00	0.00
9/14/2008 18:30	0.00
9/14/2008 19:00	0.00
9/14/2008 19:30	0.00
9/14/2008 20:00	0.00
9/14/2008 20:30	0.00
9/14/2008 21:00	0.00
9/14/2008 21:30	0.00
9/14/2008 22:00	0.00
9/14/2008 22:30	0.00
9/14/2008 23:00	0.00
9/14/2008 23:30	0.00
9/15/2008 0:00	0.00

Date Time	Rainfall (inches)
9/15/2008 0:30	0.00
9/15/2008 1:00	0.00
9/15/2008 1:30	0.00
9/15/2008 2:00	0.00
9/15/2008 2:30	0.00
9/15/2008 3:00	0.00
9/15/2008 3:30	0.00
9/15/2008 4:00	0.00
9/15/2008 4:30	0.00
9/15/2008 5:00	0.00
9/15/2008 5:30	0.00
9/15/2008 6:00	0.00
9/15/2008 6:30	0.00
9/15/2008 7:00	0.00
9/15/2008 7:30	0.00
9/15/2008 8:00	0.00
9/15/2008 8:30	0.00
9/15/2008 9:00	0.00
9/15/2008 9:30	0.00
9/15/2008 10:00	0.00
9/15/2008 10:30	0.00
9/15/2008 11:00	0.00
9/15/2008 11:30	0.00
9/15/2008 12:00	0.00
9/15/2008 12:30	0.00
9/15/2008 13:00	0.00
9/15/2008 13:30	0.00
9/15/2008 14:00	0.00
9/15/2008 14:30	0.00
9/15/2008 15:00	0.00
9/15/2008 15:30	0.00
9/15/2008 16:00	0.00
9/15/2008 16:30	0.00
9/15/2008 17:00	0.00
9/15/2008 17:30	0.00
9/15/2008 18:00	0.00
9/15/2008 18:30	0.00
9/15/2008 19:00	0.00
9/15/2008 19:30	0.00
9/15/2008 20:00	0.00
9/15/2008 20:30	0.00
9/15/2008 21:00	0.00
9/15/2008 21:30	0.00
9/15/2008 22:00	0.00
9/15/2008 22:30	0.00
9/15/2008 23:00	0.00
9/15/2008 23:30	0.00
9/16/2008 0:00	0.00

Date Time	Rainfall (inches)
9/16/2008 0:30	0.00
9/16/2008 1:00	0.00
9/16/2008 1:30	0.00
9/16/2008 2:00	0.00
9/16/2008 2:30	0.00
9/16/2008 3:00	0.00
9/16/2008 3:30	0.00
9/16/2008 4:00	0.00
9/16/2008 4:30	0.00
9/16/2008 5:00	0.00
9/16/2008 5:30	0.00
9/16/2008 6:00	0.00
9/16/2008 6:30	0.00
9/16/2008 7:00	0.00
9/16/2008 7:30	0.00
9/16/2008 8:00	0.00
9/16/2008 8:30	0.00
9/16/2008 9:00	0.00
9/16/2008 9:30	0.00
9/16/2008 10:00	0.00
9/16/2008 10:30	0.00
9/16/2008 11:00	0.00
9/16/2008 11:30	0.00
9/16/2008 12:00	0.00
9/16/2008 12:30	0.00
9/16/2008 13:00	0.00
9/16/2008 13:30	0.00
9/16/2008 14:00	0.00
9/16/2008 14:30	0.00
9/16/2008 15:00	0.00
9/16/2008 15:30	0.00
9/16/2008 16:00	0.00
9/16/2008 16:30	0.00
9/16/2008 17:00	0.00
9/16/2008 17:30	0.00
9/16/2008 18:00	0.00
9/16/2008 18:30	0.00
9/16/2008 19:00	0.00
9/16/2008 19:30	0.00
9/16/2008 20:00	0.00
9/16/2008 20:30	0.00
9/16/2008 21:00	0.00
9/16/2008 21:30	0.00
9/16/2008 22:00	0.00
9/16/2008 22:30	0.00
9/16/2008 23:00	0.00
9/16/2008 23:30	0.00
9/17/2008 0:00	0.00

Date Time	Rainfall (inches)
9/17/2008 0:30	0.00
9/17/2008 1:00	0.00
9/17/2008 1:30	0.00
9/17/2008 2:00	0.00
9/17/2008 2:30	0.00
9/17/2008 3:00	0.00
9/17/2008 3:30	0.00
9/17/2008 4:00	0.00
9/17/2008 4:30	0.00
9/17/2008 5:00	0.00
9/17/2008 5:30	0.00
9/17/2008 6:00	0.00
9/17/2008 6:30	0.00
9/17/2008 7:00	0.00
9/17/2008 7:30	0.00
9/17/2008 8:00	0.00
9/17/2008 8:30	0.00
9/17/2008 9:00	0.00
9/17/2008 9:30	0.00
9/17/2008 10:00	0.00
9/17/2008 10:30	0.00
9/17/2008 11:00	0.00
9/17/2008 11:30	0.00
9/17/2008 12:00	0.00
9/17/2008 12:30	0.00
9/17/2008 13:00	0.00
9/17/2008 13:30	0.00
9/17/2008 14:00	0.00
9/17/2008 14:30	0.00
9/17/2008 15:00	0.00
9/17/2008 15:30	0.00
9/17/2008 16:00	0.00
9/17/2008 16:30	0.00
9/17/2008 17:00	0.00
9/17/2008 17:30	0.00
9/17/2008 18:00	0.00
9/17/2008 18:30	0.00
9/17/2008 19:00	0.00
9/17/2008 19:30	0.00
9/17/2008 20:00	0.00
9/17/2008 20:30	0.00
9/17/2008 21:00	0.00
9/17/2008 21:30	0.00
9/17/2008 22:00	0.00
9/17/2008 22:30	0.00
9/17/2008 23:00	0.00
9/17/2008 23:30	0.00
9/18/2008 0:00	0.00
9/18/2008 0:30	0.00
9/18/2008 1:00	0.00
9/18/2008 1:30	0.00
9/18/2008 2:00	0.00
9/18/2008 2:30	0.00
9/18/2008 3:00	0.00
9/18/2008 3:30	0.00
9/18/2008 4:00	0.00
9/18/2008 4:30	0.00
9/18/2008 5:00	0.00
9/18/2008 5:30	0.00
9/18/2008 6:00	0.00
9/18/2008 6:30	0.00
9/18/2008 7:00	0.00
9/18/2008 7:30	0.00
9/18/2008 8:00	0.00
9/18/2008 8:30	0.00
9/18/2008 9:00	0.00
9/18/2008 9:30	0.00
9/18/2008 10:00	0.00
9/18/2008 10:30	0.00
9/18/2008 11:00	0.00
9/18/2008 11:30	0.00
9/18/2008 12:00	0.00
9/18/2008 12:30	0.00
9/18/2008 13:00	0.00
9/18/2008 13:30	0.00
9/18/2008 14:00	0.00
9/18/2008 14:30	0.00
9/18/2008 15:00	0.15
9/18/2008 15:30	0.28
9/18/2008 16:00	0.13
9/18/2008 16:30	0.00
9/18/2008 17:00	0.00
9/18/2008 17:30	0.00
9/18/2008 18:00	0.00
9/18/2008 18:30	0.00
9/18/2008 19:00	0.00
9/18/2008 19:30	0.00
9/18/2008 20:00	0.00
9/18/2008 20:30	0.00
9/18/2008 21:00	0.00
9/18/2008 21:30	0.00
9/18/2008 22:00	0.00
9/18/2008 22:30	0.04
9/18/2008 23:00	0.06
9/18/2008 23:30	0.03
9/19/2008 0:00	0.01

Date Time	Rainfall (inches)
9/19/2008 0:30	0.00
9/19/2008 1:00	0.00
9/19/2008 1:30	0.00
9/19/2008 2:00	0.00
9/19/2008 2:30	0.00
9/19/2008 3:00	0.00
9/19/2008 3:30	0.00
9/19/2008 4:00	0.00
9/19/2008 4:30	0.00
9/19/2008 5:00	0.00
9/19/2008 5:30	0.24
9/19/2008 6:00	0.30
9/19/2008 6:30	0.10
9/19/2008 7:00	0.04
9/19/2008 7:30	0.00
9/19/2008 8:00	0.00
9/19/2008 8:30	0.00
9/19/2008 9:00	0.00
9/19/2008 9:30	0.00
9/19/2008 10:00	0.00
9/19/2008 10:30	0.00
9/19/2008 11:00	0.00
9/19/2008 11:30	0.00
9/19/2008 12:00	0.00
9/19/2008 12:30	0.00
9/19/2008 13:00	0.00
9/19/2008 13:30	0.00
9/19/2008 14:00	0.00
9/19/2008 14:30	0.00
9/19/2008 15:00	0.00
9/19/2008 15:30	0.00
9/19/2008 16:00	0.00
9/19/2008 16:30	0.00
9/19/2008 17:00	0.00
9/19/2008 17:30	0.00
9/19/2008 18:00	0.00
9/19/2008 18:30	0.00
9/19/2008 19:00	0.00
9/19/2008 19:30	0.00
9/19/2008 20:00	0.00
9/19/2008 20:30	0.00
9/19/2008 21:00	0.00
9/19/2008 21:30	0.00
9/19/2008 22:00	0.00
9/19/2008 22:30	0.00
9/19/2008 23:00	0.00
9/19/2008 23:30	0.00
9/20/2008 0:00	0.00
9/20/2008 0:30	0.00
9/20/2008 1:00	0.00
9/20/2008 1:30	0.00
9/20/2008 2:00	0.00
9/20/2008 2:30	0.00
9/20/2008 3:00	0.00
9/20/2008 3:30	0.00
9/20/2008 4:00	0.00
9/20/2008 4:30	0.00
9/20/2008 5:00	0.00
9/20/2008 5:30	0.00
9/20/2008 6:00	0.00
9/20/2008 6:30	0.00
9/20/2008 7:00	0.00
9/20/2008 7:30	0.00
9/20/2008 8:00	0.00
9/20/2008 8:30	0.00
9/20/2008 9:00	0.00
9/20/2008 9:30	0.00
9/20/2008 10:00	0.00
9/20/2008 10:30	0.00
9/20/2008 11:00	0.00
9/20/2008 11:30	0.00
9/20/2008 12:00	0.00
9/20/2008 12:30	0.00
9/20/2008 13:00	0.00
9/20/2008 13:30	0.00
9/20/2008 14:00	0.00
9/20/2008 14:30	0.00
9/20/2008 15:00	0.00
9/20/2008 15:30	0.00
9/20/2008 16:00	0.00
9/20/2008 16:30	0.00
9/20/2008 17:00	0.00
9/20/2008 17:30	0.00
9/20/2008 18:00	0.00
9/20/2008 18:30	0.00
9/20/2008 19:00	0.00
9/20/2008 19:30	0.00
9/20/2008 20:00	0.00
9/20/2008 20:30	0.00
9/20/2008 21:00	0.00
9/20/2008 21:30	0.00
9/20/2008 22:00	0.00
9/20/2008 22:30	0.00
9/20/2008 23:00	0.00
9/20/2008 23:30	0.00
9/21/2008 0:00	0.00

Date Time	Rainfall (inches)
9/21/2008 0:30	0.00
9/21/2008 1:00	0.00
9/21/2008 1:30	0.00
9/21/2008 2:00	0.00
9/21/2008 2:30	0.00
9/21/2008 3:00	0.00
9/21/2008 3:30	0.00
9/21/2008 4:00	0.00
9/21/2008 4:30	0.00
9/21/2008 5:00	0.00
9/21/2008 5:30	0.00
9/21/2008 6:00	0.00
9/21/2008 6:30	0.00
9/21/2008 7:00	0.00
9/21/2008 7:30	0.00
9/21/2008 8:00	0.00
9/21/2008 8:30	0.00
9/21/2008 9:00	0.00
9/21/2008 9:30	0.00
9/21/2008 10:00	0.00
9/21/2008 10:30	0.00
9/21/2008 11:00	0.00
9/21/2008 11:30	0.00
9/21/2008 12:00	0.00
9/21/2008 12:30	0.00
9/21/2008 13:00	0.00
9/21/2008 13:30	0.00
9/21/2008 14:00	0.00
9/21/2008 14:30	0.00
9/21/2008 15:00	0.00
9/21/2008 15:30	0.00
9/21/2008 16:00	0.00
9/21/2008 16:30	0.00
9/21/2008 17:00	0.00
9/21/2008 17:30	0.00
9/21/2008 18:00	0.00
9/21/2008 18:30	0.00
9/21/2008 19:00	0.00
9/21/2008 19:30	0.00
9/21/2008 20:00	0.00
9/21/2008 20:30	0.00
9/21/2008 21:00	0.00
9/21/2008 21:30	0.00
9/21/2008 22:00	0.00
9/21/2008 22:30	0.00
9/21/2008 23:00	0.00
9/21/2008 23:30	0.00
9/22/2008 0:00	0.00
9/22/2008 0:30	0.00
9/22/2008 1:00	0.00
9/22/2008 1:30	0.00
9/22/2008 2:00	0.00
9/22/2008 2:30	0.00
9/22/2008 3:00	0.00
9/22/2008 3:30	0.00
9/22/2008 4:00	0.00
9/22/2008 4:30	0.00
9/22/2008 5:00	0.00
9/22/2008 5:30	0.00
9/22/2008 6:00	0.00
9/22/2008 6:30	0.00
9/22/2008 7:00	0.00
9/22/2008 7:30	0.00
9/22/2008 8:00	0.00
9/22/2008 8:30	0.00
9/22/2008 9:00	0.00
9/22/2008 9:30	0.00
9/22/2008 10:00	0.00
9/22/2008 10:30	0.00
9/22/2008 11:00	0.00
9/22/2008 11:30	0.00
9/22/2008 12:00	0.00
9/22/2008 12:30	0.00
9/22/2008 13:00	0.00
9/22/2008 13:30	0.00
9/22/2008 14:00	0.00
9/22/2008 14:30	0.00
9/22/2008 15:00	0.00
9/22/2008 15:30	0.00
9/22/2008 16:00	0.00
9/22/2008 16:30	0.00
9/22/2008 17:00	0.00
9/22/2008 17:30	0.00
9/22/2008 18:00	0.00
9/22/2008 18:30	0.00
9/22/2008 19:00	0.00
9/22/2008 19:30	0.00
9/22/2008 20:00	0.00
9/22/2008 20:30	0.00
9/22/2008 21:00	0.00
9/22/2008 21:30	0.00
9/22/2008 22:00	0.00
9/22/2008 22:30	0.00
9/22/2008 23:00	0.00
9/22/2008 23:30	0.00
9/23/2008 0:00	0.00

Note:
Weather Station KFLHOME55 is locate approximately 3.5 miles northeast of monitor well MW-1.
KFLHOME55 is located at Latitude 25.468 N , Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOME55

Farmland Estates, Homestead, FL

South Florida Water Management District

UR5 Job # 39617-098

Date Time	Rainfall (inches)
9/22/2008 0:30	0.00
9/22/2008 1:00	0.00
9/22/2008 1:30	0.00
9/22/2008 2:00	0.00
9/22/2008 2:30	0.00
9/22/2008 3:00	0.00
9/22/2008 3:30	0.00
9/22/2008 4:00	0.00
9/22/2008 4:30	0.00
9/22/2008 5:00	0.00
9/22/2008 5:30	0.00
9/22/2008 6:00	0.00
9/22/2008 6:30	0.00
9/22/2008 7:00	0.00
9/22/2008 7:30	0.00
9/22/2008 8:00	0.00
9/22/2008 8:30	0.00
9/22/2008 9:00	0.00
9/22/2008 9:30	0.00
9/22/2008 10:00	0.00
9/22/2008 10:30	0.00
9/22/2008 11:00	0.00
9/22/2008 11:30	0.00
9/22/2008 12:00	0.00
9/22/2008 12:30	0.00
9/22/2008 13:00	0.00
9/22/2008 13:30	0.00
9/22/2008 14:00	0.00
9/22/2008 14:30	0.00
9/22/2008 15:00	0.00
9/22/2008 15:30	0.00
9/22/2008 16:00	0.01
9/22/2008 16:30	0.02
9/22/2008 17:00	0.01
9/22/2008 17:30	0.00
9/22/2008 18:00	0.00
9/22/2008 18:30	0.01
9/22/2008 19:00	0.01
9/22/2008 19:30	0.00
9/22/2008 20:00	0.00
9/22/2008 20:30	0.00
9/22/2008 21:00	0.02
9/22/2008 21:30	0.02
9/22/2008 22:00	0.00
9/22/2008 22:30	0.00
9/22/2008 23:00	0.00
9/22/2008 23:30	0.00
9/24/2008 0:00	0.00
9/24/2008 0:30	0.00
9/24/2008 1:00	0.00
9/24/2008 1:30	0.00
9/24/2008 2:00	0.00
9/24/2008 2:30	0.00
9/24/2008 3:00	0.01
9/24/2008 3:30	0.01
9/24/2008 4:00	0.00
9/24/2008 4:30	0.00
9/24/2008 5:00	0.00
9/24/2008 5:30	0.00
9/24/2008 6:00	0.00
9/24/2008 6:30	0.00
9/24/2008 7:00	0.00
9/24/2008 7:30	0.00
9/24/2008 8:00	0.00
9/24/2008 8:30	0.00
9/24/2008 9:00	0.00
9/24/2008 9:30	0.00
9/24/2008 10:00	0.00
9/24/2008 10:30	0.00
9/24/2008 11:00	0.00
9/24/2008 11:30	0.00
9/24/2008 12:00	0.00
9/24/2008 12:30	0.00
9/24/2008 13:00	0.00
9/24/2008 13:30	0.00
9/24/2008 14:00	0.00
9/24/2008 14:30	0.00
9/24/2008 15:00	0.00
9/24/2008 15:30	0.00
9/24/2008 16:00	0.00
9/24/2008 16:30	0.00
9/24/2008 17:00	0.00
9/24/2008 17:30	0.00
9/24/2008 18:00	0.00
9/24/2008 18:30	0.00
9/24/2008 19:00	0.00
9/24/2008 19:30	0.00
9/24/2008 20:00	0.00
9/24/2008 20:30	0.00
9/24/2008 21:00	0.00
9/24/2008 21:30	0.03
9/24/2008 22:00	0.05
9/24/2008 22:30	0.02
9/24/2008 23:00	0.00
9/24/2008 23:30	0.02
9/25/2008 0:00	0.02

Date Time	Rainfall (inches)
9/25/2008 0:30	0.00
9/25/2008 1:00	0.02
9/25/2008 1:30	0.24
9/25/2008 2:00	0.00
9/25/2008 2:30	0.00
9/25/2008 3:00	0.00
9/25/2008 3:30	0.02
9/25/2008 4:00	0.03
9/25/2008 4:30	0.01
9/25/2008 5:00	0.00
9/25/2008 5:30	0.00
9/25/2008 6:00	0.00
9/25/2008 6:30	0.01
9/25/2008 7:00	0.01
9/25/2008 7:30	0.00
9/25/2008 8:00	0.00
9/25/2008 8:30	0.00
9/25/2008 9:00	0.00
9/25/2008 9:30	0.00
9/25/2008 10:00	0.00
9/25/2008 10:30	0.00
9/25/2008 11:00	0.00
9/25/2008 11:30	0.00
9/25/2008 12:00	0.00
9/25/2008 12:30	0.00
9/25/2008 13:00	0.00
9/25/2008 13:30	0.00
9/25/2008 14:00	0.00
9/25/2008 14:30	0.00
9/25/2008 15:00	0.00
9/25/2008 15:30	0.00
9/25/2008 16:00	0.00
9/25/2008 16:30	0.00
9/25/2008 17:00	0.00
9/25/2008 17:30	0.00
9/25/2008 18:00	0.00
9/25/2008 18:30	0.00
9/25/2008 19:00	0.00
9/25/2008 19:30	0.00
9/25/2008 20:00	0.00
9/25/2008 20:30	0.00
9/25/2008 21:00	0.00
9/25/2008 21:30	0.00
9/25/2008 22:00	0.00
9/25/2008 22:30	0.00
9/25/2008 23:00	0.00
9/25/2008 23:30	0.00
9/27/2008 0:00	0.00

Date Time	Rainfall (inches)
9/27/2008 0:30	0.00
9/27/2008 1:00	0.00
9/27/2008 1:30	0.00
9/27/2008 2:00	0.00
9/27/2008 2:30	0.00
9/27/2008 3:00	0.00
9/27/2008 3:30	0.00
9/27/2008 4:00	0.00
9/27/2008 4:30	0.00
9/27/2008 5:00	0.00
9/27/2008 5:30	0.00
9/27/2008 6:00	0.00
9/27/2008 6:30	0.00
9/27/2008 7:00	0.00
9/27/2008 7:30	0.00
9/27/2008 8:00	0.00
9/27/2008 8:30	0.00
9/27/2008 9:00	0.00
9/27/2008 9:30	0.00
9/27/2008 10:00	0.00
9/27/2008 10:30	0.00
9/27/2008 11:00	0.00
9/27/2008 11:30	0.00
9/27/2008 12:00	0.00
9/27/2008 12:30	0.00
9/27/2008 13:00	0.00
9/27/2008 13:30	0.00
9/27/2008 14:00	0.00
9/27/2008 14:30	0.00
9/27/2008 15:00	0.00
9/27/2008 15:30	0.00
9/27/2008 16:00	0.00
9/27/2008 16:30	0.05
9/27/2008 17:00	0.05
9/27/2008 17:30	0.00
9/27/2008 18:00	0.00
9/27/2008 18:30	0.00
9/27/2008 19:00	0.00
9/27/2008 19:30	0.00
9/27/2008 20:00	0.00
9/27/2008 20:30	0.00
9/27/2008 21:00	0.00
9/27/2008 21:30	0.00
9/27/2008 22:00	0.00
9/27/2008 22:30	0.00
9/27/2008 23:00	0.00
9/27/2008 23:30	0.00
9/28/2008 0:00	0.00
9/28/2008 0:30	0.00
9/28/2008 1:00	0.00
9/28/2008 1:30	0.00
9/28/2008 2:00	0.00
9/28/2008 2:30	0.00
9/28/2008 3:00	0.00
9/28/2008 3:30	0.00
9/28/2008 4:00	0.00
9/28/2008 4:30	0.00
9/28/2008 5:00	0.00
9/28/2008 5:30	0.00
9/28/2008 6:00	0.00
9/28/2008 6:30	0.00
9/28/2008 7:00	0.00
9/28/2008 7:30	0.00
9/28/2008 8:00	0.00
9/28/2008 8:30	0.00
9/28/2008 9:00	0.00
9/28/2008 9:30	0.00
9/28/2008 10:00	0.00
9/28/2008 10:30	0.00
9/28/2008 11:00	0.00
9/28/2008 11:30	0.00
9/28/2008 12:00	0.01
9/28/2008 12:30	0.01
9/28/2008 13:00	0.00
9/28/2008 13:30	0.00
9/28/2008 14:00	0.00
9/28/2008 14:30	0.00
9/28/2008 15:00	0.00
9/28/2008 15:30	0.00
9/28/2008 16:00	0.00
9/28/2008 16:30	0.00
9/28/2008 17:00	0.00
9/28/2008 17:30	0.00
9/28/2008 18:00	0.05
9/28/2008 18:30	0.00
9/28/2008 19:00	0.35
9/28/2008 19:30	0.70
9/28/2008 20:00	0.70
9/28/2008 20:30	0.52
9/28/2008 21:00	0.11
9/28/2008 21:30	0.03
9/28/2008 22:00	0.01
9/28/2008 22:30	0.01
9/28/2008 23:00	0.00
9/28/2008 23:30	0.00
9/29/2008 0:00	0.00

Date Time	Rainfall (inches)
9/29/2008 0:30	0.00
9/29/2008 1:00	0.00
9/29/2008 1:30	0.00
9/29/2008 2:00	0.00
9/29/2008 2:30	0.03
9/29/2008 3:00	0.00
9/29/2008 3:30	0.00
9/29/2008 4:00	0.00
9/29/2008 4:30	0.00
9/29/2008 5:00	0.00
9/29/2008 5:30	0.00
9/29/2008 6:00	0.00
9/29/2008 6:30	0.00
9/29/2008 7:00	0.00
9/29/2008 7:30	0.00
9/29/2008 8:00	0.00
9/29/2008 8:30	0.00
9/29/2008 9:00	0.00
9/29/2008 9:30	0.00
9/29/2008 10:00	0.00
9/29/2008 10:30	0.00
9/29/2008 11:00	0.00
9/29/2008 11:30	0.00
9/29/2008 12:00	0.00
9/29/2008 12:30	0.00
9/29/2008 13:00	0.00
9/29/2008 13:30	0.00
9/29/2008 14:00	0.00
9/29/2008 14:30	0.00
9/29/2008 15:00	0.00
9/29/2008 15:30	0.00
9/29/2008 16:00	0.00
9/29/2008 16:30	0.05
9/29/2008 17:00	0.06
9/29/2008 17:30	0.01
9/29/2008 18:00	0.00
9/29/2008 18:30	0.00
9/29/2008 19:00	0.02
9/29/2008 19:30	0.04
9/29/2008 20:00	0.02
9/29/2008 20:30	0.01
9/29/2008 21:00	0.01
9/29/2008 21:30	0.00
9/29/2008 22:00	0.00
9/29/2008 22:30	0.00
9/29/2008 23:00	0.00
9/29/2008 23:30	0.00
9/30/2008 0:00	0.00
9/30/2008 0:30	0.00
9/30/2008 1:00	0.00
9/30/2008 1:30	0.00
9/30/2008 2:00	0.00
9/30/2008 2:30	0.00
9/30/2008 3:00	0.00
9/30/2008 3:30	0.00
9/30/2008 4:00	0.00
9/30/2008 4:30	0.00
9/30/2008 5:00	0.00
9/30/2008 5:30	0.00
9/30/2008 6:00	0.07
9/30/2008 6:30	0.51
9/30/2008 7:00	0.45
9/30/2008 7:30	0.02
9/30/2008 8:00	0.01
9/30/2008 8:30	0.00
9/30/2008 9:00	0.00
9/30/2008 9:30	0.00
9/30/2008 10:00	0.00
9/30/2008 10:30	0.00
9/30/2008 11:00	0.00
9/30/2008 11:30	0.00
9/30/2008 12:00	0.00
9/30/2008 12:30	0.00
9/30/2008 13:00	0.00
9/30/2008 13:30	0.00
9/30/2008 14:00	0.00
9/30/2008 14:30	0.00
9/30/2008 15:00	0.00
9/30/2008 15:30	0.00
9/30/2008 16:00	0.00
9/30/2008 16:30	0.00
9/30/2008 17:00	0.00
9/30/2008 17:30	0.00
9/30/2008 18:00	0.00
9/30/2008 18:30	0.00
9/30/2008 19:00	0.00
9/30/2008 19:30	0.01
9/30/2008 20:00	1.04
9/30/2008 20:30	1.05
9/30/2008 21:00	0.05
9/30/2008 21:30	0.07
9/30/2008 22:00	0.07
9/30/2008 22:30	0.04
9/30/2008 23:00	0.01
9/30/2008 23:30	0.01
10/1/2008 0:00	0.00

Date Time	Rainfall (inches)
10/1/2008 0:30	0.00
10/1/2008 1:00	0.00
10/1/2008 1:30	0.00
10/1/2008 2:00	0.00
10/1/2008 2:30	0.00
10/1/2008 3:00	0.00
10/1/2008 3:30	0.00
10/1/2008 4:00	0.00
10/1/2008 4:30	0.00
10/1/2008 5:00	0.00
10/1/2008 5:30	0.00
10/1/2008 6:00	0.00
10/1/2008 6:30	0.00
10/1/2008 7:00	0.00
10/1/2008 7:30	0.00
10/1/2008 8:00	0.00
10/1/2008 8:30	0.00
10/1/2008 9:00	0.00
10/1/2008 9:30	0.00
10/1/2008 10:00	0.00
10/1/2008 10:30	0.00
10/1/2008 11:00	0.00
10/1/2008 11:30	0.00
10/1/2008 12:00	0.00
10/1/2008 12:30	0.00
10/1/2008 13:00	0.00
10/1/2008 13:30	0.00
10/1/2008 14:00	0.00
10/1/2008 14:30	0.00
10/1/2008 15:00	0.00
10/1/2008 15:30	0.00
10/1/2008 16:00	0.00
10/1/2008 16:30	0.00
10/1/2008 17:00	0.00
10/1/2008 17:30	0.00
10/1/2008 18:00	0.00
10/1/2008 18:30	0.00
10/1/2008 19:00	0.00
10/1/2008 19:30	0.00
10/1/2008 20:00	0.00
10/1/2008 20:30	0.00
10/1/2008 21:00	0.00
10/1/2008 21:30	0.00
10/1/2008 22:00	0.00
10/1/2008 22:30	0.00
10/1/2008 23:00	0.00
10/1/2008 23:30	0.00
10/2/2008 0:00	0.00
10/2/2008 0:30	0.00
10/2/2008 1:00	0.00
10/2/2008 1:30	0.00
10/2/2008 2:00	0.00
10/2/2008 2:30	0.00
10/2/2008 3:00	0.00
10/2/2008 3:30	0.00
10/2/2008 4:00	0.00
10/2/2008 4:30	0.00
10/2/2008 5:00	0.00
10/2/2008 5:30	0.00
10/2/2008 6:00	0.00
10/2/2008 6:30	0.00
10/2/2008 7:00	0.00
10/2/2008 7:30	0.00
10/2/2008 8:00	0.00
10/2/2008 8:30	0.00
10/2/2008 9:00	0.00
10/2/2008 9:30	0.00
10/2/2008 10:00	0.00
10/2/2008 10:30	0.00
10/2/2008 11:00	0.00
10/2/2008 11:30	0.00
10/2/2008 12:00	0.00
10/2/2008 12:30	0.00
10/2/2008 13:00	0.00
10/2/2008 13:30	0.00
10/2/2008 14:00	0.00
10/2/2008 14:30	0.00
10/2/2008 15:00	0.00
10/2/2008 15:30	0.00
10/2/2008 16:00	0.00
10/2/2008 16:30	0.00
10/2/2008 17:00	0.00
10/2/2008 17:30	0.00
10/2/2008 18:00	0.00
10/2/2008 18:30	0.00
10/2/2008 19:00	0.00
10/2/2008 19:30	0.00
10/2/2008 20:00	0.00
10/2/2008 20:30	0.00
10/2/2008 21:00	0.00
10/2/2008 21:30	0.00
10/2/2008 22:00	0.00
10/2/2008 22:30	0.00
10/2/2008 23:00	0.00
10/2/2008 23:30	0.00
10/3/2008 0:00	0.00

Date Time	Rainfall (inches)
10/3/2008 0:30	0.00
10/3/2008 1:00	0.00
10/3/2008 1:30	0.00
10/3/2008 2:00	0.00
10/3/2008 2:30	0.00
10/3/2008 3:00	0.00
10/3/2008 3:30	0.00
10/3/2008 4:00	0.00
10/3/2008 4:30	0.00
10/3/2008 5:00	0.00
10/3/2008 5:30	0.00
10/3/2008 6:00	0.00
10/3/2008 6:30	0.00
10/3/2008 7:00	0.00
10/3/2008 7:30	0.00
10/3/2008 8:00	0.00
10/3/2008 8:30	0.00
10/3/2008 9:00	0.00
10/3/2008 9:30	0.00
10/3/2008 10:00	0.00
10/3/2008 10:30	0.00
10/3/2008 11:00	0.00
10/3/2008 11:30	0.00
10/3/2008 12:00	0.00
10/3/2008 12:30	0.00
10/3/2008 13:00	0.00
10/3/2008 13:30	0.00
10/3/2008 14:00	0.00
10/3/2008 14:30	0.00
10/3/2008 15:00	0.00
10/3/2008 15:30	0.00
10/3/2008 16:00	0.00
10/3/2008 16:30	0.00
10/3/2008 17:00	0.00
10/3/2008 17:30	0.00
10/3/2008 18:00	0.00
10/3/2008 18:30	0.00
10/3/2008 19:00	0.00
10/3/2008 19:30	0.00
10/3/2008 20:00	0.00
10/3/2008 20:30	0.00
10/3/2008 21:00	0.00
10/3/2008 21:30	0.00
10/3/2008 22:00	0.00
10/3/2008 22:30	0.00
10/3/2008 23:00	0.00
10/3/2008 23:30	0.00
10/4/2008 0:00	0.00
10/4/2008 0:30	0.00
10/4/2008 1:00	0.00
10/4/2008 1:30	0.00
10/4/2008 2:00	0.00
10/4/2008 2:30	0.28
10/4/2008 3:00	1.00
10/4/2008 3:30	0.78
10/4/2008 4:00	0.14
10/4/2008 4:30	0.15
10/4/2008 5:00	0.05
10/4/2008 5:30	0.03
10/4/2008 6:00	0.09
10/4/2008 6:30	0.11
10/4/2008 7:00	0.02
10/4/2008 7:30	0.02
10/4/2008 8:00	0.06
10/4/2008 8:30	0.06
10/4/2008 9:00	0.03
10/4/2008 9:30	0.01
10/4/2008 10:00	0.00
10/4/2008 10:30	0.00
10/4/2008 11:00	0.00
10/4/2008 11:30	0.00
10/4/2008 12:00	0.00
10/4/2008 12:30	0.00
10/4/2008 13:00	0.00
10/4/2008 13:30	0.00
10/4/2008 14:00	0.01
10/4/2008 14:30	0.01
10/4/2008 15:00	0.00
10/4/2008 15:30	0.00
10/4/2008 16:00	0.02
10/4/2008 16:30	0.03
10/4/2008 17:00	0.01
10/4/2008 17:30	0.00
10/4/2008 18:00	0.00
10/4/2008 18:30	0.00
10/4/2008 19:00	0.00
10/4/2008 19:30	0.00
10/4/2008 20:00	0.00
10/4/2008 20:30	0.00
10/4/2008 21:00	0.00
10/4/2008 21:30	0.00
10/4/2008 22:00	0.00
10/4/2008 22:30	0.00
10/4/2008 23:00	0.00
10/4/2008 23:30	0.03
10/5/2008 0:00	0.07

Note:

Weather Station KFLHOME55 is locate approximately 3.5 miles northeast of monitor well MW-1.
KFLHOME55 is located at Latitude 25.468 N - Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOME55

Farmland Estates, Homestead, FL

South Florida Water Management District

UR5 Job # 39617-098

Date Time	Rainfall (inches)
10/5/2008 0:30	0.15
10/5/2008 1:00	0.78
10/5/2008 1:30	0.03
10/5/2008 2:00	0.11
10/5/2008 2:30	0.46
10/5/2008 3:00	0.38
10/5/2008 3:30	0.01
10/5/2008 4:00	0.00
10/5/2008 4:30	0.00
10/5/2008 5:00	0.00
10/5/2008 5:30	0.00
10/5/2008 6:00	0.00
10/5/2008 6:30	0.00
10/5/2008 7:00	0.00
10/5/2008 7:30	0.00
10/5/2008 8:00	0.00
10/5/2008 8:30	0.00
10/5/2008 9:00	0.00
10/5/2008 9:30	0.00
10/5/2008 10:00	0.00
10/5/2008 10:30	0.01
10/5/2008 11:00	0.01
10/5/2008 11:30	0.00
10/5/2008 12:00	0.00
10/5/2008 12:30	0.00
10/5/2008 13:00	0.00
10/5/2008 13:30	0.00
10/5/2008 14:00	0.00
10/5/2008 14:30	0.00
10/5/2008 15:00	0.00
10/5/2008 15:30	0.00
10/5/2008 16:00	0.00
10/5/2008 16:30	0.00
10/5/2008 17:00	0.01
10/5/2008 17:30	0.01
10/5/2008 18:00	0.00
10/5/2008 18:30	0.00
10/5/2008 19:00	0.00
10/5/2008 19:30	0.00
10/5/2008 20:00	0.00
10/5/2008 20:30	0.00
10/5/2008 21:00	0.00
10/5/2008 21:30	0.00
10/5/2008 22:00	0.00
10/5/2008 22:30	0.00
10/5/2008 23:00	0.00
10/5/2008 23:30	0.00
10/6/2008 0:00	0.00
10/6/2008 0:30	0.00
10/6/2008 1:00	0.00
10/6/2008 1:30	0.00
10/6/2008 2:00	0.00
10/6/2008 2:30	0.00
10/6/2008 3:00	0.00
10/6/2008 3:30	0.00
10/6/2008 4:00	0.00
10/6/2008 4:30	0.00
10/6/2008 5:00	0.00
10/6/2008 5:30	0.00
10/6/2008 6:00	0.00
10/6/2008 6:30	0.00
10/6/2008 7:00	0.00
10/6/2008 7:30	0.00
10/6/2008 8:00	0.00
10/6/2008 8:30	0.00
10/6/2008 9:00	0.00
10/6/2008 9:30	0.00
10/6/2008 10:00	0.00
10/6/2008 10:30	0.00
10/6/2008 11:00	0.00
10/6/2008 11:30	0.00
10/6/2008 12:00	0.00
10/6/2008 12:30	0.00
10/6/2008 13:00	0.00
10/6/2008 13:30	0.00
10/6/2008 14:00	0.00
10/6/2008 14:30	0.00
10/6/2008 15:00	0.00
10/6/2008 15:30	0.00
10/6/2008 16:00	0.00
10/6/2008 16:30	0.00
10/6/2008 17:00	0.00
10/6/2008 17:30	0.00
10/6/2008 18:00	0.00
10/6/2008 18:30	0.00
10/6/2008 19:00	0.00
10/6/2008 19:30	0.00
10/6/2008 20:00	0.00
10/6/2008 20:30	0.00
10/6/2008 21:00	0.00
10/6/2008 21:30	0.00
10/6/2008 22:00	0.00
10/6/2008 22:30	0.00
10/6/2008 23:00	0.00
10/6/2008 23:30	0.00
10/7/2008 0:00	0.00

Date Time	Rainfall (inches)
10/7/2008 0:30	0.00
10/7/2008 1:00	0.00
10/7/2008 1:30	0.00
10/7/2008 2:00	0.00
10/7/2008 2:30	0.00
10/7/2008 3:00	0.00
10/7/2008 3:30	0.00
10/7/2008 4:00	0.00
10/7/2008 4:30	0.00
10/7/2008 5:00	0.00
10/7/2008 5:30	0.00
10/7/2008 6:00	0.00
10/7/2008 6:30	0.00
10/7/2008 7:00	0.00
10/7/2008 7:30	0.00
10/7/2008 8:00	0.00
10/7/2008 8:30	0.00
10/7/2008 9:00	0.00
10/7/2008 9:30	0.00
10/7/2008 10:00	0.00
10/7/2008 10:30	0.00
10/7/2008 11:00	0.00
10/7/2008 11:30	0.00
10/7/2008 12:00	0.00
10/7/2008 12:30	0.00
10/7/2008 13:00	0.00
10/7/2008 13:30	0.00
10/7/2008 14:00	0.00
10/7/2008 14:30	0.00
10/7/2008 15:00	0.00
10/7/2008 15:30	0.00
10/7/2008 16:00	0.00
10/7/2008 16:30	0.00
10/7/2008 17:00	0.00
10/7/2008 17:30	0.00
10/7/2008 18:00	0.00
10/7/2008 18:30	0.00
10/7/2008 19:00	0.00
10/7/2008 19:30	0.00
10/7/2008 20:00	0.00
10/7/2008 20:30	0.00
10/7/2008 21:00	0.00
10/7/2008 21:30	0.00
10/7/2008 22:00	0.00
10/7/2008 22:30	0.00
10/7/2008 23:00	0.00
10/7/2008 23:30	0.00
10/8/2008 0:00	0.00

Date Time	Rainfall (inches)
10/8/2008 0:30	0.00
10/8/2008 1:00	0.00
10/8/2008 1:30	0.00
10/8/2008 2:00	0.00
10/8/2008 2:30	0.00
10/8/2008 3:00	0.00
10/8/2008 3:30	0.00
10/8/2008 4:00	0.00
10/8/2008 4:30	0.00
10/8/2008 5:00	0.00
10/8/2008 5:30	0.00
10/8/2008 6:00	0.00
10/8/2008 6:30	0.00
10/8/2008 7:00	0.00
10/8/2008 7:30	0.00
10/8/2008 8:00	0.00
10/8/2008 8:30	0.00
10/8/2008 9:00	0.00
10/8/2008 9:30	0.00
10/8/2008 10:00	0.01
10/8/2008 10:30	0.00
10/8/2008 11:00	0.00
10/8/2008 11:30	0.00
10/8/2008 12:00	0.00
10/8/2008 12:30	0.00
10/8/2008 13:00	0.00
10/8/2008 13:30	0.00
10/8/2008 14:00	0.00
10/8/2008 14:30	0.00
10/8/2008 15:00	0.00
10/8/2008 15:30	0.00
10/8/2008 16:00	0.00
10/8/2008 16:30	0.00
10/8/2008 17:00	0.00
10/8/2008 17:30	0.00
10/8/2008 18:00	0.00
10/8/2008 18:30	0.00
10/8/2008 19:00	0.00
10/8/2008 19:30	0.00
10/8/2008 20:00	0.00
10/8/2008 20:30	0.00
10/8/2008 21:00	0.00
10/8/2008 21:30	0.00
10/8/2008 22:00	0.00
10/8/2008 22:30	0.00
10/8/2008 23:00	0.00
10/8/2008 23:30	0.00
10/9/2008 0:00	0.00

Date Time	Rainfall (inches)
10/9/2008 0:30	0.00
10/9/2008 1:00	0.00
10/9/2008 1:30	0.00
10/9/2008 2:00	0.00
10/9/2008 2:30	0.00
10/9/2008 3:00	0.00
10/9/2008 3:30	0.00
10/9/2008 4:00	0.00
10/9/2008 4:30	0.00
10/9/2008 5:00	0.00
10/9/2008 5:30	0.00
10/9/2008 6:00	0.00
10/9/2008 6:30	0.00
10/9/2008 7:00	0.00
10/9/2008 7:30	0.00
10/9/2008 8:00	0.00
10/9/2008 8:30	0.00
10/9/2008 9:00	0.00
10/9/2008 9:30	0.00
10/9/2008 10:00	0.01
10/9/2008 10:30	0.01
10/9/2008 11:00	0.00
10/9/2008 11:30	0.00
10/9/2008 12:00	0.18
10/9/2008 12:30	0.20
10/9/2008 13:00	0.05
10/9/2008 13:30	0.01
10/9/2008 14:00	0.00
10/9/2008 14:30	0.00
10/9/2008 15:00	0.00
10/9/2008 15:30	0.00
10/9/2008 16:00	0.00
10/9/2008 16:30	0.00
10/9/2008 17:00	0.00
10/9/2008 17:30	0.00
10/9/2008 18:00	0.00
10/9/2008 18:30	0.00
10/9/2008 19:00	0.00
10/9/2008 19:30	0.00
10/9/2008 20:00	0.00
10/9/2008 20:30	0.00
10/9/2008 21:00	0.00
10/9/2008 21:30	0.00
10/9/2008 22:00	0.00
10/9/2008 22:30	0.00
10/9/2008 23:00	0.00
10/9/2008 23:30	0.00
10/10/2008 0:00	0.00

Date Time	Rainfall (inches)
10/10/2008 0:30	0.00
10/10/2008 1:00	0.00
10/10/2008 1:30	0.00
10/10/2008 2:00	0.00
10/10/2008 2:30	0.00
10/10/2008 3:00	0.00
10/10/2008 3:30	0.00
10/10/2008 4:00	0.00
10/10/2008 4:30	0.00
10/10/2008 5:00	0.00
10/10/2008 5:30	0.00
10/10/2008 6:00	0.00
10/10/2008 6:30	0.00
10/10/2008 7:00	0.00
10/10/2008 7:30	0.00
10/10/2008 8:00	0.00
10/10/2008 8:30	0.01
10/10/2008 9:00	0.01
10/10/2008 9:30	0.00
10/10/2008 10:00	0.00
10/10/2008 10:30	0.00
10/10/2008 11:00	0.00
10/10/2008 11:30	0.00
10/10/2008 12:00	0.00
10/10/2008 12:30	0.00
10/10/2008 13:00	0.00
10/10/2008 13:30	0.00
10/10/2008 14:00	0.00
10/10/2008 14:30	0.00
10/10/2008 15:00	0.00
10/10/2008 15:30	0.00
10/10/2008 16:00	0.01
10/10/2008 16:30	0.01
10/10/2008 17:00	0.00
10/10/2008 17:30	0.00
10/10/2008 18:00	0.00
10/10/2008 18:30	0.00
10/10/2008 19:00	0.00
10/10/2008 19:30	0.00
10/10/2008 20:00	0.00
10/10/2008 20:30	0.00
10/10/2008 21:00	0.00
10/10/2008 21:30	0.00
10/10/2008 22:00	0.00
10/10/2008 22:30	0.00
10/10/2008 23:00	0.00
10/10/2008 23:30	0.00
10/11/2008 0:00	0.00

Date Time	Rainfall (inches)
10/11/2008 0:30	0.00
10/11/2008 1:00	0.00
10/11/2008 1:30	0.00
10/11/2008 2:00	0.00
10/11/2008 2:30	0.00
10/11/2008 3:00	0.00
10/11/2008 3:30	0.00
10/11/2008 4:00	0.00
10/11/2008 4:30	0.00
10/11/2008 5:00	0.00
10/11/2008 5:30	0.00
10/11/2008 6:00	0.00
10/11/2008 6:30	0.00
10/11/2008 7:00	0.00
10/11/2008 7:30	0.00
10/11/2008 8:00	0.00
10/11/2008 8:30	0.00
10/11/2008 9:00	0.00
10/11/2008 9:30	0.00
10/11/2008 10:00	0.00
10/11/2008 10:30	0.00
10/11/2008 11:00	0.00
10/11/2008 11:30	0.00
10/11/2008 12:00	0.00
10/11/2008 12:30	0.00
10/11/2008 13:00	0.00
10/11/2008 13:30	0.00
10/11/2008 14:00	0.00
10/11/2008 14:30	0.00
10/11/2008 15:00	0.00
10/11/2008 15:30	0.00
10/11/2008 16:00	0.00
10/11/2008 16:30	0.00
10/11/2008 17:00	0.00
10/11/2008 17:30	0.00
10/11/2008 18:00	0.01
10/11/2008 18:30	0.01
10/11/2008 19:00	0.00
10/11/2008 19:30	0.00
10/11/2008 20:00	0.00
10/11/2008 20:30	0.00
10/11/2008 21:00	0.00
10/11/2008 21:30	0.00
10/11/2008 22:00	0.00
10/11/2008 22:30	0.00
10/11/2008 23:00	0.00
10/11/2008 23:30	0.00
10/12/2008 0:00	0.00

Date Time	Rainfall (inches)
10/12/2008 0:30	0.00
10/12/2008 1:00	0.00
10/12/2008 1:30	0.00
10/12/2008 2:00	0.00
10/12/2008 2:30	0.00
10/12/2008 3:00	0.00
10/12/2008 3:30	0.00
10/12/2008 4:00	0.00
10/12/2008 4:30	0.02
10/12/2008 5:00	0.00
10/12/2008 5:30	0.00
10/12/2008 6:00	0.00
10/12/2008 6:30	0.02
10/12/2008 7:00	0.02
10/12/2008 7:30	0.21
10/12/2008 8:00	0.23
10/12/2008 8:30	0.02
10/12/2008 9:00	0.00
10/12/2008 9:30	0.00
10/12/2008 10:00	0.10
10/12/2008 10:30	0.12
10/12/2008 11:00	0.03
10/12/2008 11:30	0.01
10/12/2008 12:00	0.00
10/12/2008 12:30	0.00
10/12/2008 13:00	0.00
10/12/2008 13:30	0.01
10/12/2008 14:00	0.01
10/12/2008 14:30	0.00
10/12/2008 15:00	0.00
10/12/2008 15:30	0.00
10/12/2008 16:00	0.00
10/12/2008 16:30	0.00
10/12/2008 17:00	0.00
10/12/2008 17:30	0.00
10/12/2008 18:00	0.00
10/12/2008 18:30	0.00
10/12/2008 19:00	0.00
10/12/2008 19:30	0.00
10/12/2008 20:00	0.00
10/12/2008 20:30	0.00
10/12/2008 21:00	0.00
10/12/2008 21:30	0.00
10/12/2008 22:00	0.00
10/12/2008 22:30	0.00
10/12/2008 23:00	0.00
10/12/2008 23:30	0.00
10/13/2008 0:00	0.00

Date Time	Rainfall (inches)
10/13/2008 0:30	0.00
10/13/2008 1:00	0.00
10/13/2008 1:30	0.00
10/13/2008 2:00	0.00
10/13/2008 2:30	0.00
10/13/2008 3:00	0.00
10/13/2008 3:30	0.00
10/13/2008 4:00	0.00
10/13/2008 4:30	0.00
10/13/2008 5:00	0.00
10/13/2008 5:30	0.00
10/13/2008 6:00	0.00
10/13/2008 6:30	0.00
10/13/2008 7:00	0.00
10/13/2008 7:30	0.00
10/13/2008 8:00	0.00
10/13/2008 8:30	0.00
10/13/2008 9:00	0.00
10/13/2008 9:30	0.00
10/13/2008 10:00	0.00
10/13/2008 10:30	0.00
10/13/2008 11:00	0.00
10/13/2008 11:30	0.00
10/13/2008 12:00	0.00
10/13/2008 12:30	0.00
10/13/2008 13:00	0.00
10/13/2008 13:30	0.00
10/13/2008 14:00	0.00
10/13/2008 14:30	0.00
10/13/2008 15:00	0.00
10/13/2008 15:30	0.00
10/13/2008 16:00	0.00
10/13/2008 16:30	0.00
10/13/2008 17:00	0.00
10/13/2008 17:30	0.00
10/13/2008 18:00	0.00
10/13/2008 18:30	0.00
10/13/2008 19:00	0.00
10/13/2008 19:30	0.00
10/13/2008 20:00	0.00
10/13/2008 20:30	0.00
10/13/2008 21:00	0.00
10/13/2008 21:30	0.00
10/13/2008 22:00	0.00
10/13/2008 22:30	0.00
10/13/2008 23:00	0.00
10/13/2008 23:30	0.00
10/14/2008 0:00	0.00

Date Time	Rainfall (inches)
10/14/2008 0:30	0.00
10/14/2008 1:00	0.00
10/14/2008 1:30	0.00
10/14/2008 2:00	0.00
10/14/2008 2:30	0.00
10/14/2008 3:00	0.00
10/14/2008 3:30	0.00
10/14/2008 4:00	0.00
10/14/2008 4:30	0.00
10/14/2008 5:00	0.14
10/14/2008 5:30	0.14
10/14/2008 6:00	0.00
10/14/2008 6:30	0.00
10/14/2008 7:00	0.01
10/14/2008 7:30	0.04
10/14/2008 8:00	0.03
10/14/2008 8:30	0.00
10/14/2008 9:00	0.00
10/14/2008 9:30	0.00
10/14/2008 10:00	0.00
10/14/2008 10:30	0.00
10/14/2008 11:00	0.01
10/14/2008 11:30	0.01
10/14/2008 12:00	0.00
10/14/2008 12:30	0.00
10/14/2008 13:00	0.00
10/14/2008 13:30	0.01
10/14/2008 14:00	0.01
10/14/2008 14:30	0.00
10/14/2008 15:00	0.00
10/14/2008 15:30	0.00
10/14/2008 16:00	0.00
10/14/2008 16:30	0.00
10/14/2008 17:00	0.00
10/14/2008 17:30	0.01
10/14/2008 18:00	0.01
10/14/2008 18:30	0.00
10/14/2008 19:00	0.00
10/14/2008 19:30	0.00
10/14/2008 20:00	0.00
10/14/2008 20:30	0.00
10/14/2008 21:00	0.00
10/14/2008 21:30	0.00
10/14/2008 22:00	0.00
10/14/2008 22:30	0.00
10/14/2008 23:00	0.01
10/14/2008 23:30	0.01
10/15/2008 0:00	0.00

Date Time	Rainfall (inches)
10/15/2008 0:30	0.00
10/15/2008 1:00	0.00
10/15/2008 1:30	0.00
10/15/2008 2:00	0.00
10/15/2008 2:30	0.00
10/15/2008 3:00	0.00
10/15/2008 3:30	0.00
10/15/2008 4:00	0.00
10/15/2008 4:30	0.00
10/15/2008 5:00	0.00
10/15/2008 5:30	0.00
10/15/2008 6:00	0.00
10/15/2008 6:30	0.00
10/15/2008 7:00	0.00
10/15/2008 7:30	0.00
10/15/2008 8:00	0.00
10/15/2008 8:30	0.00
10/15/2008 9:00	0.00
10/15/2008 9:30	0.00
10/15/2008 10:00	0.00
10/15/2008 10:30	0.00
10/15/2008 11:00	0.00
10/15/2008 11:30	0.00
10/15/2008 12:00	0.00
10/15/2008 12:30	0.00
10/15/2008 13:00	0.00
10/15/2008 13:30	0.00
10/15/2008 14:00	0.00
10/15/2008 14:30	0.00
10/15/2008 15:00	0.00
10/15/2008 15:30	0.00
10/15/2008 16:00	0.05
10/15/2008 16:30	0.05
10/15/2008 17:00	0.00
10/15/2008 17:30	0.00
10/15/2008 18:00	0.00
10/15/2008 18:30	0.00
10/15/2008 19:00	0.00
10/15/2008 19:30	0.00
10/15/2008 20:00	0.00
10/15/2008 20:30	0.00
10/15/2008 21:00	0.00
10/15/2008 21:30	0.00
10/15/2008 22:00	0.00
10/15/2008 22:30	0.00
10/15/2008 23:00	0.00
10/15/2008 23:30	0.00
10/16/2008 0:00	0.00

Date Time	Rainfall (inches)
10/16/2008 0:30	0.00
10/16/2008 1:00	0.00
10/16/2008 1:30	0.00
10/16/2008 2:00	0.00
10/16/2008 2:30	0.00
10/16/2008 3:00	0.00
10/16/2008 3:30	0.01
10/16/2008 4:00	0.01
10/16/2008 4:30	0.00
10/16/2008 5:00	0.00
10/16/2008 5:30	0.00
10/16/2008 6:00	0.00
10/16/2008 6:30	0.00
10/16/2008 7:00	0.00
10/16/2008 7:30	0.00
10/16/2008 8:00	0.00
10/16/2008 8:30	0.00
10/16/2008 9:00	0.00
10/16/2008 9:30	0.00
10/16/2008 10:00	0.00
10/16/2008 10:30	0.00
10/16/2008 11:00	0.00
10/16/2008 11:30	0.00
10/16/2008 12:00	0.00
10/16/2008 12:30	0.00
10/16/2008 13:00	0.00
10/16/2008 13:30	0.00
10/16/2008 14:00	0.00
10/16/2008 14:30	0.00
10/16/2008 15:00	0.00
10/16/2008 15:30	0.00
10/16/2008 16:00	0.00
10/16/2008 16:30	0.00
10/16/2008 17:00	0.00
10/16/2008 17:30	0.00
10/16/2008 18:00	0.00
10/16/2008 18:30	0.00
10/16/2008 19:00	0.00
10/16/2008 19:30	0.00
10/16/2008 20:00	0.00
10/16/2008 20:30	0.00
10/16/2008 21:00	0.00
10/16/2008 21:30	0.00
10/16/2008 22:00	0.00
10/16/2008 22:30	0.00
10/16/2008 23:00	0.00
10/16/2008 23:30	0.00
10/17/2008 0:00	0.00

Note:

Weather Station KFLHOME55 is locate approximately 3.5 miles northwest of monitor well MW-1.
KFLHOME55 is located at Latitude 25.468 N , Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
10/17/2008 0:30	0.00
10/17/2008 1:00	0.00
10/17/2008 1:30	0.00
10/17/2008 2:00	0.00
10/17/2008 2:30	0.00
10/17/2008 3:00	0.00
10/17/2008 3:30	0.00
10/17/2008 4:00	0.00
10/17/2008 4:30	0.00
10/17/2008 5:00	0.00
10/17/2008 5:30	0.00
10/17/2008 6:00	0.00
10/17/2008 6:30	0.00
10/17/2008 7:00	0.00
10/17/2008 7:30	0.00
10/17/2008 8:00	0.00
10/17/2008 8:30	0.00
10/17/2008 9:00	0.00
10/17/2008 9:30	0.00
10/17/2008 10:00	0.00
10/17/2008 10:30	0.00
10/17/2008 11:00	0.00
10/17/2008 11:30	0.00
10/17/2008 12:00	0.00
10/17/2008 12:30	0.00
10/17/2008 13:00	0.00
10/17/2008 13:30	0.00
10/17/2008 14:00	0.00
10/17/2008 14:30	0.00
10/17/2008 15:00	0.00
10/17/2008 15:30	0.00
10/17/2008 16:00	0.00
10/17/2008 16:30	0.00
10/17/2008 17:00	0.00
10/17/2008 17:30	0.00
10/17/2008 18:00	0.00
10/17/2008 18:30	0.00
10/17/2008 19:00	0.00
10/17/2008 19:30	0.00
10/17/2008 20:00	0.00
10/17/2008 20:30	0.00
10/17/2008 21:00	0.00
10/17/2008 21:30	0.00
10/17/2008 22:00	0.00
10/17/2008 22:30	0.00
10/17/2008 23:00	0.00
10/17/2008 23:30	0.00
10/18/2008 0:00	0.00
10/18/2008 0:30	0.00
10/18/2008 1:00	0.00
10/18/2008 1:30	0.00
10/18/2008 2:00	0.00
10/18/2008 2:30	0.00
10/18/2008 3:00	0.00
10/18/2008 3:30	0.00
10/18/2008 4:00	0.00
10/18/2008 4:30	0.00
10/18/2008 5:00	0.00
10/18/2008 5:30	0.00
10/18/2008 6:00	0.00
10/18/2008 6:30	0.00
10/18/2008 7:00	0.00
10/18/2008 7:30	0.00
10/18/2008 8:00	0.00
10/18/2008 8:30	0.00
10/18/2008 9:00	0.00
10/18/2008 9:30	0.00
10/18/2008 10:00	0.00
10/18/2008 10:30	0.00
10/18/2008 11:00	0.00
10/18/2008 11:30	0.00
10/18/2008 12:00	0.00
10/18/2008 12:30	0.00
10/18/2008 13:00	0.00
10/18/2008 13:30	0.00
10/18/2008 14:00	0.00
10/18/2008 14:30	0.00
10/18/2008 15:00	0.00
10/18/2008 15:30	0.00
10/18/2008 16:00	0.00
10/18/2008 16:30	0.00
10/18/2008 17:00	0.00
10/18/2008 17:30	0.00
10/18/2008 18:00	0.00
10/18/2008 18:30	0.00
10/18/2008 19:00	0.00
10/18/2008 19:30	0.00
10/18/2008 20:00	0.00
10/18/2008 20:30	0.00
10/18/2008 21:00	0.00
10/18/2008 21:30	0.00
10/18/2008 22:00	0.00
10/18/2008 22:30	0.00
10/18/2008 23:00	0.00
10/18/2008 23:30	0.00
10/19/2008 0:00	0.00

Date Time	Rainfall (inches)
10/19/2008 0:30	0.00
10/19/2008 1:00	0.00
10/19/2008 1:30	0.00
10/19/2008 2:00	0.00
10/19/2008 2:30	0.00
10/19/2008 3:00	0.00
10/19/2008 3:30	0.00
10/19/2008 4:00	0.00
10/19/2008 4:30	0.00
10/19/2008 5:00	0.00
10/19/2008 5:30	0.00
10/19/2008 6:00	0.00
10/19/2008 6:30	0.00
10/19/2008 7:00	0.00
10/19/2008 7:30	0.00
10/19/2008 8:00	0.00
10/19/2008 8:30	0.00
10/19/2008 9:00	0.00
10/19/2008 9:30	0.00
10/19/2008 10:00	0.00
10/19/2008 10:30	0.00
10/19/2008 11:00	0.00
10/19/2008 11:30	0.00
10/19/2008 12:00	0.00
10/19/2008 12:30	0.00
10/19/2008 13:00	0.00
10/19/2008 13:30	0.00
10/19/2008 14:00	0.00
10/19/2008 14:30	0.00
10/19/2008 15:00	0.00
10/19/2008 15:30	0.00
10/19/2008 16:00	0.00
10/19/2008 16:30	0.00
10/19/2008 17:00	0.00
10/19/2008 17:30	0.00
10/19/2008 18:00	0.00
10/19/2008 18:30	0.00
10/19/2008 19:00	0.00
10/19/2008 19:30	0.00
10/19/2008 20:00	0.00
10/19/2008 20:30	0.00
10/19/2008 21:00	0.00
10/19/2008 21:30	0.00
10/19/2008 22:00	0.00
10/19/2008 22:30	0.00
10/19/2008 23:00	0.00
10/19/2008 23:30	0.00
10/20/2008 0:00	0.00
10/20/2008 0:30	0.00
10/20/2008 1:00	0.00
10/20/2008 1:30	0.00
10/20/2008 2:00	0.00
10/20/2008 2:30	0.00
10/20/2008 3:00	0.00
10/20/2008 3:30	0.00
10/20/2008 4:00	0.00
10/20/2008 4:30	0.00
10/20/2008 5:00	0.00
10/20/2008 5:30	0.00
10/20/2008 6:00	0.00
10/20/2008 6:30	0.00
10/20/2008 7:00	0.00
10/20/2008 7:30	0.00
10/20/2008 8:00	0.00
10/20/2008 8:30	0.00
10/20/2008 9:00	0.00
10/20/2008 9:30	0.00
10/20/2008 10:00	0.00
10/20/2008 10:30	0.00
10/20/2008 11:00	0.00
10/20/2008 11:30	0.00
10/20/2008 12:00	0.00
10/20/2008 12:30	0.00
10/20/2008 13:00	0.00
10/20/2008 13:30	0.00
10/20/2008 14:00	0.00
10/20/2008 14:30	0.00
10/20/2008 15:00	0.00
10/20/2008 15:30	0.00
10/20/2008 16:00	0.00
10/20/2008 16:30	0.00
10/20/2008 17:00	0.00
10/20/2008 17:30	0.00
10/20/2008 18:00	0.00
10/20/2008 18:30	0.00
10/20/2008 19:00	0.00
10/20/2008 19:30	0.00
10/20/2008 20:00	0.00
10/20/2008 20:30	0.00
10/20/2008 21:00	0.00
10/20/2008 21:30	0.00
10/20/2008 22:00	0.00
10/20/2008 22:30	0.00
10/20/2008 23:00	0.00
10/20/2008 23:30	0.00
10/21/2008 0:00	0.00

Date Time	Rainfall (inches)
10/21/2008 0:30	0.00
10/21/2008 1:00	0.00
10/21/2008 1:30	0.00
10/21/2008 2:00	0.00
10/21/2008 2:30	0.00
10/21/2008 3:00	0.00
10/21/2008 3:30	0.00
10/21/2008 4:00	0.00
10/21/2008 4:30	0.00
10/21/2008 5:00	0.00
10/21/2008 5:30	0.00
10/21/2008 6:00	0.00
10/21/2008 6:30	0.00
10/21/2008 7:00	0.00
10/21/2008 7:30	0.00
10/21/2008 8:00	0.00
10/21/2008 8:30	0.00
10/21/2008 9:00	0.00
10/21/2008 9:30	0.00
10/21/2008 10:00	0.00
10/21/2008 10:30	0.00
10/21/2008 11:00	0.00
10/21/2008 11:30	0.00
10/21/2008 12:00	0.00
10/21/2008 12:30	0.00
10/21/2008 13:00	0.00
10/21/2008 13:30	0.00
10/21/2008 14:00	0.00
10/21/2008 14:30	0.00
10/21/2008 15:00	0.00
10/21/2008 15:30	0.00
10/21/2008 16:00	0.00
10/21/2008 16:30	0.00
10/21/2008 17:00	0.00
10/21/2008 17:30	0.00
10/21/2008 18:00	0.00
10/21/2008 18:30	0.00
10/21/2008 19:00	0.00
10/21/2008 19:30	0.00
10/21/2008 20:00	0.00
10/21/2008 20:30	0.00
10/21/2008 21:00	0.00
10/21/2008 21:30	0.00
10/21/2008 22:00	0.00
10/21/2008 22:30	0.00
10/21/2008 23:00	0.00
10/21/2008 23:30	0.00
10/22/2008 0:00	0.00
10/22/2008 0:30	0.00
10/22/2008 1:00	0.00
10/22/2008 1:30	0.00
10/22/2008 2:00	0.00
10/22/2008 2:30	0.00
10/22/2008 3:00	0.00
10/22/2008 3:30	0.00
10/22/2008 4:00	0.00
10/22/2008 4:30	0.00
10/22/2008 5:00	0.00
10/22/2008 5:30	0.00
10/22/2008 6:00	0.00
10/22/2008 6:30	0.00
10/22/2008 7:00	0.00
10/22/2008 7:30	0.00
10/22/2008 8:00	0.00
10/22/2008 8:30	0.00
10/22/2008 9:00	0.00
10/22/2008 9:30	0.00
10/22/2008 10:00	0.00
10/22/2008 10:30	0.00
10/22/2008 11:00	0.00
10/22/2008 11:30	0.00
10/22/2008 12:00	0.00
10/22/2008 12:30	0.00
10/22/2008 13:00	0.00
10/22/2008 13:30	0.00
10/22/2008 14:00	0.00
10/22/2008 14:30	0.00
10/22/2008 15:00	0.00
10/22/2008 15:30	0.00
10/22/2008 16:00	0.00
10/22/2008 16:30	0.00
10/22/2008 17:00	0.00
10/22/2008 17:30	0.00
10/22/2008 18:00	0.00
10/22/2008 18:30	0.00
10/22/2008 19:00	0.00
10/22/2008 19:30	0.00
10/22/2008 20:00	0.00
10/22/2008 20:30	0.00
10/22/2008 21:00	0.00
10/22/2008 21:30	0.00
10/22/2008 22:00	0.00
10/22/2008 22:30	0.00
10/22/2008 23:00	0.00
10/22/2008 23:30	0.00
10/23/2008 0:00	0.00
10/23/2008 0:30	0.00
10/23/2008 1:00	0.00
10/23/2008 1:30	0.00
10/23/2008 2:00	0.00
10/23/2008 2:30	0.00
10/23/2008 3:00	0.00
10/23/2008 3:30	0.00
10/23/2008 4:00	0.00
10/23/2008 4:30	0.00
10/23/2008 5:00	0.00
10/23/2008 5:30	0.00

Date Time	Rainfall (inches)
10/23/2008 6:00	0.00
10/23/2008 6:30	0.00
10/23/2008 7:00	0.00
10/23/2008 7:30	0.00
10/23/2008 8:00	0.00
10/23/2008 8:30	0.00
10/23/2008 9:00	0.00
10/23/2008 9:30	0.00
10/23/2008 10:00	0.00
10/23/2008 10:30	0.00
10/23/2008 11:00	0.00
10/23/2008 11:30	0.00
10/23/2008 12:00	0.00
10/23/2008 12:30	0.00
10/23/2008 13:00	0.00
10/23/2008 13:30	0.00
10/23/2008 14:00	0.00
10/23/2008 14:30	0.00
10/23/2008 15:00	0.00
10/23/2008 15:30	0.00
10/23/2008 16:00	0.00
10/23/2008 16:30	0.00
10/23/2008 17:00	0.00
10/23/2008 17:30	0.00
10/23/2008 18:00	0.00
10/23/2008 18:30	0.00
10/23/2008 19:00	0.00
10/23/2008 19:30	0.00
10/23/2008 20:00	0.00
10/23/2008 20:30	0.00
10/23/2008 21:00	0.00
10/23/2008 21:30	0.00
10/23/2008 22:00	0.00
10/23/2008 22:30	0.00
10/23/2008 23:00	0.00
10/23/2008 23:30	0.00
10/24/2008 0:00	0.00
10/24/2008 0:30	0.00
10/24/2008 1:00	0.00
10/24/2008 1:30	0.00
10/24/2008 2:00	0.00
10/24/2008 2:30	0.00
10/24/2008 3:00	0.00
10/24/2008 3:30	0.00
10/24/2008 4:00	0.00
10/24/2008 4:30	0.00
10/24/2008 5:00	0.00
10/24/2008 5:30	0.00
10/24/2008 6:00	0.00
10/24/2008 6:30	0.00
10/24/2008 7:00	0.00
10/24/2008 7:30	0.00
10/24/2008 8:00	0.00
10/24/2008 8:30	0.00
10/24/2008 9:00	0.00
10/24/2008 9:30	0.00
10/24/2008 10:00	0.00
10/24/2008 10:30	0.00
10/24/2008 11:00	0.00
10/24/2008 11:30	0.00
10/24/2008 12:00	0.00
10/24/2008 12:30	0.00
10/24/2008 13:00	0.00
10/24/2008 13:30	0.00
10/24/2008 14:00	0.00
10/24/2008 14:30	0.00
10/24/2008 15:00	0.00
10/24/2008 15:30	0.00
10/24/2008 16:00	0.00
10/24/2008 16:30	0.00
10/24/2008 17:00	0.00
10/24/2008 17:30	0.00
10/24/2008 18:00	0.00
10/24/2008 18:30	0.00
10/24/2008 19:00	0.00
10/24/2008 19:30	0.00
10/24/2008 20:00	0.00
10/24/2008 20:30	0.00
10/24/2008 21:00	0.00
10/24/2008 21:30	0.00
10/24/2008 22:00	0.00
10/24/2008 22:30	0.00
10/24/2008 23:00	0.00
10/24/2008 23:30	0.00
10/25/2008 0:00	0.00
10/25/2008 0:30	0.00
10/25/2008 1:00	0.00
10/25/2008 1:30	0.00
10/25/2008 2:00	0.00
10/25/2008 2:30	0.00
10/25/2008 3:00	0.00
10/25/2008 3:30	0.00
10/25/2008 4:00	0.00
10/25/2008 4:30	0.00
10/25/2008 5:00	0.00
10/25/2008 5:30	0.00
10/25/2008 6:00	0.00
10/25/2008 6:30	0.00
10/25/2008 7:00	0.00
10/25/2008 7:30	0.00
10/25/2008 8:00	0.00
10/25/2008 8:30	0.00
10/25/2008 9:00	0.00
10/25/2008 9:30	0.00
10/25/2008 10:00	0.00
10/25/2008 10:30	0.00
10/25/2008 11:00	0.00
10/25/2008 11:30	0.00
10/25/2008 12:00	0.00
10/25/2008 12:30	0.00
10/25/2008 13:00	0.00
10/25/2008 13:30	0.00
10/25/2008 14:00	0.00
10/25/2008 14:30	0.00
10/25/2008 15:00	0.00
10/25/2008 15:30	0.00
10/25/2008 16:00	0.00
10/25/2008 16:30	0.00
10/25/2008 17:00	0.00
10/25/2008 17:30	0.00
10/25/2008 18:00	0.00
10/25/2008 18:30	0.00
10/25/2008 19:00	0.00
10/25/2008 19:30	0.00
10/25/2008 20:00	0.00
10/25/2008 20:30	0.00
10/25/2008 21:00	0.00
10/25/2008 21:30	0.00
10/25/2008 22:00	0.00
10/25/2008 22:30	0.00
10/25/2008 23:00	0.00
10/25/2008 23:30	0.00
10/26/2008 0:00	0.00
10/26/2008 0:30	0.00
10/26/2008 1:00	0.00
10/26/2008 1:30	0.00
10/26/2008 2:00	0.00
10/26/2008 2:30	0.00
10/26/2008 3:00	0.00
10/26/2008 3:30	0.00
10/26/2008 4:00	0.00
10/26/2008 4:30	0.00
10/26/2008 5:00	0.00
10/26/2008 5:30	0.00
10/26/2008 6:00	0.00
10/26/2008 6:30	0.00
10/26/2008 7:00	0.00
10/26/2008 7:30	0.00
10/26/2008 8:00	0.00
10/26/2008 8:30	0.00
10/26/2008 9:00	0.00
10/26/2008 9:30	0.00
10/26/2008 10:00	0.00
10/26/2008 10:30	0.00
10/26/2008 11:00	0.00
10/26/2008 11:30	0.00
10/26/2008 12:00	0.00
10/26/2008 12:30	0.00
10/26/2008 13:00	0.00
10/26/2008 13:30	0.00
10/26/2008 14:00	0.00
10/26/2008 14:30	0.00
10/26/2008 15:00	0.00
10/26/2008 15:30	0.00
10/26/2008 16:00	0.00
10/26/2008 16:30	0.00
10/26/2008 17:00	0.00
10/26/2008 17:30	0.00
10/26/2008 18:00	0.00
10/26/2008 18:30	0.00
10/26/2008 19:00	0.00
10/26/2008 19:30	0.00
10/26/2008 20:00	0.00
10/26/2008 20:30	0.01
10/26/2008 21:00	0.00
10/26/2008 21:30	0.00
10/26/2008 22:00	0.00
10/26/2008 22:30	0.00
10/26/2008 23:00	0.00
10/26/2008 23:30	0.00
10/27/2008 0:00	0.00
10/27/2008 0:30	0.00
10/27/2008 1:00	0.00
10/27/2008 1:30	0.01
10/27/2008 2:00	0.01
10/27/2008 2:30	0.00
10/27/2008 3:00	0.00
10/27/2008 3:30	0.00
10/27/2008 4:00	0.00
10/27/2008 4:30	0.00
10/27/2008 5:00	0.00
10/27/2008 5:30	0.00

Date Time	Rainfall (inches)
10/27/2008 6:00	0.00
10/27/2008 6:30	0.00
10/27/2008 7:00	0.00
10/27/2008 7:30	0.00
10/27/2008 8:00	0.00
10/27/2008 8:30	0.00
10/27/2008 9:00	0.00
10/27/2008 9:30	0.00
10/27/2008 10:00	0.00
10/27/2008 10:30	0.00
10/27/2008 11:00	0.00
10/27/2008 11:30	0.00
10/27/2008 12:00	0.00
10/27/2008 12:30	0.01
10/27/2008 13:00	0.01
10/27/2008 13:30	0.00
10/27/2008 14:00	0.00
10/27/2008 14:30	0.00
10/27/2008 15:00	0.00
10/27/2008 15:30	0.00
10/27/2008 16:00	0.23
10/27/2008 16:30	0.40
10/27/2008 17:00	0.22
10/27/2008 17:30	0.09
10/27/2008 18:00	0.07
10/27/2008 18:30	0.07
10/27/2008 19:00	0.07
10/27/2008 19:30	0.05
10/27/2008 20:00	0.02
10/27/2008 20:30	0.00
10/27/2008 21:00	0.00
10/27/2008 21:30	0.00
10/27/2008 22:00	0.00
10/27/2008 22:30	0.00
10/27/2008 23:00	0.01
10/27/2008 23:30	0.01
10/28/2008 0:00	0.03
10/28/2008 0:30	0.03
10/28/2008 1:00	0.00
10/28/2008 1:30	0.01
10/28/2008 2:00	0.01
10/28/2008 2:30	0.00
10/28/2008 3:00	0.00
10/28/2008 3:30	0.00
10/28/2008 4:00	0.05
10/28/2008 4:30	0.09
10/28/2008 5:00	0.00
10/28/2008 5:30	0.00
10/28/2008 6:00	0.00
10/28/2008 6:30	0.00
10/28/2008 7:00	0.00
10/28/2008 7:30	0.00
10/28/2008 8:00	0.00
10/28/2008 8:30	0.00
10/28/2008 9:00	0.00
10/28/2008 9:30	0.00
10/28/2008 10:00	0.00
10/28/2008 10:30	0.00
10/28/2008 11:00	0.00
10/28/2008 11:30	0.00
10/28/2008 12:00	0.00
10/28/2008 12:30	0.00
10/28/2008 13:00	0.00
10/28/2008 13:30	0.00
10/28/2008 14:00	0.00
10/28/2008 14:30	0.00
10/28/2008 15:00	0.00
10/28/2008 15:30	0.00
10/28/2008 16:00	0.00
10/28/2008 16:30	0.00
10/28/2008 17:00	0.00
10/28/2008 17:30	0.00
10/28/2008 18:00	0.00
10/28/2008 18:30	0.00
10/28/2008 19:00	0.00
10/28/2008 19:30	0.00
10/28/2008 20:00	0.00
10/28/2008 20:30	0.00
10/28/2008 21:00	0.00
10/28/2008 21:30	0.00
10/28/2008 22:00	0.00
10/28/2008 22:30	0.00
10/28/2008 23:00	0.00
10/28/2008 23:30	0.00
10/29/2008 0:00	0.00
10/29/2008 0:30	0.00
10/29/2008 1:00	0.00
10/29/2008 1:30	0.00
10/29/2008 2:00	0.00
10/29/2008 2:30	0.00
10/29/2008 3:00	0.00
10/29/2008 3:30	0.00
10/29/2008 4:00	0.00
10/29/2008 4:30	0.00
10/29/2008 5:00	0.00
10/29/2008 5:30	0.00

Note:

Weather Station KFLHOMES5 is locate approximately 3.5 miles northeast of monitor well MW-1.

KFLHOMES5 is located at Latitude 25.488 N , Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
10/29/2008 6:00	0.00
10/29/2008 6:30	0.00
10/29/2008 7:00	0.00
10/29/2008 7:30	0.00
10/29/2008 8:00	0.00
10/29/2008 8:30	0.01
10/29/2008 9:00	0.01
10/29/2008 9:30	0.00
10/29/2008 10:00	0.00
10/29/2008 10:30	0.00
10/29/2008 11:00	0.00
10/29/2008 11:30	0.00
10/29/2008 12:00	0.00
10/29/2008 12:30	0.00
10/29/2008 13:00	0.00
10/29/2008 13:30	0.00
10/29/2008 14:00	0.00
10/29/2008 14:30	0.00
10/29/2008 15:00	0.00
10/29/2008 15:30	0.00
10/29/2008 16:00	0.00
10/29/2008 16:30	0.00
10/29/2008 17:00	0.00
10/29/2008 17:30	0.00
10/29/2008 18:00	0.00
10/29/2008 18:30	0.00
10/29/2008 19:00	0.00
10/29/2008 19:30	0.00
10/29/2008 20:00	0.00
10/29/2008 20:30	0.00
10/29/2008 21:00	0.01
10/29/2008 21:30	0.02
10/29/2008 22:00	0.01
10/29/2008 22:30	0.00
10/29/2008 23:00	0.00
10/29/2008 23:30	0.00
10/30/2008 0:00	0.00
10/30/2008 0:30	0.00
10/30/2008 1:00	0.00
10/30/2008 1:30	0.00
10/30/2008 2:00	0.00
10/30/2008 2:30	0.00
10/30/2008 3:00	0.00
10/30/2008 3:30	0.00
10/30/2008 4:00	0.00
10/30/2008 4:30	0.00
10/30/2008 5:00	0.00
10/30/2008 5:30	0.02
10/30/2008 6:00	0.02
10/30/2008 6:30	0.00
10/30/2008 7:00	0.00
10/30/2008 7:30	0.00
10/30/2008 8:00	0.00
10/30/2008 8:30	0.00
10/30/2008 9:00	0.00
10/30/2008 9:30	0.00
10/30/2008 10:00	0.00
10/30/2008 10:30	0.00
10/30/2008 11:00	0.00
10/30/2008 11:30	0.01
10/30/2008 12:00	0.01
10/30/2008 12:30	0.00
10/30/2008 13:00	0.00
10/30/2008 13:30	0.01
10/30/2008 14:00	0.01
10/30/2008 14:30	0.00
10/30/2008 15:00	0.00
10/30/2008 15:30	0.00
10/30/2008 16:00	0.00
10/30/2008 16:30	0.00
10/30/2008 17:00	0.00
10/30/2008 17:30	0.00
10/30/2008 18:00	0.00
10/30/2008 18:30	0.00
10/30/2008 19:00	0.00
10/30/2008 19:30	0.00
10/30/2008 20:00	0.00
10/30/2008 20:30	0.00
10/30/2008 21:00	0.00
10/30/2008 21:30	0.00
10/30/2008 22:00	0.00
10/30/2008 22:30	0.00
10/30/2008 23:00	0.00
10/30/2008 23:30	0.00
10/31/2008 0:00	0.00
10/31/2008 0:30	0.00
10/31/2008 1:00	0.00
10/31/2008 1:30	0.00
10/31/2008 2:00	0.00
10/31/2008 2:30	0.00
10/31/2008 3:00	0.00
10/31/2008 3:30	0.00
10/31/2008 4:00	0.00
10/31/2008 4:30	0.00
10/31/2008 5:00	0.00
10/31/2008 5:30	0.00

Date Time	Rainfall (inches)
10/31/2008 6:00	0.00
10/31/2008 6:30	0.00
10/31/2008 7:00	0.00
10/31/2008 7:30	0.00
10/31/2008 8:00	0.00
10/31/2008 8:30	0.00
10/31/2008 9:00	0.00
10/31/2008 9:30	0.00
10/31/2008 10:00	0.00
10/31/2008 10:30	0.00
10/31/2008 11:00	0.00
10/31/2008 11:30	0.00
10/31/2008 12:00	0.00
10/31/2008 12:30	0.00
10/31/2008 13:00	0.00
10/31/2008 13:30	0.00
10/31/2008 14:00	0.00
10/31/2008 14:30	0.00
10/31/2008 15:00	0.00
10/31/2008 15:30	0.00
10/31/2008 16:00	0.00
10/31/2008 16:30	0.00
10/31/2008 17:00	0.00
10/31/2008 17:30	0.00
10/31/2008 18:00	0.00
10/31/2008 18:30	0.00
10/31/2008 19:00	0.00
10/31/2008 19:30	0.00
10/31/2008 20:00	0.00
10/31/2008 20:30	0.00
10/31/2008 21:00	0.00
10/31/2008 21:30	0.00
10/31/2008 22:00	0.00
10/31/2008 22:30	0.00
10/31/2008 23:00	0.00
10/31/2008 23:30	0.00
11/2/2008 0:00	0.00
11/2/2008 0:30	0.00
11/2/2008 1:00	0.00
11/2/2008 1:30	0.00
11/2/2008 2:00	0.00
11/2/2008 2:30	0.00
11/2/2008 3:00	0.00
11/2/2008 3:30	0.00
11/2/2008 4:00	0.00
11/2/2008 4:30	0.00
11/2/2008 5:00	0.00
11/2/2008 5:30	0.00
11/2/2008 6:00	0.00
11/2/2008 6:30	0.00
11/2/2008 7:00	0.00
11/2/2008 7:30	0.00
11/2/2008 8:00	0.00
11/2/2008 8:30	0.00
11/2/2008 9:00	0.00
11/2/2008 9:30	0.00
11/2/2008 10:00	0.00
11/2/2008 10:30	0.00
11/2/2008 11:00	0.00
11/2/2008 11:30	0.00
11/2/2008 12:00	0.00
11/2/2008 12:30	0.00
11/2/2008 13:00	0.00
11/2/2008 13:30	0.00
11/2/2008 14:00	0.00
11/2/2008 14:30	0.00
11/2/2008 15:00	0.00
11/2/2008 15:30	0.00
11/2/2008 16:00	0.00
11/2/2008 16:30	0.00
11/2/2008 17:00	0.00
11/2/2008 17:30	0.00
11/2/2008 18:00	0.00
11/2/2008 18:30	0.00
11/2/2008 19:00	0.00
11/2/2008 19:30	0.00
11/2/2008 20:00	0.00
11/2/2008 20:30	0.00
11/2/2008 21:00	0.00
11/2/2008 21:30	0.00
11/2/2008 22:00	0.00
11/2/2008 22:30	0.00
11/2/2008 23:00	0.00
11/2/2008 23:30	0.00
11/4/2008 0:00	0.00
11/4/2008 0:30	0.00
11/4/2008 1:00	0.00
11/4/2008 1:30	0.00
11/4/2008 2:00	0.00
11/4/2008 2:30	0.00
11/4/2008 3:00	0.00
11/4/2008 3:30	0.00
11/4/2008 4:00	0.00
11/4/2008 4:30	0.00
11/4/2008 5:00	0.00
11/4/2008 5:30	0.00

Date Time	Rainfall (inches)
11/4/2008 6:00	0.00
11/4/2008 6:30	0.00
11/4/2008 7:00	0.00
11/4/2008 7:30	0.00
11/4/2008 8:00	0.00
11/4/2008 8:30	0.00
11/4/2008 9:00	0.00
11/4/2008 9:30	0.00
11/4/2008 10:00	0.00
11/4/2008 10:30	0.00
11/4/2008 11:00	0.00
11/4/2008 11:30	0.00
11/4/2008 12:00	0.00
11/4/2008 12:30	0.00
11/4/2008 13:00	0.00
11/4/2008 13:30	0.00
11/4/2008 14:00	0.00
11/4/2008 14:30	0.00
11/4/2008 15:00	0.00
11/4/2008 15:30	0.00
11/4/2008 16:00	0.00
11/4/2008 16:30	0.00
11/4/2008 17:00	0.00
11/4/2008 17:30	0.00
11/4/2008 18:00	0.00
11/4/2008 18:30	0.00
11/4/2008 19:00	0.00
11/4/2008 19:30	0.00
11/4/2008 20:00	0.00
11/4/2008 20:30	0.00
11/4/2008 21:00	0.00
11/4/2008 21:30	0.00
11/4/2008 22:00	0.00
11/4/2008 22:30	0.00
11/4/2008 23:00	0.00
11/4/2008 23:30	0.00
11/5/2008 0:00	0.00
11/5/2008 0:30	0.00
11/5/2008 1:00	0.00
11/5/2008 1:30	0.00
11/5/2008 2:00	0.00
11/5/2008 2:30	0.00
11/5/2008 3:00	0.00
11/5/2008 3:30	0.00
11/5/2008 4:00	0.00
11/5/2008 4:30	0.00
11/5/2008 5:00	0.00
11/5/2008 5:30	0.00
11/5/2008 6:00	0.00
11/5/2008 6:30	0.00
11/5/2008 7:00	0.00
11/5/2008 7:30	0.00
11/5/2008 8:00	0.00
11/5/2008 8:30	0.00
11/5/2008 9:00	0.00
11/5/2008 9:30	0.00
11/5/2008 10:00	0.00
11/5/2008 10:30	0.00
11/5/2008 11:00	0.00
11/5/2008 11:30	0.00
11/5/2008 12:00	0.00
11/5/2008 12:30	0.00
11/5/2008 13:00	0.00
11/5/2008 13:30	0.00
11/5/2008 14:00	0.00
11/5/2008 14:30	0.00
11/5/2008 15:00	0.00
11/5/2008 15:30	0.00
11/5/2008 16:00	0.00
11/5/2008 16:30	0.00
11/5/2008 17:00	0.00
11/5/2008 17:30	0.00
11/5/2008 18:00	0.00
11/5/2008 18:30	0.00
11/5/2008 19:00	0.00
11/5/2008 19:30	0.00
11/5/2008 20:00	0.00
11/5/2008 20:30	0.00
11/5/2008 21:00	0.00
11/5/2008 21:30	0.00
11/5/2008 22:00	0.00
11/5/2008 22:30	0.00
11/5/2008 23:00	0.00
11/5/2008 23:30	0.00
11/6/2008 0:00	0.00
11/6/2008 0:30	0.00
11/6/2008 1:00	0.00
11/6/2008 1:30	0.00
11/6/2008 2:00	0.00
11/6/2008 2:30	0.00
11/6/2008 3:00	0.00
11/6/2008 3:30	0.00
11/6/2008 4:00	0.00
11/6/2008 4:30	0.00
11/6/2008 5:00	0.00
11/6/2008 5:30	0.00

Date Time	Rainfall (inches)
11/6/2008 6:00	0.00
11/6/2008 6:30	0.00
11/6/2008 7:00	0.00
11/6/2008 7:30	0.00
11/6/2008 8:00	0.00
11/6/2008 8:30	0.00
11/6/2008 9:00	0.00
11/6/2008 9:30	0.00
11/6/2008 10:00	0.00
11/6/2008 10:30	0.00
11/6/2008 11:00	0.00
11/6/2008 11:30	0.01
11/6/2008 12:00	0.01
11/6/2008 12:30	0.00
11/6/2008 13:00	0.00
11/6/2008 13:30	0.00
11/6/2008 14:00	0.00
11/6/2008 14:30	0.00
11/6/2008 15:00	0.00
11/6/2008 15:30	0.00
11/6/2008 16:00	0.00
11/6/2008 16:30	0.00
11/6/2008 17:00	0.00
11/6/2008 17:30	0.00
11/6/2008 18:00	0.00
11/6/2008 18:30	0.00
11/6/2008 19:00	0.00
11/6/2008 19:30	0.00
11/6/2008 20:00	0.00
11/6/2008 20:30	0.00
11/6/2008 21:00	0.00
11/6/2008 21:30	0.00
11/6/2008 22:00	0.00
11/6/2008 22:30	0.00
11/6/2008 23:00	0.00
11/6/2008 23:30	0.00
11/7/2008 0:00	0.00
11/7/2008 0:30	0.00
11/7/2008 1:00	0.00
11/7/2008 1:30	0.00
11/7/2008 2:00	0.00
11/7/2008 2:30	0.00
11/7/2008 3:00	0.00
11/7/2008 3:30	0.00
11/7/2008 4:00	0.00
11/7/2008 4:30	0.00
11/7/2008 5:00	0.00
11/7/2008 5:30	0.01
11/7/2008 6:00	0.01
11/7/2008 6:30	0.00
11/7/2008 7:00	0.00
11/7/2008 7:30	0.00
11/7/2008 8:00	0.00
11/7/2008 8:30	0.00
11/7/2008 9:00	0.00
11/7/2008 9:30	0.00
11/7/2008 10:00	0.00
11/7/2008 10:30	0.00
11/7/2008 11:00	0.00
11/7/2008 11:30	0.00
11/7/2008 12:00	0.00
11/7/2008 12:30	0.00
11/7/2008 13:00	0.00
11/7/2008 13:30	0.00
11/7/2008 14:00	0.00
11/7/2008 14:30	0.00
11/7/2008 15:00	0.00
11/7/2008 15:30	0.00
11/7/2008 16:00	0.04
11/7/2008 16:30	0.95
11/7/2008 17:00	1.40
11/7/2008 17:30	0.50
11/7/2008 18:00	0.01
11/7/2008 18:30	0.00
11/7/2008 19:00	0.00
11/7/2008 19:30	0.00
11/7/2008 20:00	0.00
11/7/2008 20:30	0.00
11/7/2008 21:00	0.00
11/7/2008 21:30	0.00
11/7/2008 22:00	0.00
11/7/2008 22:30	0.00
11/7/2008 23:00	0.00
11/7/2008 23:30	0.00
11/8/2008 0:00	0.00
11/8/2008 0:30	0.00
11/8/2008 1:00	0.00
11/8/2008 1:30	0.00
11/8/2008 2:00	0.00
11/8/2008 2:30	0.00
11/8/2008 3:00	0.00
11/8/2008 3:30	0.00
11/8/2008 4:00	0.00
11/8/2008 4:30	0.00
11/8/2008 5:00	0.00
11/8/2008 5:30	0.00

Date Time	Rainfall (inches)
11/8/2008 6:00	0.00
11/8/2008 6:30	0.00
11/8/2008 7:00	0.00
11/8/2008 7:30	0.00
11/8/2008 8:00	0.00
11/8/2008 8:30	0.00
11/8/2008 9:00	0.00
11/8/2008 9:30	0.00
11/8/2008 10:00	0.00
11/8/2008 10:30	0.00
11/8/2008 11:00	0.00
11/8/2008 11:30	0.00
11/8/2008 12:00	0.00
11/8/2008 12:30	0.00
11/8/2008 13:00	0.00
11/8/2008 13:30	0.00
11/8/2008 14:00	0.00
11/8/2008 14:30	0.00
11/8/2008 15:00	0.00
11/8/2008 15:30	0.00
11/8/2008 16:00	0.00
11/8/2008 16:30	0.00
11/8/2008 17:00	0.00
11/8/2008 17:30	0.00
11/8/2008 18:00	0.00
11/8/2008 18:30	0.00
11/8/2008 19:00	0.00
11/8/2008 19:30	0.00
11/8/2008 20:00	0.00
11/8/2008 20:30	0.00
11/8/2008 21:00	0.00
11/8/2008 21:30	0.00
11/8/2008 22:00	0.00
11/8/2008 22:30	0.00
11/8/2008 23:00	0.00
11/8/2008 23:30	0.00
11/9/2008 0:00	0.00
11/9/2008 0:30	0.00
11/9/2008 1:00	0.00
11/9/2008 1:30	0.00
11/9/2008 2:00	0.00
11/9/2008 2:30	0.00
11/9/2008 3:00	0.00
11/9/2008 3:30	0.00
11/9/2008 4:00	0.00
11/9/2008 4:30	0.00
11/9/2008 5:00	0.00
11/9/2008 5:30	0.00

Date Time	Rainfall (inches)
11/9/2008 6:00	0.00
11/9/2008 6:30	0.00
11/9/2008 7:00	0.00
11/9/2008 7:30	0.00
11/9/2008 8:00	0.00
11/9/2008 8:30	0.00
11/9/2008 9:00	0.00
11/9/2008 9:30	0.00
11/9/2008 10:00	0.00
11/9/2008 10:30	0.00
11/9/2008 11:00	0.00
11/9/2008 11:30	0.00
11/9/2008 12:00	0.00
11/9/2008 12:30	0.00
11/9/2008 13:00	0.00
11/9/2008 13:30	0.00
11/9/2008 14:00	0.00
11/9/2008 14:30	0.00
11/9/2008 15:00	0.00
11/9/2008 15:30	0.00
11/9/2008 16:00	0.00
11/9/2008 16:30	0.00
11/9/2008 17:00	0.00
11/9/2008 17:30	0.00
11/9/2008 18:00	0.00
11/9/2008 18:30	0.00
11/9/2008 19:00	0.00
11/9/2008 19:30	0.00
11/9/2008 20:00	0.00
11/9/2008 20:30	0.00
11/9/2008 21:00	0.00
11/9/2008 21:30	0.00
11/9/2008 22:00	0.00
11/9/2008 22:30	0.00
11/9/2008 23:00	0.00
11/9/2008 23:30	0.00
11/10/2008 0:00	0.00
11/10/2008 0:30	0.00
11/10/2008 1:00	0.00
11/10/2008 1:30	0.00
11/10/2008 2:00	0.00
11/10/2008 2:30	0.00
11/10/2008 3:00	0.00
11/10/2008 3:30	0.00
11/10/2008 4:00	0.00
11/10/2008 4:30	0.00
11/10/2008 5:00	0.00
11/10/2008 5:30	0.00

Note:
Weather Station KFLHOMES5 is locate approximately 3.5 miles northeast of monitor well MW-1.
KFLHOMES5 is located at Latitude 25.458 N ; Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOME55

Farmland Estates, Homestead, FL

South Florida Water Management District

UR5 Job # 38617-098

Date Time	Rainfall (inches)
11/10/2008 6:00	0.00
11/10/2008 6:30	0.00
11/10/2008 7:00	0.00
11/10/2008 7:30	0.00
11/10/2008 8:00	0.00
11/10/2008 8:30	0.00
11/10/2008 9:00	0.00
11/10/2008 9:30	0.00
11/10/2008 10:00	0.00
11/10/2008 10:30	0.00
11/10/2008 11:00	0.00
11/10/2008 11:30	0.00
11/10/2008 12:00	0.00
11/10/2008 12:30	0.00
11/10/2008 13:00	0.00
11/10/2008 13:30	0.00
11/10/2008 14:00	0.00
11/10/2008 14:30	0.00
11/10/2008 15:00	0.00
11/10/2008 15:30	0.00
11/10/2008 16:00	0.00
11/10/2008 16:30	0.00
11/10/2008 17:00	0.00
11/10/2008 17:30	0.00
11/10/2008 18:00	0.00
11/10/2008 18:30	0.00
11/10/2008 19:00	0.00
11/10/2008 19:30	0.00
11/10/2008 20:00	0.00
11/10/2008 20:30	0.00
11/10/2008 21:00	0.00
11/10/2008 21:30	0.00
11/10/2008 22:00	0.00
11/10/2008 22:30	0.00
11/10/2008 23:00	0.00
11/10/2008 23:30	0.00
11/11/2008 0:00	0.00
11/11/2008 0:30	0.00
11/11/2008 1:00	0.00
11/11/2008 1:30	0.00
11/11/2008 2:00	0.00
11/11/2008 2:30	0.00
11/11/2008 3:00	0.00
11/11/2008 3:30	0.00
11/11/2008 4:00	0.00
11/11/2008 4:30	0.00
11/11/2008 5:00	0.00
11/11/2008 5:30	0.00
11/11/2008 6:00	0.00
11/11/2008 6:30	0.00
11/11/2008 7:00	0.00
11/11/2008 7:30	0.00
11/11/2008 8:00	0.00
11/11/2008 8:30	0.00
11/11/2008 9:00	0.00
11/11/2008 9:30	0.00
11/11/2008 10:00	0.00
11/11/2008 10:30	0.00
11/11/2008 11:00	0.00
11/11/2008 11:30	0.00
11/11/2008 12:00	0.00
11/11/2008 12:30	0.00
11/11/2008 13:00	0.00
11/11/2008 13:30	0.00
11/11/2008 14:00	0.00
11/11/2008 14:30	0.00
11/11/2008 15:00	0.00
11/11/2008 15:30	0.00
11/11/2008 16:00	0.00
11/11/2008 16:30	0.00
11/11/2008 17:00	0.00
11/11/2008 17:30	0.00
11/11/2008 18:00	0.00
11/11/2008 18:30	0.00
11/11/2008 19:00	0.00
11/11/2008 19:30	0.00
11/11/2008 20:00	0.00
11/11/2008 20:30	0.00
11/11/2008 21:00	0.00
11/11/2008 21:30	0.00
11/11/2008 22:00	0.00
11/11/2008 22:30	0.00
11/11/2008 23:00	0.00
11/11/2008 23:30	0.00
11/12/2008 0:00	0.00
11/12/2008 0:30	0.00
11/12/2008 1:00	0.00
11/12/2008 1:30	0.00
11/12/2008 2:00	0.00
11/12/2008 2:30	0.00
11/12/2008 3:00	0.00
11/12/2008 3:30	0.00
11/12/2008 4:00	0.00
11/12/2008 4:30	0.00
11/12/2008 5:00	0.00
11/12/2008 5:30	0.00

Date Time	Rainfall (inches)
11/12/2008 6:00	0.00
11/12/2008 6:30	0.00
11/12/2008 7:00	0.00
11/12/2008 7:30	0.00
11/12/2008 8:00	0.00
11/12/2008 8:30	0.00
11/12/2008 9:00	0.00
11/12/2008 9:30	0.00
11/12/2008 10:00	0.00
11/12/2008 10:30	0.00
11/12/2008 11:00	0.00
11/12/2008 11:30	0.00
11/12/2008 12:00	0.00
11/12/2008 12:30	0.00
11/12/2008 13:00	0.00
11/12/2008 13:30	0.00
11/12/2008 14:00	0.00
11/12/2008 14:30	0.00
11/12/2008 15:00	0.00
11/12/2008 15:30	0.00
11/12/2008 16:00	0.00
11/12/2008 16:30	0.00
11/12/2008 17:00	0.00
11/12/2008 17:30	0.00
11/12/2008 18:00	0.00
11/12/2008 18:30	0.00
11/12/2008 19:00	0.00
11/12/2008 19:30	0.00
11/12/2008 20:00	0.00
11/12/2008 20:30	0.00
11/12/2008 21:00	0.00
11/12/2008 21:30	0.00
11/12/2008 22:00	0.00
11/12/2008 22:30	0.00
11/12/2008 23:00	0.00
11/12/2008 23:30	0.00
11/13/2008 0:00	0.00
11/13/2008 0:30	0.00
11/13/2008 1:00	0.00
11/13/2008 1:30	0.00
11/13/2008 2:00	0.00
11/13/2008 2:30	0.00
11/13/2008 3:00	0.00
11/13/2008 3:30	0.00
11/13/2008 4:00	0.00
11/13/2008 4:30	0.00
11/13/2008 5:00	0.00
11/13/2008 5:30	0.00
11/13/2008 6:00	0.00
11/13/2008 6:30	0.00
11/13/2008 7:00	0.00
11/13/2008 7:30	0.00
11/13/2008 8:00	0.00
11/13/2008 8:30	0.00
11/13/2008 9:00	0.00
11/13/2008 9:30	0.00
11/13/2008 10:00	0.00
11/13/2008 10:30	0.00
11/13/2008 11:00	0.00
11/13/2008 11:30	0.00
11/13/2008 12:00	0.00
11/13/2008 12:30	0.00
11/13/2008 13:00	0.00
11/13/2008 13:30	0.00
11/13/2008 14:00	0.00
11/13/2008 14:30	0.00
11/13/2008 15:00	0.00
11/13/2008 15:30	0.00
11/13/2008 16:00	0.00
11/13/2008 16:30	0.00
11/13/2008 17:00	0.00
11/13/2008 17:30	0.00
11/13/2008 18:00	0.00
11/13/2008 18:30	0.00
11/13/2008 19:00	0.00
11/13/2008 19:30	0.00
11/13/2008 20:00	0.00
11/13/2008 20:30	0.00
11/13/2008 21:00	0.00
11/13/2008 21:30	0.00
11/13/2008 22:00	0.00
11/13/2008 22:30	0.00
11/13/2008 23:00	0.00
11/13/2008 23:30	0.00
11/14/2008 0:00	0.00
11/14/2008 0:30	0.00
11/14/2008 1:00	0.00
11/14/2008 1:30	0.00
11/14/2008 2:00	0.00
11/14/2008 2:30	0.00
11/14/2008 3:00	0.00
11/14/2008 3:30	0.00
11/14/2008 4:00	0.00
11/14/2008 4:30	0.00
11/14/2008 5:00	0.00
11/14/2008 5:30	0.00

Date Time	Rainfall (inches)
11/14/2008 6:00	0.00
11/14/2008 6:30	0.00
11/14/2008 7:00	0.00
11/14/2008 7:30	0.00
11/14/2008 8:00	0.00
11/14/2008 8:30	0.00
11/14/2008 9:00	0.00
11/14/2008 9:30	0.00
11/14/2008 10:00	0.00
11/14/2008 10:30	0.00
11/14/2008 11:00	0.00
11/14/2008 11:30	0.00
11/14/2008 12:00	0.00
11/14/2008 12:30	0.00
11/14/2008 13:00	0.00
11/14/2008 13:30	0.00
11/14/2008 14:00	0.00
11/14/2008 14:30	0.00
11/14/2008 15:00	0.00
11/14/2008 15:30	0.00
11/14/2008 16:00	0.00
11/14/2008 16:30	0.00
11/14/2008 17:00	0.00
11/14/2008 17:30	0.00
11/14/2008 18:00	0.00
11/14/2008 18:30	0.00
11/14/2008 19:00	0.00
11/14/2008 19:30	0.00
11/14/2008 20:00	0.00
11/14/2008 20:30	0.00
11/14/2008 21:00	0.00
11/14/2008 21:30	0.00
11/14/2008 22:00	0.00
11/14/2008 22:30	0.00
11/14/2008 23:00	0.00
11/14/2008 23:30	0.00
11/15/2008 0:00	0.00
11/15/2008 0:30	0.00
11/15/2008 1:00	0.00
11/15/2008 1:30	0.00
11/15/2008 2:00	0.00
11/15/2008 2:30	0.00
11/15/2008 3:00	0.00
11/15/2008 3:30	0.00
11/15/2008 4:00	0.00
11/15/2008 4:30	0.00
11/15/2008 5:00	0.00
11/15/2008 5:30	0.00
11/15/2008 6:00	0.00
11/15/2008 6:30	0.00
11/15/2008 7:00	0.00
11/15/2008 7:30	0.00
11/15/2008 8:00	0.00
11/15/2008 8:30	0.00
11/15/2008 9:00	0.00
11/15/2008 9:30	0.00
11/15/2008 10:00	0.00
11/15/2008 10:30	0.00
11/15/2008 11:00	0.00
11/15/2008 11:30	0.00
11/15/2008 12:00	0.00
11/15/2008 12:30	0.00
11/15/2008 13:00	0.00
11/15/2008 13:30	0.00
11/15/2008 14:00	0.00
11/15/2008 14:30	0.00
11/15/2008 15:00	0.00
11/15/2008 15:30	0.00
11/15/2008 16:00	0.00
11/15/2008 16:30	0.00
11/15/2008 17:00	0.00
11/15/2008 17:30	0.00
11/15/2008 18:00	0.00
11/15/2008 18:30	0.00
11/15/2008 19:00	0.00
11/15/2008 19:30	0.00
11/15/2008 20:00	0.00
11/15/2008 20:30	0.00
11/15/2008 21:00	0.00
11/15/2008 21:30	0.00
11/15/2008 22:00	0.00
11/15/2008 22:30	0.00
11/15/2008 23:00	0.00
11/15/2008 23:30	0.00
11/16/2008 0:00	0.00
11/16/2008 0:30	0.00
11/16/2008 1:00	0.00
11/16/2008 1:30	0.00
11/16/2008 2:00	0.00
11/16/2008 2:30	0.00
11/16/2008 3:00	0.00
11/16/2008 3:30	0.00
11/16/2008 4:00	0.00
11/16/2008 4:30	0.00
11/16/2008 5:00	0.00
11/16/2008 5:30	0.00

Date Time	Rainfall (inches)
11/16/2008 6:00	0.00
11/16/2008 6:30	0.00
11/16/2008 7:00	0.00
11/16/2008 7:30	0.00
11/16/2008 8:00	0.00
11/16/2008 8:30	0.00
11/16/2008 9:00	0.00
11/16/2008 9:30	0.00
11/16/2008 10:00	0.00
11/16/2008 10:30	0.00
11/16/2008 11:00	0.00
11/16/2008 11:30	0.00
11/16/2008 12:00	0.00
11/16/2008 12:30	0.00
11/16/2008 13:00	0.00
11/16/2008 13:30	0.00
11/16/2008 14:00	0.00
11/16/2008 14:30	0.00
11/16/2008 15:00	0.00
11/16/2008 15:30	0.00
11/16/2008 16:00	0.00
11/16/2008 16:30	0.00
11/16/2008 17:00	0.00
11/16/2008 17:30	0.00
11/16/2008 18:00	0.00
11/16/2008 18:30	0.00
11/16/2008 19:00	0.00
11/16/2008 19:30	0.00
11/16/2008 20:00	0.00
11/16/2008 20:30	0.00
11/16/2008 21:00	0.00
11/16/2008 21:30	0.00
11/16/2008 22:00	0.00
11/16/2008 22:30	0.00
11/16/2008 23:00	0.00
11/16/2008 23:30	0.00
11/17/2008 0:00	0.00
11/17/2008 0:30	0.00
11/17/2008 1:00	0.00
11/17/2008 1:30	0.00
11/17/2008 2:00	0.00
11/17/2008 2:30	0.00
11/17/2008 3:00	0.00
11/17/2008 3:30	0.00
11/17/2008 4:00	0.00
11/17/2008 4:30	0.00
11/17/2008 5:00	0.00
11/17/2008 5:30	0.00
11/17/2008 6:00	0.00
11/17/2008 6:30	0.00
11/17/2008 7:00	0.00
11/17/2008 7:30	0.00
11/17/2008 8:00	0.00
11/17/2008 8:30	0.00
11/17/2008 9:00	0.00
11/17/2008 9:30	0.00
11/17/2008 10:00	0.00
11/17/2008 10:30	0.00
11/17/2008 11:00	0.00
11/17/2008 11:30	0.00
11/17/2008 12:00	0.00
11/17/2008 12:30	0.00
11/17/2008 13:00	0.00
11/17/2008 13:30	0.00
11/17/2008 14:00	0.00
11/17/2008 14:30	0.00
11/17/2008 15:00	0.00
11/17/2008 15:30	0.00
11/17/2008 16:00	0.00
11/17/2008 16:30	0.00
11/17/2008 17:00	0.00
11/17/2008 17:30	0.00
11/17/2008 18:00	0.00
11/17/2008 18:30	0.00
11/17/2008 19:00	0.00
11/17/2008 19:30	0.00
11/17/2008 20:00	0.00
11/17/2008 20:30	0.00
11/17/2008 21:00	0.00
11/17/2008 21:30	0.00
11/17/2008 22:00	0.00
11/17/2008 22:30	0.00
11/17/2008 23:00	0.00
11/17/2008 23:30	0.00
11/18/2008 0:00	0.00
11/18/2008 0:30	0.00
11/18/2008 1:00	0.00
11/18/2008 1:30	0.00
11/18/2008 2:00	0.00
11/18/2008 2:30	0.00
11/18/2008 3:00	0.00
11/18/2008 3:30	0.00
11/18/2008 4:00	0.00
11/18/2008 4:30	0.00
11/18/2008 5:00	0.00
11/18/2008 5:30	0.00

Date Time	Rainfall (inches)
11/18/2008 6:00	0.00
11/18/2008 6:30	0.00
11/18/2008 7:00	0.00
11/18/2008 7:30	0.00
11/18/2008 8:00	0.00
11/18/2008 8:30	0.00
11/18/2008 9:00	0.00
11/18/2008 9:30	0.00
11/18/2008 10:00	0.00
11/18/2008 10:30	0.00
11/18/2008 11:00	0.00
11/18/2008 11:30	0.00
11/18/2008 12:00	0.00
11/18/2008 12:30	0.00
11/18/2008 13:00	0.00
11/18/2008 13:30	0.00
11/18/2008 14:00	0.00
11/18/2008 14:30	0.00
11/18/2008 15:00	0.00
11/18/2008 15:30	0.00
11/18/2008 16:00	0.00
11/18/2008 16:30	0.00
11/18/2008 17:00	0.00
11/18/2008 17:30	0.00
11/18/2008 18:00	0.00
11/18/2008 18:30	0.00
11/18/2008 19:00	0.00
11/18/2008 19:30	0.00
11/18/2008 20:00	0.00
11/18/2008 20:30	0.00
11/18/2008 21:00	0.00
11/18/2008 21:30	0.00
11/18/2008 22:00	0.00
11/18/2008 22:30	0.00
11/18/2008 23:00	0.00
11/18/2008 23:30	0.00
11/19/2008 0:00	0.00
11/19/2008 0:30	0.00
11/19/2008 1:00	0.00
11/19/2008 1:30	0.00
11/19/2008 2:00	0.00
11/19/2008 2:30	0.00
11/19/2008 3:00	0.00
11/19/2008 3:30	0.00
11/19/2008 4:00	0.00
11/19/2008 4:30	0.00
11/19/2008 5:00	0.00
11/19/2008 5:30	0.00
11/19/2008 6:00	0.00
11/19/2008 6:30	0.00
11/19/2008 7:00	0.00
11/19/2008 7:30	0.00
11/19/2008 8:00	0.00
11/19/2008 8:30	0.00
11/19/2008 9:00	0.00
11/19/2008 9:30	0.00
11/19/2008 10:00	0.00
11/19/2008 10:30	0.00
11/19/2008 11:00	0.00
11/19/2008 11:30	0.00
11/19/2008 12:00	0.00
11/19/2008 12:30	0.00
11/19/2008 13:00	0.00
11/19/2008 13:30	0.00
11/19/2008 14:00	0.00
11/19/2008 14:30	0.00
11/19/2008 15:00	0.00
11/19/2008 15:30	0.00
11/19/2008 16:00	0.00
11/19/2008 16:30	0.00
11/19/2008 17:00	0.00
11/19/2008 17:30	0.00
11/19/2008 18:00	0.00
11/19/2008 18:30	0.00
11/19/2008 19:00	0.00
11/19/2008 19:30	0.00
11/19/2008 20:00	0.00
11/19/2008 20:30	0.00
11/19/2008 21:00	0.00
11/19/2008 21:30	0.00
11/19/2008 22:00	0.00
11/19/2008 22:30	0.00
11/19/2008 23:00	0.00
11/19/2008 23:30	0.00
11/20/2008 0:00	0.00
11/20/2008 0:30	0.00
11/20/2008 1:00	0.00
11/20/2008 1:30	0.00
11/20/2008 2:00	0.00
11/20/2008 2:30	0.00
11/20/2008 3:00	0.00
11/20/2008 3:30	0.00
11/20/2008 4:00	0.00
11/20/2008 4:30	0.00
11/20/2008 5:00	0.00
11/20/2008 5:30	0.00

Date Time	Rainfall (inches)
11/20/2008 6:00	0.00
11/20/2008 6:30	0.00
11/20/2008 7:00	0.00
11/20/2008 7:30	0.00
11/20/2008 8:00	0.00
11/20/2008 8:30	0.00
11/20/2008 9:00	0.00
11/20/2008 9:30	0.00
11/20/2008 10:00	0.00
11/20/2008 10:30	0.00
11/20/2008 11:00	0.00
11/20/2008 11:30	0.00
11/20/2008 12:00	0.00
11/20/2008 12:30	0.00
11/20/2008 13:00	0.00
11/20/2008 13:30	0.00
11/20/2008 14:00	0.00
11/20/2008 14:30	0.00
11/20/2008 15:00	0.00
11/20/2008 15:30	0.00
11/20/2008 16:00	0.00
11/20/2008 16:30	0.00
11/20/2008 17:00	0.00
11/20/2008 17:30	0.00
11/20/2008 18:00	0.00
11/20/2008 18:30	0.00
11/20/2008 19:00	0.00
11/20/2008 19:30	0.00
11/20/2008 20:00	0.00
11/20/2008 20:30	0.00
11/20/2008 21:00	0.00
11/20/2008 21:30	0.00
11/20/2008 22:00	0.00
11/20/2008 22:30	0.00
11/20/2008 23:00	0.00
11/20/2008 23:30	0.00
11/21/2008 0:00	0.00
11/21/2008 0:30	0.00
11/21/2008 1:00	0.00
11/21/2008 1:30	0.00
11/21/2008 2:00	0.00
11/21/2008 2:30	0.00
11/21/2008 3:00	0.00
11/21/2008 3:30	0.00
11/21/2008 4:00	0.00
11/21/2008 4:30	0.00
11/21/2008 5:00	0.00
11/21/2008 5:30	0.00
11/21/2008 6:00	0.00
11/21/2008 6:30	0.00
11/21/2008 7:00	0.00
11/21/2008 7:30	0.00
11/21/2008 8:00	0.00
11/21/2008 8:30	0.00
11/21/2008 9:00	0.00
11/21/2008 9:30	0.00
11/21/2008 10:00	0.00
11/21/2008 10:30	0.00
11/21/2008 11:00	0.00
11/21/2008 11:30	0.00
11/21/2008 12:00	0.00
11/21/2008 12:30	0.00
11/21/2008 13:00	0.00
11/21/2008 13:30	0.00
11/21/2008 14:00	0.00
11/21/2008 14:30	0.00
11/21/2008 15:00	0.00
11/21/2008 15:30	0.00
11/21/2008 16:00	0.00
11/21/2008 16:30	0.00
11/21/2008 17:00	0.00
11/21/2008 17:30	0.00
11/21/2008 18:00	0.00
11/21/2008 18:30	0.00
11/21/2008 19:00	0.00
11/21/2008 19:30	0.00
11/21/2008 20:00	0.00
11/21/2008 20:30	0.00
11/21/2008 21:00	0.00
11/21/2008 21:30	0.00
11/21/2008 22:00	0.00
11/21/2008 22:30	0.00
11/21/2008 23:00	0.00
11/21/2008 23:30	0.00
11/22/2008 0:00	0.00
11/22/2008 0:30	0.00
11/22/2008 1:00	0.00
11/22/2008 1:30	0.00
11/22/2008 2:00	0.00
11/22/2008 2:30	0.00
11/22/2008 3:00	0.00
11/22/2008 3:30	0.00
11/22/2008 4:00	0.00
11/22/2008 4:30	0.00
11/22/2008 5:00	0.00
11/22/2008 5:30	0.00

Note:

Weather Station KFLHOME55 is locate approximately 3.5 miles northwest of monitor well MW-1.
KFLHOME55 is located at Latitude 25.498 N ; Longitude 80.519 W recorded in NAD 83.

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
11/23/2008 6:00	0.00
11/23/2008 6:30	0.00
11/23/2008 7:00	0.00
11/23/2008 7:30	0.00
11/23/2008 8:00	0.00
11/23/2008 8:30	0.00
11/23/2008 9:00	0.00
11/23/2008 9:30	0.00
11/23/2008 10:00	0.00
11/23/2008 10:30	0.00
11/23/2008 11:00	0.00
11/23/2008 11:30	0.00
11/23/2008 12:00	0.00
11/23/2008 12:30	0.00
11/23/2008 13:00	0.00
11/23/2008 13:30	0.00
11/23/2008 14:00	0.00
11/23/2008 14:30	0.00
11/23/2008 15:00	0.00
11/23/2008 15:30	0.00
11/23/2008 16:00	0.00
11/23/2008 16:30	0.00
11/23/2008 17:00	0.00
11/23/2008 17:30	0.00
11/23/2008 18:00	0.00
11/23/2008 18:30	0.00
11/23/2008 19:00	0.00
11/23/2008 19:30	0.00
11/23/2008 20:00	0.00
11/23/2008 20:30	0.00
11/23/2008 21:00	0.00
11/23/2008 21:30	0.00
11/23/2008 22:00	0.00
11/23/2008 22:30	0.00
11/23/2008 23:00	0.00
11/23/2008 23:30	0.00
11/24/2008 0:00	0.00
11/24/2008 0:30	0.00
11/24/2008 1:00	0.00
11/24/2008 1:30	0.00
11/24/2008 2:00	0.00
11/24/2008 2:30	0.00
11/24/2008 3:00	0.00
11/24/2008 3:30	0.00
11/24/2008 4:00	0.00
11/24/2008 4:30	0.00
11/24/2008 5:00	0.00
11/24/2008 5:30	0.00

Date Time	Rainfall (inches)
11/24/2008 6:00	0.00
11/24/2008 6:30	0.00
11/24/2008 7:00	0.00
11/24/2008 7:30	0.00
11/24/2008 8:00	0.00
11/24/2008 8:30	0.00
11/24/2008 9:00	0.00
11/24/2008 9:30	0.00
11/24/2008 10:00	0.00
11/24/2008 10:30	0.00
11/24/2008 11:00	0.00
11/24/2008 11:30	0.00
11/24/2008 12:00	0.00
11/24/2008 12:30	0.00
11/24/2008 13:00	0.00
11/24/2008 13:30	0.00
11/24/2008 14:00	0.00
11/24/2008 14:30	0.00
11/24/2008 15:00	0.00
11/24/2008 15:30	0.00
11/24/2008 16:00	0.00
11/24/2008 16:30	0.00
11/24/2008 17:00	0.00
11/24/2008 17:30	0.00
11/24/2008 18:00	0.00
11/24/2008 18:30	0.00
11/24/2008 19:00	0.00
11/24/2008 19:30	0.00
11/24/2008 20:00	0.00
11/24/2008 20:30	0.00
11/24/2008 21:00	0.00
11/24/2008 21:30	0.00
11/24/2008 22:00	0.00
11/24/2008 22:30	0.00
11/24/2008 23:00	0.00
11/24/2008 23:30	0.00
11/25/2008 0:00	0.00
11/25/2008 0:30	0.00
11/25/2008 1:00	0.00
11/25/2008 1:30	0.00
11/25/2008 2:00	0.00
11/25/2008 2:30	0.00
11/25/2008 3:00	0.00
11/25/2008 3:30	0.00
11/25/2008 4:00	0.00
11/25/2008 4:30	0.00
11/25/2008 5:00	0.00
11/25/2008 5:30	0.00

Date Time	Rainfall (inches)
11/25/2008 6:00	0.00
11/25/2008 6:30	0.00
11/25/2008 7:00	0.00
11/25/2008 7:30	0.00
11/25/2008 8:00	0.00
11/25/2008 8:30	0.00
11/25/2008 9:00	0.00
11/25/2008 9:30	0.00
11/25/2008 10:00	0.00
11/25/2008 10:30	0.00
11/25/2008 11:00	0.00
11/25/2008 11:30	0.00
11/25/2008 12:00	0.00
11/25/2008 12:30	0.00
11/25/2008 13:00	0.00
11/25/2008 13:30	0.00
11/25/2008 14:00	0.00
11/25/2008 14:30	0.00
11/25/2008 15:00	0.00
11/25/2008 15:30	0.00
11/25/2008 16:00	0.00
11/25/2008 16:30	0.00
11/25/2008 17:00	0.00
11/25/2008 17:30	0.00
11/25/2008 18:00	0.00
11/25/2008 18:30	0.00
11/25/2008 19:00	0.00
11/25/2008 19:30	0.00
11/25/2008 20:00	0.00
11/25/2008 20:30	0.00
11/25/2008 21:00	0.00
11/25/2008 21:30	0.00
11/25/2008 22:00	0.00
11/25/2008 22:30	0.00
11/25/2008 23:00	0.00
11/25/2008 23:30	0.00
11/26/2008 0:00	0.00
11/26/2008 0:30	0.00
11/26/2008 1:00	0.00
11/26/2008 1:30	0.00
11/26/2008 2:00	0.00
11/26/2008 2:30	0.00
11/26/2008 3:00	0.00
11/26/2008 3:30	0.00
11/26/2008 4:00	0.00
11/26/2008 4:30	0.00
11/26/2008 5:00	0.00
11/26/2008 5:30	0.00

Date Time	Rainfall (inches)
11/26/2008 6:00	0.00
11/26/2008 6:30	0.00
11/26/2008 7:00	0.00
11/26/2008 7:30	0.00
11/26/2008 8:00	0.00
11/26/2008 8:30	0.00
11/26/2008 9:00	0.00
11/26/2008 9:30	0.00
11/26/2008 10:00	0.00
11/26/2008 10:30	0.00
11/26/2008 11:00	0.00
11/26/2008 11:30	0.00
11/26/2008 12:00	0.00
11/26/2008 12:30	0.00
11/26/2008 13:00	0.00
11/26/2008 13:30	0.00
11/26/2008 14:00	0.00
11/26/2008 14:30	0.00
11/26/2008 15:00	0.00
11/26/2008 15:30	0.00
11/26/2008 16:00	0.00
11/26/2008 16:30	0.00
11/26/2008 17:00	0.00
11/26/2008 17:30	0.00
11/26/2008 18:00	0.00
11/26/2008 18:30	0.00
11/26/2008 19:00	0.00
11/26/2008 19:30	0.00
11/26/2008 20:00	0.00
11/26/2008 20:30	0.00
11/26/2008 21:00	0.00
11/26/2008 21:30	0.00
11/26/2008 22:00	0.00
11/26/2008 22:30	0.00
11/26/2008 23:00	0.00
11/26/2008 23:30	0.00
11/27/2008 0:00	0.00
11/27/2008 0:30	0.00
11/27/2008 1:00	0.00
11/27/2008 1:30	0.00
11/27/2008 2:00	0.00
11/27/2008 2:30	0.00
11/27/2008 3:00	0.00
11/27/2008 3:30	0.00
11/27/2008 4:00	0.00
11/27/2008 4:30	0.00
11/27/2008 5:00	0.00
11/27/2008 5:30	0.00

Date Time	Rainfall (inches)
11/27/2008 6:00	0.00
11/27/2008 6:30	0.00
11/27/2008 7:00	0.00
11/27/2008 7:30	0.00
11/27/2008 8:00	0.00
11/27/2008 8:30	0.00
11/27/2008 9:00	0.00
11/27/2008 9:30	0.00
11/27/2008 10:00	0.00
11/27/2008 10:30	0.00
11/27/2008 11:00	0.00
11/27/2008 11:30	0.00
11/27/2008 12:00	0.00
11/27/2008 12:30	0.00
11/27/2008 13:00	0.00
11/27/2008 13:30	0.00
11/27/2008 14:00	0.00
11/27/2008 14:30	0.00
11/27/2008 15:00	0.00
11/27/2008 15:30	0.00
11/27/2008 16:00	0.00
11/27/2008 16:30	0.00
11/27/2008 17:00	0.00
11/27/2008 17:30	0.00
11/27/2008 18:00	0.00
11/27/2008 18:30	0.00
11/27/2008 19:00	0.00
11/27/2008 19:30	0.00
11/27/2008 20:00	0.00
11/27/2008 20:30	0.00
11/27/2008 21:00	0.00
11/27/2008 21:30	0.00
11/27/2008 22:00	0.00
11/27/2008 22:30	0.00
11/27/2008 23:00	0.00
11/27/2008 23:30	0.00
11/28/2008 0:00	0.00
11/28/2008 0:30	0.00
11/28/2008 1:00	0.00
11/28/2008 1:30	0.00
11/28/2008 2:00	0.00
11/28/2008 2:30	0.00
11/28/2008 3:00	0.00
11/28/2008 3:30	0.00
11/28/2008 4:00	0.00
11/28/2008 4:30	0.00
11/28/2008 5:00	0.00
11/28/2008 5:30	0.00

Date Time	Rainfall (inches)
11/28/2008 6:00	0.00
11/28/2008 6:30	0.00
11/28/2008 7:00	0.00
11/28/2008 7:30	0.00
11/28/2008 8:00	0.00
11/28/2008 8:30	0.00
11/28/2008 9:00	0.00
11/28/2008 9:30	0.00
11/28/2008 10:00	0.00
11/28/2008 10:30	0.00
11/28/2008 11:00	0.00
11/28/2008 11:30	0.00
11/28/2008 12:00	0.00
11/28/2008 12:30	0.00
11/28/2008 13:00	0.00
11/28/2008 13:30	0.00
11/28/2008 14:00	0.00
11/28/2008 14:30	0.00
11/28/2008 15:00	0.00
11/28/2008 15:30	0.00
11/28/2008 16:00	0.00
11/28/2008 16:30	0.00
11/28/2008 17:00	0.00
11/28/2008 17:30	0.00
11/28/2008 18:00	0.00
11/28/2008 18:30	0.00
11/28/2008 19:00	0.00
11/28/2008 19:30	0.00
11/28/2008 20:00	0.00
11/28/2008 20:30	0.00
11/28/2008 21:00	0.00
11/28/2008 21:30	0.00
11/28/2008 22:00	0.00
11/28/2008 22:30	0.00
11/28/2008 23:00	0.00
11/28/2008 23:30	0.00
11/29/2008 0:00	0.00
11/29/2008 0:30	0.00
11/29/2008 1:00	0.00
11/29/2008 1:30	0.00
11/29/2008 2:00	0.00
11/29/2008 2:30	0.00
11/29/2008 3:00	0.00
11/29/2008 3:30	0.00
11/29/2008 4:00	0.00
11/29/2008 4:30	0.00
11/29/2008 5:00	0.00
11/29/2008 5:30	0.00

Date Time	Rainfall (inches)
11/29/2008 6:00	0.00
11/29/2008 6:30	0.00
11/29/2008 7:00	0.00
11/29/2008 7:30	0.00
11/29/2008 8:00	0.00
11/29/2008 8:30	0.00
11/29/2008 9:00	0.00
11/29/2008 9:30	0.00
11/29/2008 10:00	0.00
11/29/2008 10:30	0.00
11/29/2008 11:00	0.00
11/29/2008 11:30	0.00
11/29/2008 12:00	0.00
11/29/2008 12:30	0.00
11/29/2008 13:00	0.00
11/29/2008 13:30	0.00
11/29/2008 14:00	0.00
11/29/2008 14:30	0.00
11/29/2008 15:00	0.00
11/29/2008 15:30	0.00
11/29/2008 16:00	0.00
11/29/2008 16:30	0.00
11/29/2008 17:00	0.00
11/29/2008 17:30	0.00
11/29/2008 18:00	0.00
11/29/2008 18:30	0.00
11/29/2008 19:00	0.00
11/29/2008 19:30	0.00
11/29/2008 20:00	0.00
11/29/2008 20:30	0.00
11/29/2008 21:00	0.00
11/29/2008 21:30	0.00
11/29/2008 22:00	0.00
11/29/2008 22:30	0.00
11/29/2008 23:00	0.00
11/29/2008 23:30	0.00
11/30/2008 0:00	0.00
11/30/2008 0:30	0.00
11/30/2008 1:00	0.00
11/30/2008 1:30	0.00
11/30/2008 2:00	0.00
11/30/2008 2:30	0.00
11/30/2008 3:00	0.00
11/30/2008 3:30	0.00
11/30/2008 4:00	0.00
11/30/2008 4:30	0.00
11/30/2008 5:00	0.00
11/30/2008 5:30	0.00

Date Time	Rainfall (inches)
11/30/2008 6:00	0.00
11/30/2008 6:30	0.00
11/30/2008 7:00	0.00
11/30/2008 7:30	0.00
11/30/2008 8:00	0.00
11/30/2008 8:30	0.00
11/30/2008 9:00	0.00
11/30/2008 9:30	0.00
11/30/2008 10:00	0.00
11/30/2008 10:30	0.00
11/30/2008 11:00	0.00
11/30/2008 11:30	0.00
11/30/2008 12:00	0.00
11/30/2008 12:30	0.00
11/30/2008 13:00	0.00
11/30/2008 13:30	0.00
11/30/2008 14:00	0.00
11/30/2008 14:30	0.00
11/30/2008 15:00	0.00
11/30/2008 15:30	0.00
11/30/2008 16:00	0.00
11/30/2008 16:30	0.00
11/30/2008 17:00	0.00
11/30/2008 17:30	0.00
11/30/2008 18:00	0.00
11/30/2008 18:30	0.00
11/30/2008 19:00	0.00
11/30/2008 19:30	0.00
11/30/2008 20:00	0.00
11/30/2008 20:30	0.00
11/30/2008 21:00	0.00
11/30/2008 21:30	0.00
11/30/2008 22:00	0.00
11/30/2008 22:30	0.00
11/30/2008 23:00	0.00
11/30/2008 23:30	0.00
12/1/2008 0:00	0.00
12/1/2008 0:32	0.00
12/1/2008 1:04	0.00
12/1/2008 1:30	0.00
12/1/2008 2:02	0.00
12/1/2008 2:32	0.00
12/1/2008 3:02	0.00
12/1/2008 3:32	0.00
12/1/2008 4:02	0.00
12/1/2008 4:33	0.00
12/1/2008 5:03	0.00
12/1/2008 5:33	0.00
12/1/2008 6:03	0.00
12/1/2008 6:33	0.00
12/1/2008 7:03	0.00
12/1/2008 7:33	0.00
12/1/2008 8:04	0.00
12/1/2008 8:34	0.00
12/1/2008 9:04	0.00
12/1/2008 9:34	0.00
12/1/2008 10:04	0.00
12/1/2008 10:34	0.00
12/1/2008 11:04	0.00
12/1/2008 11:34	0.00
12/1/2008 12:03	0.00
12/1/2008 12:31	0.00
12/1/2008 13:02	0.00
12/1/2008 13:32	0.00
12/1/2008 14:02	0.00
12/1/2008 14:32	0.00
12/1/2008 15:02	0.00
12/1/2008 15:32	0.00
12/1/2008 16:02	0.00
12/1/2008 16:32	0.00
12/1/2008 17:03	0.00
12/1/2008 17:33	0.00
12/1/2008 18:03	0.00
12/1/2008 18:33	0.00
12/1/2008 19:03	0.00
12/1/2008 19:34	0.00
12/1/2008 20:04	0.00
12/1/2008 20:34	0.00
12/1/2008 21:04	0.00
12/1/2008 21:34	0.00
12/1/2008 22:04	0.00
12/1/2008 22:34	0.00
12/1/2008 23:05	0.00
12/1/2008 23:30	0.00
12/2/2008 0:09	0.00
12/2/2008 0:41	0.00
12/2/2008 1:14	0.00
12/2/2008 1:47	0.00
12/2/2008 2:17	0.00
12/2/2008 2:47	0.00
12/2/2008 3:17	0.00
12/2/2008 3:47	0.00
12/2/2008 4:17	0.00
12/2/2008 4:47	0.00
12/2/2008 5:17	0.00
12/2/2008 5:47	0.00

Date Time	Rainfall (inches)
12/2/2008 6:17	0.00
12/2/2008 6:47	0.00
12/2/2008 7:17	0.00
12/2/2008 7:42	0.00
12/2/2008 8:12	0.00
12/2/2008 8:42	0.00
12/2/2008 9:12	0.00
12/2/2008 9:42	0.00
12/2/2008 10:13	0.00
12/2/2008 10:43	0.00
12/2/2008 11:13	0.00
12/2/2008 11:43	0.00
12/2/2008 11:48	0.00
12/2/2008 12:13	0.00
12/2/2008 12:43	0.00
12/2/2008 13:13	0.00
12/2/2008 13:43	0.00
12/2/2008 14:13	0.00
12/2/2008 14:43	0.00
12/2/2008 15:14	0.00
12/2/2008 15:45	0.00
12/2/2008 16:16	0.00
12/2/2008 16:46	0.00
12/2/2008 17:16	0.00
12/2/2008 17:46	0.00
12/2/2008 18:16	0.00
12/2/2008 18:46	0.00
12/2/2008 19:11	0.00
12/2/2008 19:31	0.00
12/2/2008 20:02	0.00
12/2/2008 20:32	0.00
12/2/2008 21:01	0.00
12/2/2008 21:32	0.00
12/2/2008 22:01	0.00
12/2/2008 22:32	0.00
12/2/2008 23:02	0.00
12/2/2008 23:32	0.00
12/3/2008 0:01	0.00
12/3/2008 0:30	0.00
12/3/2008 1:03	0.00
12/3/2008 1:30	0.00
12/3/2008 2:02	0.00
12/3/2008 2:32	0.00
12/3/2008 3:02	0.00
12/3/2008 3:32	0.00
12/3/2008 4:02	0.00
12/3/2008 4:32	0.00
12/3/2008 5:02	0.00
12/3/2008 5:33	0.00
12/3/2008 6:03	0.00
12/3/2008 6:33	0.00
12/3/2008 7:04	0.00
12/3/2008 7:33	0.00
12/3/2008 8:04	0.00
12/3/2008 8:34	0.00
12/3/2008 9:04	0.00
12/3/2008 9:34	0.00
12/3/2008 10:04	0.00
12/3/2008 10:34	0.00
12/3/2008 11:04	0.00
12/3/2008 11:34	0.00
12/3/2008 12:04	0.00
12/3/2008 12:34	0.00
12/3/2008 13:00	0.00
12/3/2008 13:31	0.00
12/3/2008 14:01	0.00
12/3/2008 14:32	0.00
12/3/2008 15:02	0.00
12/3/2008 15:32	0.00
12/3/2008 16:02	0.00
12/3/2008 16:32	0.00
12/3/2008 17:03	0.00
12/3/2008 17:33	0.00
12/3/2008 18:03	0.00
12/3/2008 18:33	0.00
12/3/2008 19:03	0.00
12/3/2008 19:34	0.00
12/3/2008 20:04	0.00
12/3/2008 20:34	0.00
12/3/2008 21:04	0.00
12/3/2008 21:34	0.00
12/3/2008 22:04	0.00
12/3/2008 22:35	0.00
12/3/2008 23:01	0.00
12/3/2008 23:31	0.00
12/4/2008 0:01	0.00
12/4/2008 0:31	0.00
12/4/2008 1:02	0.00
12/4/2008 1:34	0.00
12/4/2008 2:01	0.00
12/4/2008 2:31	0.00
12/4/2008 3:01	0.00
12/4/2008 3:32	0.00
12/4/2008 4:02	0.00
12/4/2008 4:32	0.00
12/4/2008 5:02	0.00

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
12/4/2008 5:33	0.00
12/4/2008 6:02	0.00
12/4/2008 6:32	0.00
12/4/2008 7:02	0.00
12/4/2008 7:32	0.00
12/4/2008 8:02	0.00
12/4/2008 8:32	0.00
12/4/2008 9:03	0.00
12/4/2008 9:33	0.00
12/4/2008 10:03	0.00
12/4/2008 10:33	0.00
12/4/2008 11:04	0.00
12/4/2008 11:34	0.00
12/4/2008 12:04	0.00
12/4/2008 12:30	0.00
12/4/2008 13:00	0.00
12/4/2008 13:31	0.00
12/4/2008 14:01	0.00
12/4/2008 14:32	0.00
12/4/2008 15:02	0.00
12/4/2008 15:32	0.00
12/4/2008 16:03	0.00
12/4/2008 16:33	0.00
12/4/2008 17:03	0.00
12/4/2008 17:33	0.00
12/4/2008 18:03	0.00
12/4/2008 18:34	0.00
12/4/2008 19:04	0.00
12/4/2008 19:34	0.00
12/4/2008 20:04	0.00
12/4/2008 20:34	0.00
12/4/2008 21:04	0.00
12/4/2008 21:34	0.00
12/4/2008 22:04	0.00
12/4/2008 22:35	0.00
12/4/2008 23:01	0.00
12/4/2008 23:31	0.00
12/5/2008 0:00	0.00
12/5/2008 0:31	0.00
12/5/2008 1:02	0.00
12/5/2008 1:32	0.00
12/5/2008 2:02	0.00
12/5/2008 2:32	0.00
12/5/2008 3:02	0.00
12/5/2008 3:32	0.00
12/5/2008 4:02	0.00
12/5/2008 4:32	0.00
12/5/2008 5:02	0.00
12/5/2008 5:32	0.00
12/5/2008 6:03	0.00
12/5/2008 6:32	0.00
12/5/2008 7:03	0.00
12/5/2008 7:33	0.00
12/5/2008 8:03	0.00
12/5/2008 8:33	0.00
12/5/2008 9:03	0.00
12/5/2008 9:34	0.00
12/5/2008 10:04	0.00
12/5/2008 10:34	0.00
12/5/2008 11:04	0.00
12/5/2008 11:34	0.00
12/5/2008 12:00	0.00
12/5/2008 12:32	0.00
12/5/2008 13:02	0.00
12/5/2008 13:32	0.00
12/5/2008 14:03	0.00
12/5/2008 14:33	0.00
12/5/2008 15:03	0.00
12/5/2008 15:33	0.00
12/5/2008 16:03	0.00
12/5/2008 16:34	0.00
12/5/2008 17:04	0.00
12/5/2008 17:34	0.00
12/5/2008 18:04	0.00
12/5/2008 18:34	0.00
12/5/2008 19:04	0.00
12/5/2008 19:34	0.00
12/5/2008 20:04	0.00
12/5/2008 20:34	0.00
12/5/2008 21:04	0.00
12/5/2008 21:30	0.00
12/5/2008 22:01	0.00
12/5/2008 22:32	0.00
12/5/2008 23:02	0.00
12/5/2008 23:32	0.00
12/6/2008 0:01	0.00
12/6/2008 0:31	0.00
12/6/2008 1:02	0.00
12/6/2008 1:32	0.00
12/6/2008 2:03	0.00
12/6/2008 2:33	0.00
12/6/2008 3:01	0.00
12/6/2008 3:32	0.00
12/6/2008 4:02	0.00
12/6/2008 4:32	0.00
12/6/2008 5:02	0.00

Date Time	Rainfall (inches)
12/6/2008 5:33	0.00
12/6/2008 6:03	0.00
12/6/2008 6:33	0.00
12/6/2008 7:03	0.00
12/6/2008 7:34	0.00
12/6/2008 8:04	0.00
12/6/2008 8:34	0.00
12/6/2008 9:04	0.00
12/6/2008 9:34	0.00
12/6/2008 10:04	0.00
12/6/2008 10:34	0.00
12/6/2008 11:00	0.00
12/6/2008 11:30	0.00
12/6/2008 12:00	0.00
12/6/2008 12:31	0.00
12/6/2008 13:01	0.00
12/6/2008 13:31	0.00
12/6/2008 14:01	0.00
12/6/2008 14:32	0.00
12/6/2008 15:01	0.00
12/6/2008 15:31	0.00
12/6/2008 16:01	0.00
12/6/2008 16:32	0.00
12/6/2008 17:02	0.00
12/6/2008 17:33	0.00
12/6/2008 18:02	0.00
12/6/2008 18:32	0.00
12/6/2008 19:03	0.00
12/6/2008 19:33	0.00
12/6/2008 20:03	0.00
12/6/2008 20:33	0.00
12/6/2008 21:03	0.00
12/6/2008 21:33	0.00
12/6/2008 22:03	0.00
12/6/2008 22:34	0.00
12/6/2008 23:04	0.00
12/6/2008 23:34	0.00
12/8/2008 0:01	0.00
12/8/2008 0:33	0.00
12/8/2008 1:02	0.00
12/8/2008 1:33	0.00
12/8/2008 2:04	0.00
12/8/2008 2:34	0.00
12/8/2008 3:04	0.00
12/8/2008 3:34	0.00
12/8/2008 4:04	0.00
12/8/2008 4:34	0.00
12/8/2008 5:04	0.00

Date Time	Rainfall (inches)
12/8/2008 5:34	0.00
12/8/2008 6:04	0.00
12/8/2008 6:34	0.00
12/8/2008 7:04	0.00
12/8/2008 7:34	0.00
12/8/2008 8:04	0.00
12/8/2008 8:34	0.00
12/8/2008 9:04	0.00
12/8/2008 9:34	0.00
12/8/2008 10:00	0.00
12/8/2008 10:30	0.00
12/8/2008 11:00	0.00
12/8/2008 11:30	0.00
12/8/2008 12:00	0.00
12/8/2008 12:31	0.00
12/8/2008 13:01	0.00
12/8/2008 13:31	0.00
12/8/2008 14:01	0.00
12/8/2008 14:32	0.00
12/8/2008 15:02	0.00
12/8/2008 15:32	0.00
12/8/2008 16:02	0.00
12/8/2008 16:33	0.00
12/8/2008 17:03	0.00
12/8/2008 17:33	0.00
12/8/2008 18:04	0.00
12/8/2008 18:34	0.00
12/8/2008 19:04	0.00
12/8/2008 19:34	0.00
12/8/2008 20:04	0.00
12/8/2008 20:34	0.00
12/8/2008 21:04	0.00
12/8/2008 21:33	0.00
12/8/2008 22:03	0.00
12/8/2008 22:33	0.00
12/8/2008 23:03	0.00
12/8/2008 23:33	0.00
12/9/2008 0:01	0.00
12/9/2008 0:31	0.00
12/9/2008 1:03	0.00
12/9/2008 1:32	0.00
12/9/2008 2:04	0.00
12/9/2008 2:34	0.00
12/9/2008 3:04	0.00
12/9/2008 3:34	0.00
12/9/2008 4:02	0.00
12/9/2008 4:33	0.00
12/9/2008 5:02	0.00
12/9/2008 5:32	0.00
12/9/2008 6:02	0.00
12/9/2008 6:32	0.00
12/9/2008 7:02	0.00
12/9/2008 7:32	0.00
12/9/2008 8:02	0.00
12/9/2008 8:32	0.00
12/9/2008 9:02	0.00
12/9/2008 9:32	0.00
12/9/2008 10:02	0.00
12/9/2008 10:33	0.00
12/9/2008 11:03	0.00
12/9/2008 11:33	0.00
12/9/2008 12:03	0.00
12/9/2008 12:34	0.00
12/9/2008 13:04	0.00
12/9/2008 13:34	0.00
12/9/2008 14:04	0.00
12/9/2008 14:34	0.00
12/9/2008 15:04	0.00
12/9/2008 15:35	0.00
12/9/2008 16:05	0.00
12/9/2008 16:31	0.00
12/9/2008 17:01	0.00
12/9/2008 17:31	0.00
12/9/2008 18:01	0.00
12/9/2008 18:32	0.00
12/9/2008 19:02	0.00
12/9/2008 19:32	0.00
12/9/2008 20:02	0.00
12/9/2008 20:32	0.00
12/9/2008 21:02	0.00
12/9/2008 21:32	0.00
12/9/2008 22:03	0.00
12/9/2008 22:33	0.00
12/9/2008 23:03	0.00
12/9/2008 23:33	0.00
12/10/2008 0:01	0.00
12/10/2008 0:32	0.00
12/10/2008 1:04	0.00
12/10/2008 1:32	0.00
12/10/2008 2:04	0.00
12/10/2008 2:34	0.00
12/10/2008 3:04	0.00
12/10/2008 3:30	0.00
12/10/2008 4:00	0.00
12/10/2008 4:31	0.00
12/10/2008 5:01	0.00

Date Time	Rainfall (inches)
12/10/2008 5:32	0.00
12/10/2008 6:02	0.00
12/10/2008 6:32	0.00
12/10/2008 7:02	0.00
12/10/2008 7:33	0.00
12/10/2008 8:03	0.00
12/10/2008 8:33	0.00
12/10/2008 9:03	0.00
12/10/2008 9:33	0.00
12/10/2008 10:03	0.00
12/10/2008 10:33	0.00
12/10/2008 11:03	0.00
12/10/2008 11:34	0.00
12/10/2008 12:04	0.00
12/10/2008 12:34	0.00
12/10/2008 13:04	0.00
12/10/2008 13:34	0.00
12/10/2008 14:04	0.00
12/10/2008 14:34	0.00
12/10/2008 15:04	0.00
12/10/2008 15:34	0.00
12/10/2008 16:04	0.00
12/10/2008 16:34	0.00
12/10/2008 17:04	0.00
12/10/2008 17:34	0.00
12/10/2008 18:00	0.00
12/10/2008 18:30	0.00
12/10/2008 19:01	0.00
12/10/2008 19:31	0.00
12/10/2008 20:01	0.00
12/10/2008 20:32	0.00
12/10/2008 21:02	0.00
12/10/2008 21:32	0.00
12/10/2008 22:02	0.00
12/10/2008 22:32	0.00
12/10/2008 23:04	0.00
12/10/2008 23:34	0.00
12/11/2008 0:00	0.00
12/11/2008 0:30	0.00
12/11/2008 1:02	0.00
12/11/2008 1:34	0.00
12/11/2008 2:00	0.00
12/11/2008 2:31	0.00
12/11/2008 3:01	0.00
12/11/2008 3:31	0.00
12/11/2008 4:02	0.00
12/11/2008 4:32	0.00
12/11/2008 5:02	0.00
12/11/2008 5:32	0.00
12/11/2008 6:02	0.00
12/11/2008 6:32	0.00
12/11/2008 7:02	0.00
12/11/2008 7:32	0.00
12/11/2008 8:02	0.00
12/11/2008 8:33	0.00
12/11/2008 9:03	0.00
12/11/2008 9:33	0.00
12/11/2008 10:03	0.00
12/11/2008 10:33	0.00
12/11/2008 11:03	0.00
12/11/2008 11:33	0.00
12/11/2008 12:03	0.00
12/11/2008 12:33	0.00
12/11/2008 13:03	0.00
12/11/2008 13:33	0.00
12/11/2008 14:03	0.00
12/11/2008 14:33	0.00
12/11/2008 15:03	0.00
12/11/2008 15:33	0.00
12/11/2008 16:04	0.00
12/11/2008 16:34	0.00
12/11/2008 17:04	0.00
12/11/2008 17:34	0.00
12/11/2008 18:04	0.00
12/11/2008 18:34	0.00
12/11/2008 19:04	0.00
12/11/2008 19:34	0.00
12/11/2008 20:04	0.00
12/11/2008 20:34	0.00
12/11/2008 21:04	0.00
12/11/2008 21:35	0.00
12/11/2008 22:00	0.00
12/11/2008 22:34	0.00
12/11/2008 23:00	0.00
12/11/2008 23:30	0.00
12/12/2008 0:01	0.00
12/12/2008 0:31	0.00
12/12/2008 1:04	0.00
12/12/2008 1:30	0.00
12/12/2008 2:02	0.00
12/12/2008 2:32	0.00
12/12/2008 3:02	0.00
12/12/2008 3:32	0.00
12/12/2008 4:03	0.00
12/12/2008 4:33	0.00
12/12/2008 5:03	0.00

Date Time	Rainfall (inches)
12/12/2008 5:33	0.00
12/12/2008 6:03	0.00
12/12/2008 6:33	0.00
12/12/2008 7:03	0.00
12/12/2008 7:33	0.00
12/12/2008 8:03	0.00
12/12/2008 8:33	0.00
12/12/2008 9:03	0.00
12/12/2008 9:34	0.00
12/12/2008 10:04	0.00
12/12/2008 10:34	0.00
12/12/2008 11:04	0.00
12/12/2008 11:34	0.00
12/12/2008 12:04	0.00
12/12/2008 12:34	0.00
12/12/2008 13:04	0.00
12/12/2008 13:34	0.00
12/12/2008 14:04	0.00
12/12/2008 14:34	0.00
12/12/2008 15:04	0.00
12/12/2008 15:34	0.00
12/12/2008 16:04	0.00
12/12/2008 16:30	0.00
12/12/2008 17:00	0.00
12/12/2008 17:30	0.00
12/12/2008 18:01	0.00
12/12/2008 18:32	0.00
12/12/2008 19:02	0.00
12/12/2008 19:32	0.00
12/12/2008 20:02	0.00
12/12/2008 20:32	0.00
12/12/2008 21:02	0.00
12/12/2008 21:32	0.00
12/12/2008 22:02	0.00
12/12/2008 22:32	0.00
12/12/2008 23:02	0.00
12/12/2008 23:33	0.00
12/13/2008 0:01	0.00
12/13/2008 0:34	0.00
12/13/2008 1:01	0.00
12/13/2008 1:33	0.00
12/13/2008 2:04	0.00
12/13/2008 2:34	0.00
12/13/2008 3:04	0.00
12/13/2008 3:34	0.00
12/13/2008 4:04	0.00
12/13/2008 4:34	0.00
12/13/2008 5:04	0.00
12/13/2008 5:34	0.00
12/13/2008 6:04	0.00
12/13/2008 6:34	0.00
12/13/2008 7:04	0.00
12/13/2008 7:34	0.00
12/13/2008 8:04	0.00
12/13/2008 8:30	0.00
12/13/2008 9:01	0.00
12/13/2008 9:31	0.00
12/13/2008 10:01	0.00
12/13/2008 10:31	0.00
12/13/2008 11:02	0.00
12/13/2008 11:32	0.00
12/13/2008 12:02	0.00
12/13/2008 12:32	0.00
12/13/2008 13:02	0.00
12/13/2008 13:32	0.00
12/13/2008 14:03	0.00
12/13/2008 14:33	0.00
12/13/2008 15:03	0.00
12/13/2008 15:34	0.00
12/13/2008 16:04	0.00
12/13/2008 16:34	0.00
12/13/2008 17:04	0.00
12/13/2008 17:34	0.00
12/13/2008 18:04	0.00
12/13/2008 18:34	0.00
12/13/2008 19:04	0.00
12/13/2008 19:34	0.00
12/13/2008 20:01	0.00
12/13/2008 20:32	0.00
12/13/2008 21:02	0.00
12/13/2008 21:32	0.00
12/13/2008 22:02	0.00
12/13/2008 22:32	0.00
12/13/2008 23:02	0.00
12/13/2008 23:33	0.00
12/14/2008 0:01	0.00
12/14/2008 0:30	0.00
12/14/2008 1:03	0.00
12/14/2008 1:35	0.00
12/14/2008 2:01	0.00
12/14/2008 2:31	0.00
12/14/2008 3:02	0.00
12/14/2008 3:32	0.00
12/14/2008 4:03	0.00
12/14/2008 4:33	0.00
12/14/2008 5:03	0.00

Date Time	Rainfall (inches)
12/14/2008 5:33	0.00
12/14/2008 6:03	0.00
12/14/2008 6:33	0.00
12/14/2008 7:03	0.00
12/14/2008 7:33	0.00
12/14/2008 8:04	0.00
12/14/2008 8:34	0.00
12/14/2008 9:04	0.00
12/14/2008 9:34	0.00
12/14/2008 10:04	0.00
12/14/2008 10:34	0.00
12/14/2008 11:04	0.00
12/14/2008 11:34	0.00
12/14/2008 12:04	0.00
12/14/2008 12:34	0.00
12/14/2008 13:00	0.00
12/14/2008 13:31	0.00
12/14/2008 14:02	0.00
12/14/2008 14:37	0.00
12/14/2008 15:02	0.00
12/14/2008 15:32	0.00
12/14/2008 16:02	0.00
12/14/2008 16:32	0.00
12/14/2008 17:02	0.00
12/14/2008 17:32	0.00
12/14/2008 18:03	0.00
12/14/2008 18:33	0.00
12/14/2008 19:03	0.00
12/14/2008 19:33	0.00
12/14/2008 20:03	0.00
12/14/2008 20:33	0.00
12/14/2008 21:03	0.00
12/14/2008 21:34	0.00
12/14/2008 22:04	0.00
12/14/2008 22:34	0.00
12/14/2008 23:04	0.00
12/14/2008 23:33	0.00
12/15/2008 0:00	0.00
12/15/2008 0:30	0.00
12/15/2008 1:03	0.00
12/15/2008 1:31	0.00
12/15/2008 2:03	0.00
12/15/2008 2:33	0.00
12/15/2008 3:03	0.00
12/15/2008 3:34	0.00
12/15/2008 4:03	0.00
12/15/2008 4:34	0.00
12/15/2008 5:03	0.00
12/15/2008 5:34	0.00
12/15/2008 6:04	0.00
12/15/2008 6:34	0.00
12/15/2008 7:04	0.00
12/15/2008 7:34	0.00
12/15/2008 8:04	0.00
12/15/2008 8:34	0.00
12/15/2008 9:04	0.00
12/15/2008 9:34	0.00
12/15/2008 10:04	0.00
12/15/2008 10:34	0.00
12/15/2008 11:04	0.00
12/15/2008 11:30	0.00
12/15/2008 12:00	0.00
12/15/2008 12:31	0.00
12/15/2008 13:01	0.00
12/15/2008 13:31	0.00
12/15/2008 14:01	0.00
12/15/2008 14:31	0.00
12/15/2008 15:01	0.00
12/15/2008 15:32	0.00
12/15/2008 16:02	0.00
12/15/2008 16:32	0.00
12/15/2008 17:03	0.00
12/15/2008 17:33	0.00
12/15/2008 18:03	0.00
12/15/2008 18:34	0.00
12/15/2008 19:04	0.00
12/15/2008 19:35	0.00
12/15/2008 20:00	0.00
12/15/2008 20:32	0.00
12/15/2008 21:02	0.00
12/15/2008 21:32	0.00
12/15/2008 22:02	0.00
12/15/2008 22:32	0.00
12/15/2008 23:02	0.00
12/15/2008 23:32	0.00
12/16/2008 0:01	0.00
12/16/2008 0:33	0.00
12/16/2008 1:06	0.00
12/16/2008 1:33	0.00
12/16/2008 2:02	0.00
12/16/2008 2:32	0.00
12/16/2008 3:02	0.00
12/16/2008 3:33	0.00
12/16/2008 4:03	0.00
12/16/2008 4:34	0.00
12/16/2008 5:04	0.00

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
12/16/2008 5:34	0.00
12/16/2008 6:04	0.00
12/16/2008 6:34	0.00
12/16/2008 7:04	0.00
12/16/2008 7:34	0.00
12/16/2008 8:00	0.00
12/16/2008 8:30	0.00
12/16/2008 9:01	0.00
12/16/2008 9:31	0.00
12/16/2008 10:01	0.00
12/16/2008 10:31	0.00
12/16/2008 11:02	0.00
12/16/2008 11:32	0.00
12/16/2008 12:02	0.00
12/16/2008 12:32	0.00
12/16/2008 13:02	0.00
12/16/2008 13:32	0.00
12/16/2008 14:02	0.00
12/16/2008 14:32	0.00
12/16/2008 15:03	0.00
12/16/2008 15:32	0.00
12/16/2008 16:03	0.00
12/16/2008 16:33	0.00
12/16/2008 17:03	0.00
12/16/2008 17:33	0.00
12/16/2008 18:03	0.00
12/16/2008 18:33	0.00
12/16/2008 19:03	0.00
12/16/2008 19:34	0.00
12/16/2008 20:04	0.00
12/16/2008 20:29	0.00
12/16/2008 21:04	0.00
12/16/2008 21:30	0.00
12/16/2008 22:00	0.00
12/16/2008 22:30	0.00
12/16/2008 23:01	0.00
12/16/2008 23:31	0.00
12/17/2008 0:01	0.00
12/17/2008 0:34	0.00
12/17/2008 1:01	0.00
12/17/2008 1:34	0.00
12/17/2008 2:02	0.00
12/17/2008 2:32	0.00
12/17/2008 3:02	0.00
12/17/2008 3:33	0.00
12/17/2008 4:03	0.00
12/17/2008 4:33	0.00
12/17/2008 5:03	0.00
12/17/2008 5:33	0.00
12/17/2008 6:03	0.00
12/17/2008 6:33	0.00
12/17/2008 7:03	0.00
12/17/2008 7:33	0.00
12/17/2008 8:04	0.00
12/17/2008 8:34	0.00
12/17/2008 9:04	0.00
12/17/2008 9:30	0.00
12/17/2008 10:00	0.00
12/17/2008 10:30	0.00
12/17/2008 11:00	0.00
12/17/2008 11:31	0.00
12/17/2008 12:00	0.00
12/17/2008 12:31	0.00
12/17/2008 13:01	0.00
12/17/2008 13:31	0.00
12/17/2008 14:01	0.00
12/17/2008 14:31	0.00
12/17/2008 15:01	0.00
12/17/2008 15:31	0.00
12/17/2008 16:01	0.00
12/17/2008 16:31	0.00
12/17/2008 17:02	0.00
12/17/2008 17:32	0.00
12/17/2008 18:02	0.00
12/17/2008 18:32	0.00
12/17/2008 19:02	0.00
12/17/2008 19:32	0.00
12/17/2008 20:02	0.00
12/17/2008 20:33	0.00
12/17/2008 21:03	0.00
12/17/2008 21:33	0.00
12/17/2008 22:03	0.00
12/17/2008 22:34	0.00
12/17/2008 23:04	0.00
12/17/2008 23:34	0.00
12/18/2008 0:01	0.00
12/18/2008 0:32	0.00
12/18/2008 1:00	0.00
12/18/2008 1:33	0.00
12/18/2008 2:04	0.00
12/18/2008 2:34	0.00
12/18/2008 3:04	0.00
12/18/2008 3:34	0.00
12/18/2008 4:04	0.00
12/18/2008 4:34	0.00
12/18/2008 5:04	0.00

Date Time	Rainfall (inches)
12/18/2008 5:34	0.00
12/18/2008 6:04	0.00
12/18/2008 6:34	0.00
12/18/2008 7:05	0.00
12/18/2008 7:31	0.00
12/18/2008 8:01	0.00
12/18/2008 8:31	0.00
12/18/2008 9:01	0.00
12/18/2008 9:32	0.00
12/18/2008 10:02	0.00
12/18/2008 10:32	0.00
12/18/2008 11:02	0.00
12/18/2008 11:32	0.00
12/18/2008 12:02	0.00
12/18/2008 12:32	0.00
12/18/2008 13:02	0.00
12/18/2008 13:32	0.00
12/18/2008 14:02	0.00
12/18/2008 14:32	0.00
12/18/2008 15:03	0.00
12/18/2008 15:33	0.00
12/18/2008 16:03	0.00
12/18/2008 16:33	0.00
12/18/2008 17:03	0.00
12/18/2008 17:33	0.00
12/18/2008 18:04	0.00
12/18/2008 18:34	0.00
12/18/2008 19:04	0.00
12/18/2008 19:34	0.00
12/18/2008 20:04	0.00
12/18/2008 20:34	0.00
12/18/2008 21:04	0.00
12/18/2008 21:34	0.00
12/18/2008 22:07	0.00
12/18/2008 22:43	0.00
12/18/2008 23:03	0.00
12/18/2008 23:33	0.00
12/19/2008 0:01	0.00
12/19/2008 0:30	0.00
12/19/2008 1:00	0.00
12/19/2008 1:31	0.00
12/19/2008 2:04	0.00
12/19/2008 2:34	0.00
12/19/2008 3:04	0.00
12/19/2008 3:34	0.00
12/19/2008 4:04	0.00
12/19/2008 4:34	0.00
12/19/2008 5:04	0.00
12/19/2008 5:34	0.00
12/19/2008 6:04	0.00
12/19/2008 6:34	0.00
12/19/2008 7:04	0.00
12/19/2008 7:34	0.00
12/19/2008 8:04	0.00
12/19/2008 8:34	0.00
12/19/2008 9:00	0.00
12/19/2008 9:31	0.00
12/19/2008 10:01	0.00
12/19/2008 10:31	0.00
12/19/2008 11:01	0.00
12/19/2008 11:31	0.00
12/19/2008 12:01	0.00
12/19/2008 12:31	0.00
12/19/2008 13:01	0.00
12/19/2008 13:31	0.00
12/19/2008 14:01	0.00
12/19/2008 14:31	0.00
12/19/2008 15:01	0.00
12/19/2008 15:31	0.00
12/19/2008 16:01	0.00
12/19/2008 16:31	0.00
12/19/2008 17:01	0.00
12/19/2008 17:31	0.00
12/19/2008 18:01	0.00
12/19/2008 18:31	0.00
12/19/2008 19:01	0.00
12/19/2008 19:32	0.00
12/19/2008 20:02	0.00
12/19/2008 20:33	0.00
12/19/2008 21:02	0.00
12/19/2008 21:32	0.00
12/19/2008 22:02	0.00
12/19/2008 22:33	0.00
12/19/2008 23:03	0.00
12/19/2008 23:33	0.00
12/20/2008 0:01	0.00
12/20/2008 0:31	0.00
12/20/2008 1:04	0.00
12/20/2008 1:32	0.00
12/20/2008 2:03	0.00
12/20/2008 2:33	0.00
12/20/2008 3:03	0.00
12/20/2008 3:33	0.00
12/20/2008 4:03	0.00
12/20/2008 4:33	0.00
12/20/2008 5:03	0.00

Date Time	Rainfall (inches)
12/20/2008 5:34	0.00
12/20/2008 6:04	0.00
12/20/2008 6:34	0.00
12/20/2008 7:04	0.00
12/20/2008 7:34	0.00
12/20/2008 8:04	0.00
12/20/2008 8:34	0.00
12/20/2008 9:34	0.00
12/20/2008 10:00	0.00
12/20/2008 10:30	0.00
12/20/2008 11:01	0.00
12/20/2008 11:31	0.00
12/20/2008 12:01	0.00
12/20/2008 12:31	0.00
12/20/2008 13:01	0.00
12/20/2008 13:32	0.00
12/20/2008 14:02	0.00
12/20/2008 14:32	0.00
12/20/2008 15:02	0.00
12/20/2008 15:32	0.00
12/20/2008 16:02	0.00
12/20/2008 16:33	0.00
12/20/2008 17:03	0.00
12/20/2008 17:33	0.00
12/20/2008 18:03	0.00
12/20/2008 18:34	0.00
12/20/2008 19:04	0.00
12/20/2008 19:34	0.00
12/20/2008 20:04	0.00
12/20/2008 20:34	0.00
12/20/2008 21:00	0.00
12/20/2008 21:30	0.00
12/20/2008 22:01	0.00
12/20/2008 22:31	0.00
12/20/2008 23:01	0.00
12/20/2008 23:31	0.00
12/21/2008 0:01	0.00
12/21/2008 0:30	0.00
12/21/2008 1:03	0.00
12/21/2008 1:35	0.00
12/21/2008 2:01	0.00
12/21/2008 2:32	0.00
12/21/2008 3:02	0.00
12/21/2008 3:32	0.00
12/21/2008 4:03	0.00
12/21/2008 4:33	0.00
12/21/2008 5:03	0.00
12/21/2008 5:33	0.00
12/21/2008 6:04	0.00
12/21/2008 6:34	0.00
12/21/2008 7:04	0.00
12/21/2008 7:30	0.00
12/21/2008 8:00	0.00
12/21/2008 8:31	0.00
12/21/2008 9:01	0.00
12/21/2008 9:32	0.00
12/21/2008 10:02	0.00
12/21/2008 10:32	0.00
12/21/2008 11:02	0.00
12/21/2008 11:32	0.00
12/21/2008 12:02	0.00
12/21/2008 12:32	0.00
12/21/2008 13:02	0.00
12/21/2008 13:32	0.00
12/21/2008 14:02	0.00
12/21/2008 14:33	0.00
12/21/2008 15:03	0.00
12/21/2008 15:33	0.00
12/21/2008 16:03	0.00
12/21/2008 16:33	0.00
12/21/2008 17:04	0.00
12/21/2008 17:34	0.00
12/21/2008 18:04	0.00
12/21/2008 18:34	0.00
12/21/2008 19:04	0.00
12/21/2008 19:34	0.00
12/21/2008 20:04	0.00
12/21/2008 20:34	0.00
12/21/2008 21:04	0.00
12/21/2008 21:30	0.00
12/21/2008 22:01	0.00
12/21/2008 22:32	0.00
12/21/2008 23:02	0.00
12/21/2008 23:32	0.00
12/22/2008 0:01	0.00
12/22/2008 0:32	0.00
12/22/2008 1:04	0.00
12/22/2008 1:33	0.00
12/22/2008 2:06	0.00
12/22/2008 2:31	0.00
12/22/2008 3:01	0.00
12/22/2008 3:31	0.00
12/22/2008 4:01	0.00
12/22/2008 4:31	0.00
12/22/2008 5:02	0.00

Date Time	Rainfall (inches)
12/22/2008 5:32	0.00
12/22/2008 6:02	0.00
12/22/2008 6:32	0.00
12/22/2008 7:02	0.00
12/22/2008 7:32	0.00
12/22/2008 8:02	0.00
12/22/2008 8:32	0.00
12/22/2008 9:02	0.00
12/22/2008 9:32	0.00
12/22/2008 10:02	0.00
12/22/2008 10:32	0.00
12/22/2008 11:03	0.00
12/22/2008 11:33	0.00
12/22/2008 12:03	0.00
12/22/2008 12:33	0.00
12/22/2008 13:03	0.00
12/22/2008 13:33	0.00
12/22/2008 14:03	0.00
12/22/2008 14:33	0.00
12/22/2008 15:04	0.00
12/22/2008 15:34	0.00
12/22/2008 16:00	0.00
12/22/2008 16:34	0.00
12/22/2008 17:00	0.00
12/22/2008 17:31	0.00
12/22/2008 18:01	0.00
12/22/2008 18:31	0.00
12/22/2008 19:02	0.00
12/22/2008 19:32	0.00
12/22/2008 20:02	0.00
12/22/2008 20:33	0.00
12/22/2008 21:03	0.00
12/22/2008 21:33	0.00
12/22/2008 22:03	0.00
12/22/2008 22:33	0.00
12/22/2008 23:03	0.00
12/22/2008 23:33	0.00
12/23/2008 0:01	0.00
12/23/2008 0:34	0.00
12/23/2008 1:00	0.00
12/23/2008 1:33	0.00
12/23/2008 2:04	0.00
12/23/2008 2:34	0.00
12/23/2008 3:00	0.00
12/23/2008 3:30	0.00
12/23/2008 4:01	0.00
12/23/2008 4:31	0.00
12/23/2008 5:01	0.00
12/23/2008 5:31	0.00
12/23/2008 6:02	0.00
12/23/2008 6:32	0.00
12/23/2008 7:02	0.00
12/23/2008 7:32	0.00
12/23/2008 8:03	0.00
12/23/2008 8:33	0.00
12/23/2008 9:03	0.00
12/23/2008 9:33	0.00
12/23/2008 10:03	0.00
12/23/2008 10:34	0.00
12/23/2008 11:04	0.00
12/23/2008 11:34	0.00
12/23/2008 12:04	0.00
12/23/2008 12:34	0.00
12/23/2008 13:04	0.00
12/23/2008 13:35	0.00
12/23/2008 14:01	0.00
12/23/2008 14:31	0.00
12/23/2008 15:01	0.00
12/23/2008 15:31	0.00
12/23/2008 16:01	0.00
12/23/2008 16:31	0.00
12/23/2008 17:02	0.00
12/23/2008 17:32	0.00
12/23/2008 18:02	0.00
12/23/2008 18:32	0.00
12/23/2008 19:02	0.00
12/23/2008 19:32	0.00
12/23/2008 20:00	0.00
12/23/2008 20:32	0.00
12/23/2008 21:03	0.00
12/23/2008 21:33	0.00
12/23/2008 22:03	0.00
12/23/2008 22:33	0.00
12/23/2008 23:04	0.00
12/23/2008 23:34	0.00
12/24/2008 0:01	0.00
12/24/2008 0:32	0.00
12/24/2008 1:04	0.00
12/24/2008 1:32	0.00
12/24/2008 2:03	0.00
12/24/2008 2:33	0.00
12/24/2008 3:03	0.00
12/24/2008 3:33	0.00
12/24/2008 4:04	0.00
12/24/2008 4:34	0.00
12/24/2008 5:00	0.00

Date Time	Rainfall (inches)
12/24/2008 5:31	0.00
12/24/2008 6:01	0.00
12/24/2008 6:31	0.00
12/24/2008 7:01	0.00
12/24/2008 7:31	0.00
12/24/2008 8:02	0.00
12/24/2008 8:32	0.00
12/24/2008 9:02	0.00
12/24/2008 9:32	0.00
12/24/2008 10:03	0.00
12/24/2008 10:33	0.00
12/24/2008 11:03	0.00
12/24/2008 11:33	0.00
12/24/2008 12:03	0.00
12/24/2008 12:33	0.00
12/24/2008 13:03	0.00
12/24/2008 13:33	0.00
12/24/2008 14:04	0.00
12/24/2008 14:34	0.00
12/24/2008 15:04	0.00
12/24/2008 15:34	0.00
12/24/2008 16:04	0.00
12/24/2008 16:34	0.00
12/24/2008 17:04	0.00
12/24/2008 17:30	0.00
12/24/2008 18:00	0.00
12/24/2008 18:31	0.00
12/24/2008 19:01	0.00
12/24/2008 19:31	0.00
12/24/2008 20:02	0.00
12/24/2008 20:32	0.00
12/24/2008 21:02	0.00
12/24/2008 21:32	0.00
12/24/2008 22:03	0.00
12/24/2008 22:33	0.00
12/24/2008 23:03	0.00
12/24/2008 23:33	0.00
12/25/2008 0:01	0.00
12/25/2008 0:31	0.00
12/25/2008 1:03	0.00
12/25/2008 1:30	0.00
12/25/2008 2:02	0.00
12/25/2008 2:32	0.00
12/25/2008 3:02	0.00
12/25/2008 3:32	0.00
12/25/2008 4:02	0.00
12/25/2008 4:32	0.00
12/25/2008 5:02	0.00
12/25/2008 5:32	0.00
12/25/2008 6:02	0.00
12/25/2008 6:32	0.00
12/25/2008 7:03	0.00
12/25/2008 7:33	0.00
12/25/2008 8:03	0.00
12/25/2008 8:33	0.00
12/25/2008 9:04	0.00
12/25/2008 9:34	0.00
12/25/2008 10:04	0.00
12/25/2008 10:34	0.00
12/25/2008 11:04	0.00
12/25/2008 11:34	0.00
12/25/2008 12:00	0.00
12/25/2008 12:31	0.00
12/25/2008 13:01	0.00
12/25/2008 13:31	0.00
12/25/2008 14:07	0.00
12/25/2008 14:32	0.00
12/25/2008 15:02	0.00
12/25/2008 15:33	0.00
12/25/2008 16:03	0.00
12/25/2008 16:33	0.00
12/25/2008 17:03	0.00
12/25/2008 17:33	0.00
12/25/2008 18:03	0.00
12/25/2008 18:33	0.00
12/25/2008 19:04	0.00
12/25/2008 19:34	0.00
12/25/2008 20:04	0.00
12/25/2008 20:31	0.00
12/25/2008 21:02	0.00
12/25/2008 21:32	0.00
12/25/2008 22:02	0.00
12/25/2008 22:32	0.00
12/25/2008 23:02	0.00
12/25/2008 23:32	0.00
12/26/2008 0:00	0.00
12/26/2008 0:33	0.00
12/26/2008 1:03	0.00
12/26/2008 1:31	0.00
12/26/2008 2:03	0.00
12/26/2008 2:33	0.00
12/26/2008 3:03	0.00
12/26/2008 3:34	0.00
12/26/2008 4:04	0.00
12/26/2008 4:34	0.00
12/26/2008 5:04	0.00

Date Time	Rainfall (inches)
12/26/2008 5:34	0.00
12/26/2008 6:04	0.00
12/26/2008 6:34	0.00
12/26/2008 7:04	0.00
12/26/2008 7:31	0.00
12/26/2008 8:01	0.00
12/26/2008 8:32	0.00
12/26/2008 9:02	0.00
12/26/2008 9:32	0.00
12/26/2008 10:02	0.00
12/26/2008 10:32	0.00
12/26/2008 11:02	0.00
12/26/2008 11:32	0.00
12/26/2008 12:03	0.00
12/26/2008 12:33	0.00
12/26/2008 13:03	0.00
12/26/2008 13:33	0.00
12/26/2008 14:03	0.00
12/26/2008 14:33	0.00
12/26/2008 15:03	0.00
12/26/2008 15:33	0.00
12/26/2008 16:03	0.00
12/26/2008 16:34	0.00
12/26/2008 17:04	0.00
12/26/2008 17:34	0.00
12/26/2008 18:00	0.00
12/26/2008 18:30	0.00
12/26/2008 19:00	0.00
12/26/2008 19:31	0.00
12/26/2008 20:01	0.00
12/26/2008 20:32	0.00
12/26/2008 21:02	0.00
12/26/2008 21:32	0.00
12/26/2008 22:02	0.00
12/26/2008 22:32	0.00
12/26/2008 23:03	0.00
12/26/2008 23:33	0.00
12/27/2008 0:01	0.00
12/27/2008 0:35	0.00
12/27/2008 1:02	0.00
12/27/2008 1:31	0.00
12/27/2008 2:03	0.00
12/27/2008 2:33	0.00
12/27/2008 3:03	0.00
12/27/2008 3:33	0.00
12/27/2008 4:04	0.00
12/27/2008 4:34	0.00
12/27/2008 5:04	0.00
12/27/2008 5:30	0.00
12/27/2008 6:00	0.00
12/27/2008 6:30	0.00
12/27/2008 7:00	0.00
12/27/2008 7:31	0.00
12/27/2008 8:01	0.00
12/27/2008 8:32	0.00
12/27/2008 9:02	0.00
12/27/2008 9:32	0.00
12/27/2008 10:02	0.00
12/27/2008 10:32	0.00
12/27/2008 11:03	0.00
12/27/2008 11:33	0.00
12/27/2008 12:03	0.00
12/27/2008 12:33	0.00
12/27/2008 13:03	0.00
12/27/2008 13:33	0.00
12/27/2008 14:04	0.00
12/27/2008 14:34	0.00
12/27/2008 15:04	0.00
12/27/2008 15:33	0.00
12/27/2008 16:03	0.00
12/27/2008 16:31	0.00
12/27/2008 17:01	0.00
12/27/2008 17:31	0.00
12/27/2008 18:01	0.00
12/27/2008 18:31	0.00
12/27/2008 19:02	0.00
12/27/2008 19:32	0.00
12/27/2008 20:02	0.00
12/27/2008 20:33	0.00
12/27/2008 21:03	0.00
12/27/2008 21:33	0.00
12/27/2008 22:04	0.00
12/27/2008 22:34	0.00
12/27/2008 23:04	0.00
12/27/2008 23:30	0.00
12/28/2008 0:01	0.00
12/28/2008 0:32	0.00
12/28/2008 1:04	0.00
12/28/2008 1:35	0.00
12/28/2008 2:03	0.00
12/28/2008 2:33	0.00
12/28/2008 3:03	0.00
12/28/2008 3:33	0.00
12/28/2008 4:04	0.00
12/28/2008 4:34	0.00
12/28/2008 5:04	0.00

Daily Rainfall Data

September 1, 2008 (00:00) to December 31, 2008 (23:30)

Frog Pond

Station: KFLHOMES5

Farmland Estates, Homestead, FL

South Florida Water Management District

URS Job # 38617-098

Date Time	Rainfall (inches)
12/28/2008 5:34	0.00
12/28/2008 6:04	0.00
12/28/2008 6:31	0.00
12/28/2008 7:01	0.00
12/28/2008 7:32	0.00
12/28/2008 8:02	0.00
12/28/2008 8:33	0.00
12/28/2008 9:02	0.00
12/28/2008 9:32	0.00
12/28/2008 10:03	0.00
12/28/2008 10:33	0.00
12/28/2008 11:03	0.00
12/28/2008 11:34	0.00
12/28/2008 12:04	0.00
12/28/2008 12:34	0.00
12/28/2008 13:05	0.00
12/28/2008 13:30	0.00
12/28/2008 14:01	0.00
12/28/2008 14:32	0.00
12/28/2008 15:02	0.00
12/28/2008 15:32	0.00
12/28/2008 16:02	0.00
12/28/2008 16:33	0.00
12/28/2008 17:03	0.00
12/28/2008 17:33	0.00
12/28/2008 18:03	0.00
12/28/2008 18:34	0.00
12/28/2008 19:04	0.00
12/28/2008 19:34	0.00
12/28/2008 20:04	0.00
12/28/2008 20:34	0.00
12/28/2008 21:04	0.00
12/28/2008 21:34	0.00
12/28/2008 22:04	0.00
12/28/2008 22:34	0.00
12/28/2008 23:04	0.00
12/28/2008 23:34	0.00
12/29/2008 0:01	0.00
12/29/2008 0:33	0.00
12/29/2008 1:05	0.00
12/29/2008 1:31	0.00
12/29/2008 2:02	0.00
12/29/2008 2:32	0.00
12/29/2008 3:02	0.00
12/29/2008 3:32	0.00
12/29/2008 4:02	0.00
12/29/2008 4:33	0.00
12/29/2008 5:03	0.00
12/29/2008 5:33	0.00
12/29/2008 6:04	0.00
12/29/2008 6:34	0.00
12/29/2008 7:04	0.00
12/29/2008 7:30	0.00
12/29/2008 8:04	0.00
12/29/2008 8:30	0.00
12/29/2008 9:00	0.00
12/29/2008 9:30	0.00
12/29/2008 10:00	0.00
12/29/2008 10:30	0.00
12/29/2008 11:01	0.00
12/29/2008 11:31	0.00
12/29/2008 12:02	0.00
12/29/2008 12:32	0.00
12/29/2008 13:02	0.00
12/29/2008 13:32	0.00
12/29/2008 14:02	0.00
12/29/2008 14:32	0.00
12/29/2008 15:03	0.00
12/29/2008 15:33	0.00
12/29/2008 16:03	0.00
12/29/2008 16:34	0.00
12/29/2008 17:04	0.00
12/29/2008 17:34	0.00
12/29/2008 18:04	0.00
12/29/2008 18:30	0.00
12/29/2008 19:01	0.00
12/29/2008 19:32	0.00
12/29/2008 20:02	0.00
12/29/2008 20:32	0.00
12/29/2008 21:02	0.00
12/29/2008 21:32	0.00
12/29/2008 22:02	0.00
12/29/2008 22:32	0.00
12/29/2008 23:02	0.00
12/29/2008 23:34	0.00
12/30/2008 0:01	0.00
12/30/2008 0:33	0.00
12/30/2008 1:04	0.00
12/30/2008 1:30	0.00
12/30/2008 2:01	0.00
12/30/2008 2:31	0.00
12/30/2008 3:01	0.00
12/30/2008 3:32	0.00
12/30/2008 4:02	0.00
12/30/2008 4:32	0.00
12/30/2008 5:02	0.00

Date Time	Rainfall (inches)
12/30/2008 5:32	0.00
12/30/2008 6:02	0.00
12/30/2008 6:32	0.00
12/30/2008 7:02	0.00
12/30/2008 7:32	0.00
12/30/2008 8:03	0.00
12/30/2008 8:33	0.00
12/30/2008 9:03	0.00
12/30/2008 9:33	0.00
12/30/2008 10:03	0.00
12/30/2008 10:33	0.00
12/30/2008 11:03	0.00
12/30/2008 11:34	0.00
12/30/2008 12:04	0.00
12/30/2008 12:34	0.00
12/30/2008 13:04	0.00
12/30/2008 13:34	0.00
12/30/2008 14:00	0.00
12/30/2008 14:30	0.00
12/30/2008 15:01	0.00
12/30/2008 15:31	0.00
12/30/2008 16:02	0.00
12/30/2008 16:32	0.00
12/30/2008 17:02	0.00
12/30/2008 17:32	0.00
12/30/2008 18:02	0.00
12/30/2008 18:32	0.00
12/30/2008 19:02	0.00
12/30/2008 19:33	0.00
12/30/2008 20:03	0.00
12/30/2008 20:33	0.00
12/30/2008 21:03	0.00
12/30/2008 21:34	0.00
12/30/2008 22:04	0.00
12/30/2008 22:34	0.00
12/30/2008 23:04	0.00
12/30/2008 23:34	0.00
12/31/2008 0:00	0.00
12/31/2008 0:33	0.00
12/31/2008 1:05	0.00
12/31/2008 1:33	0.00
12/31/2008 2:04	0.00
12/31/2008 2:34	0.00
12/31/2008 3:04	0.00
12/31/2008 3:34	0.00
12/31/2008 4:00	0.00
12/31/2008 4:30	0.00
12/31/2008 5:00	0.00
12/31/2008 5:31	0.00
12/31/2008 6:01	0.00
12/31/2008 6:32	0.00
12/31/2008 7:02	0.00
12/31/2008 7:32	0.00
12/31/2008 8:02	0.00
12/31/2008 8:32	0.00
12/31/2008 9:02	0.00
12/31/2008 9:33	0.00
12/31/2008 10:03	0.00
12/31/2008 10:33	0.00
12/31/2008 11:03	0.00
12/31/2008 11:33	0.00
12/31/2008 12:03	0.00
12/31/2008 12:34	0.00
12/31/2008 13:04	0.00
12/31/2008 13:34	0.00
12/31/2008 14:04	0.00
12/31/2008 14:34	0.00
12/31/2008 15:00	0.00
12/31/2008 15:30	0.00
12/31/2008 16:01	0.00
12/31/2008 16:32	0.00
12/31/2008 17:02	0.00
12/31/2008 17:32	0.00
12/31/2008 18:04	0.00
12/31/2008 18:34	0.00
12/31/2008 19:04	0.00
12/31/2008 19:34	0.00
12/31/2008 20:05	0.00
12/31/2008 20:30	0.00
12/31/2008 21:01	0.00
12/31/2008 21:31	0.00
12/31/2008 22:01	0.00
12/31/2008 22:31	0.00
12/31/2008 23:02	0.00
12/31/2008 23:32	0.00

Date Time	Rainfall (inches)

Date Time	Rainfall (inches)

Date Time	Rainfall (inches)

Date Time	Rainfall (inches)

Note:

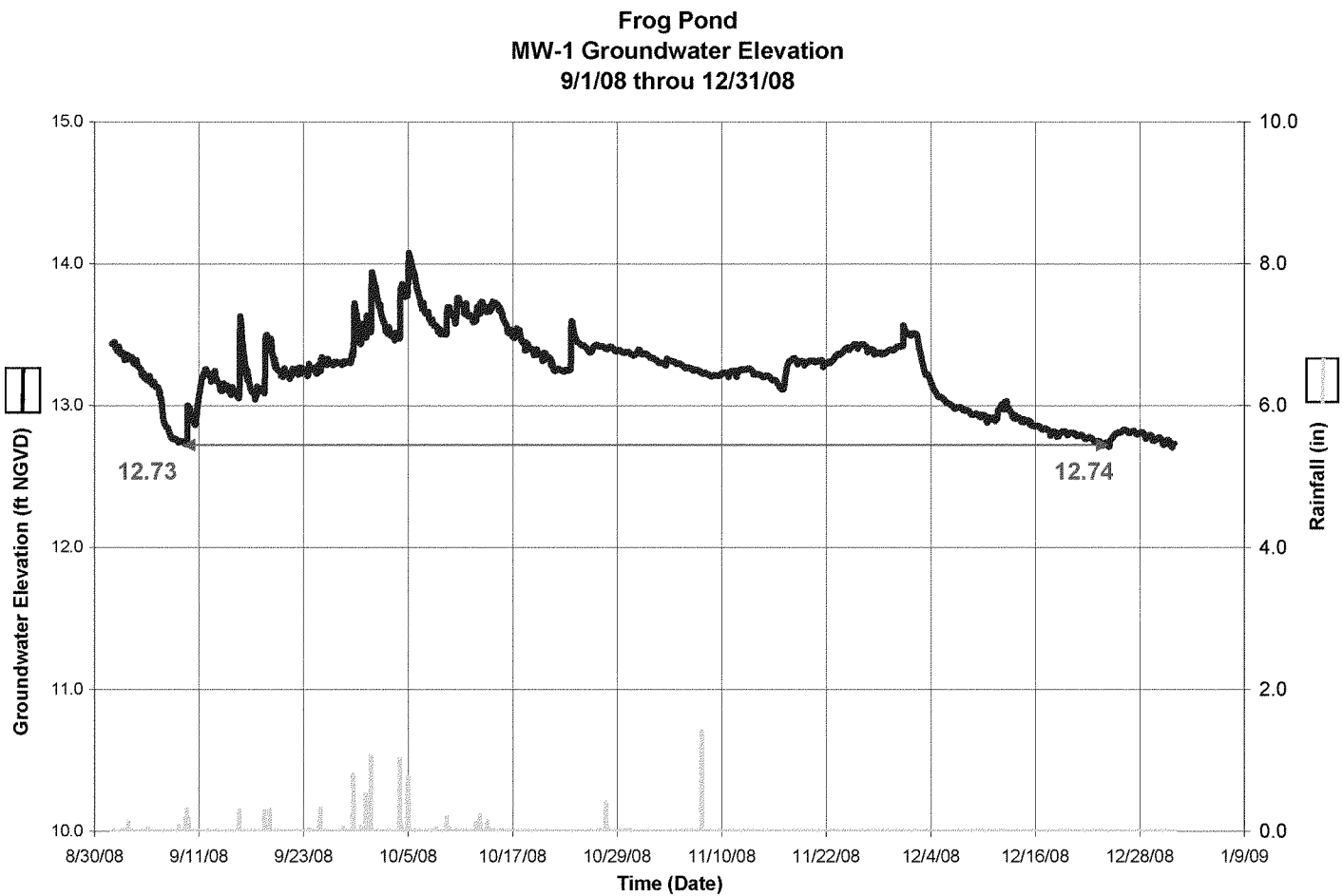
Weather Station KFLHOMES5 is locale approximately 3.5 miles northeast of monitor well MW-1.
KFLHOMES5 is located at Latitude 25.458 N ; Longitude 80.519 W recorded in NAD 83.

APPENDIX B

LEVEL TROLL WATER TABLE ELEVATION GRAPHS

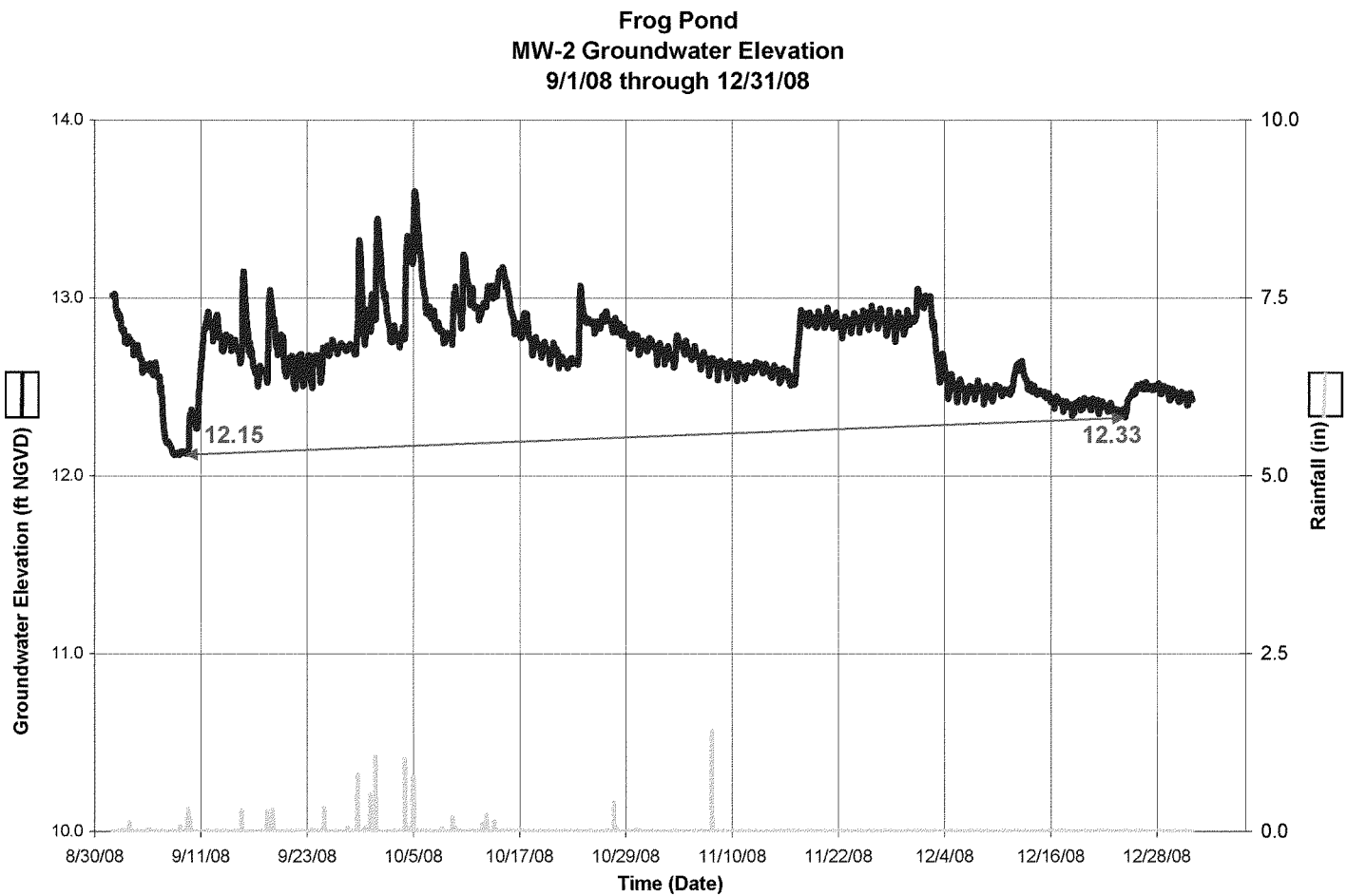
APPENDIX B1

MONITOR WELL MW-1 ELEVATION GRAPH


Frog Pond
MW-1 Groundwater Elevation
9/1/08 throu 12/31/08
Groundwater Elevation (ft NGVD)
Rainfall (in)
Time (Date)
15.0
14.0
13.0
12.0
11.0
10.0
10.0
8.0
6.0
4.0
2.0
0.0
8/30/08
9/11/08
9/23/08
10/5/08
10/17/08
10/29/08
11/10/08
11/22/08
12/4/08
12/16/08
12/28/08
1/9/09
12.73
12.74

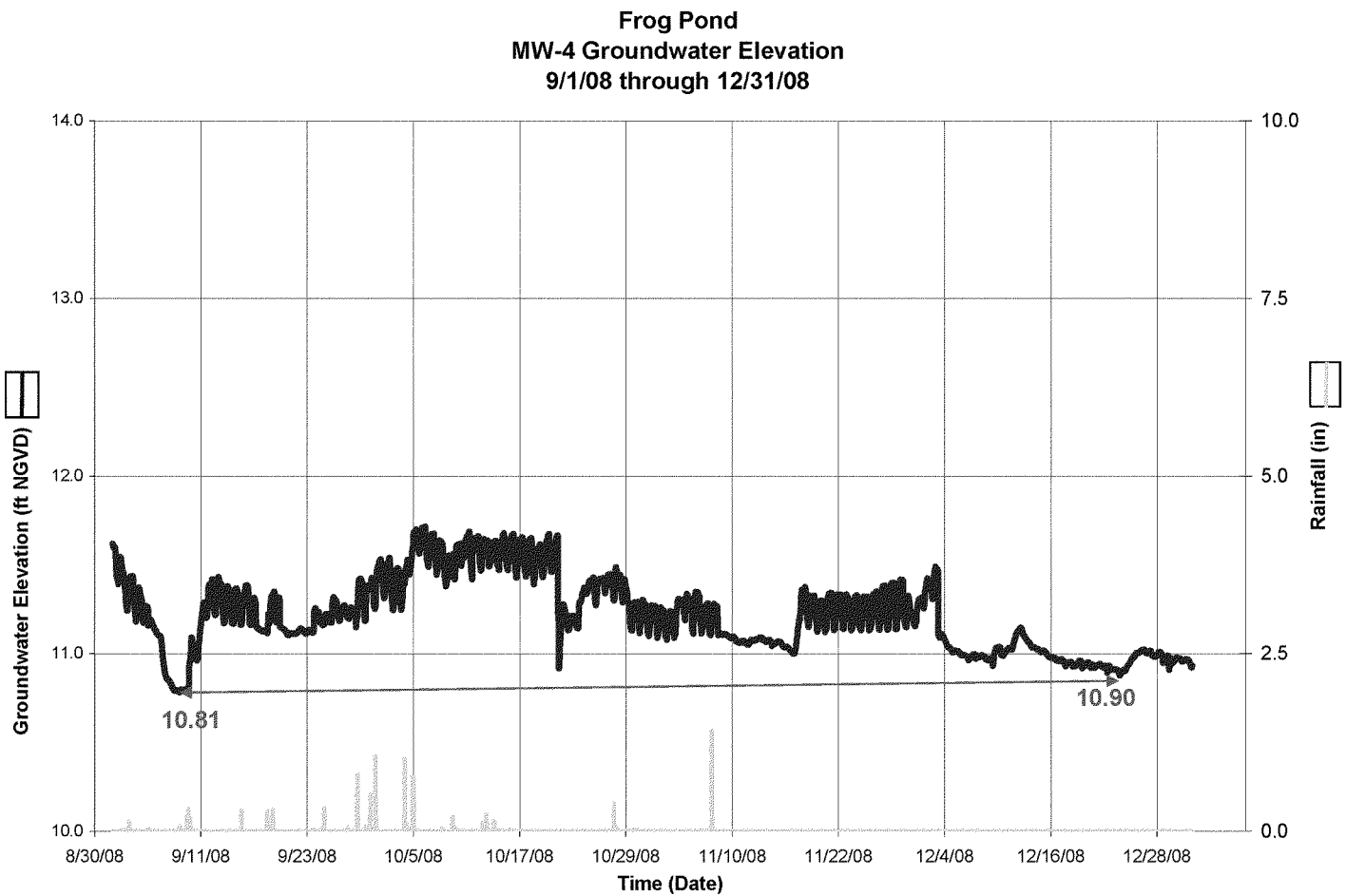
APPENDIX B2

MONITOR WELL MW-2 ELEVATION GRAPH


Frog Pond
MW-2 Groundwater Elevation
9/1/08 through 12/31/08
Groundwater Elevation (ft NGVD)
Rainfall (in)
Time (Date)
14.0
13.0
12.0
11.0
10.0
10.0
7.5
5.0
2.5
0.0
12.15
12.33
8/30/08
9/11/08
9/23/08
10/5/08
10/17/08
10/29/08
11/10/08
11/22/08
12/4/08
12/16/08
12/28/08

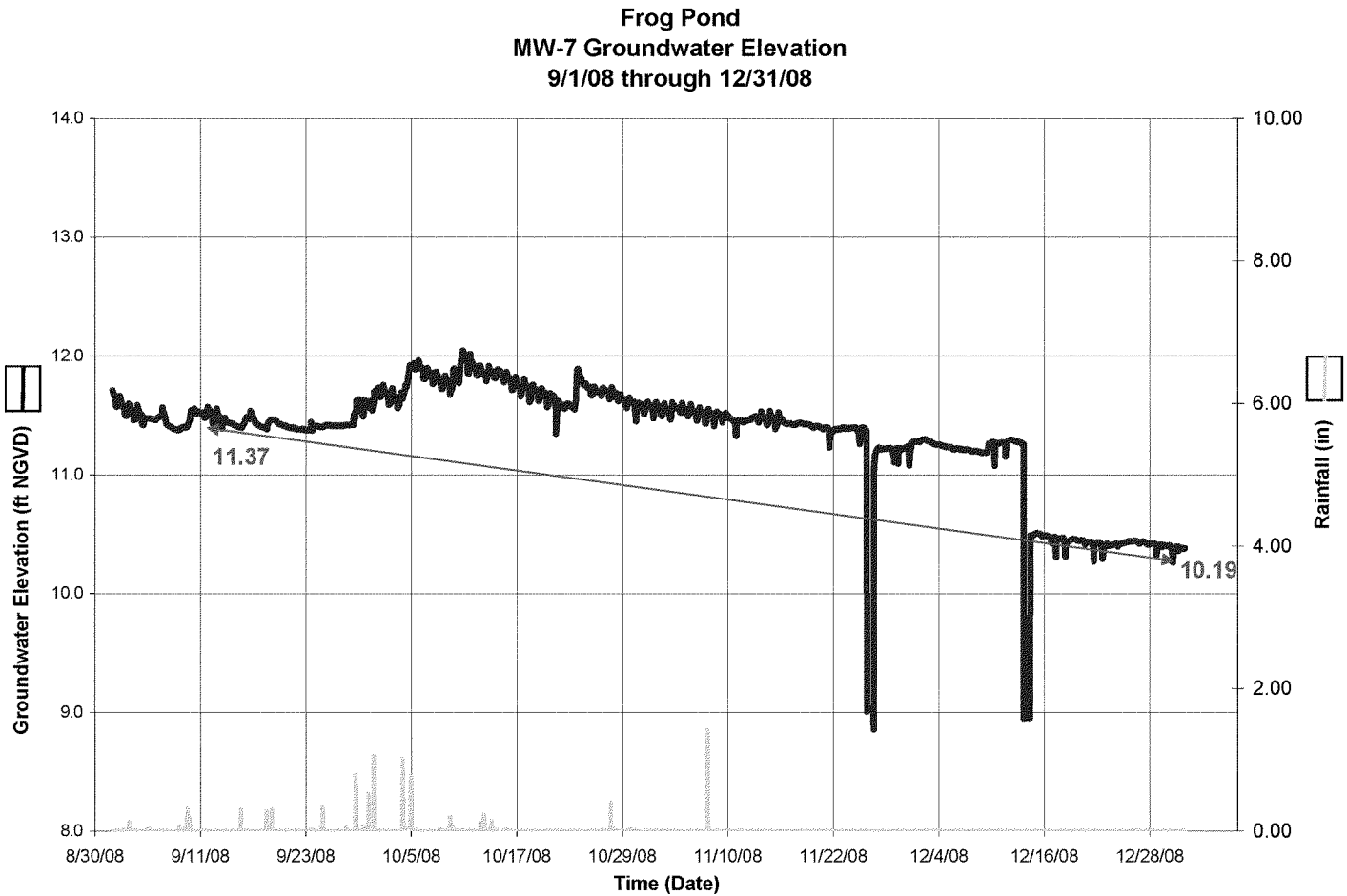
APPENDIX B3

MONITOR WELL MW-4 ELEVATION GRAPH


Frog Pond
MW-4 Groundwater Elevation
9/1/08 through 12/31/08
Groundwater Elevation (ft NGVD)
Rainfall (in)
Time (Date)
14.0
13.0
12.0
11.0
10.0
10.0
7.5
5.0
2.5
0.0
8/30/08
9/11/08
9/23/08
10/5/08
10/17/08
10/29/08
11/10/08
11/22/08
12/4/08
12/16/08
12/28/08
10.81
10.90

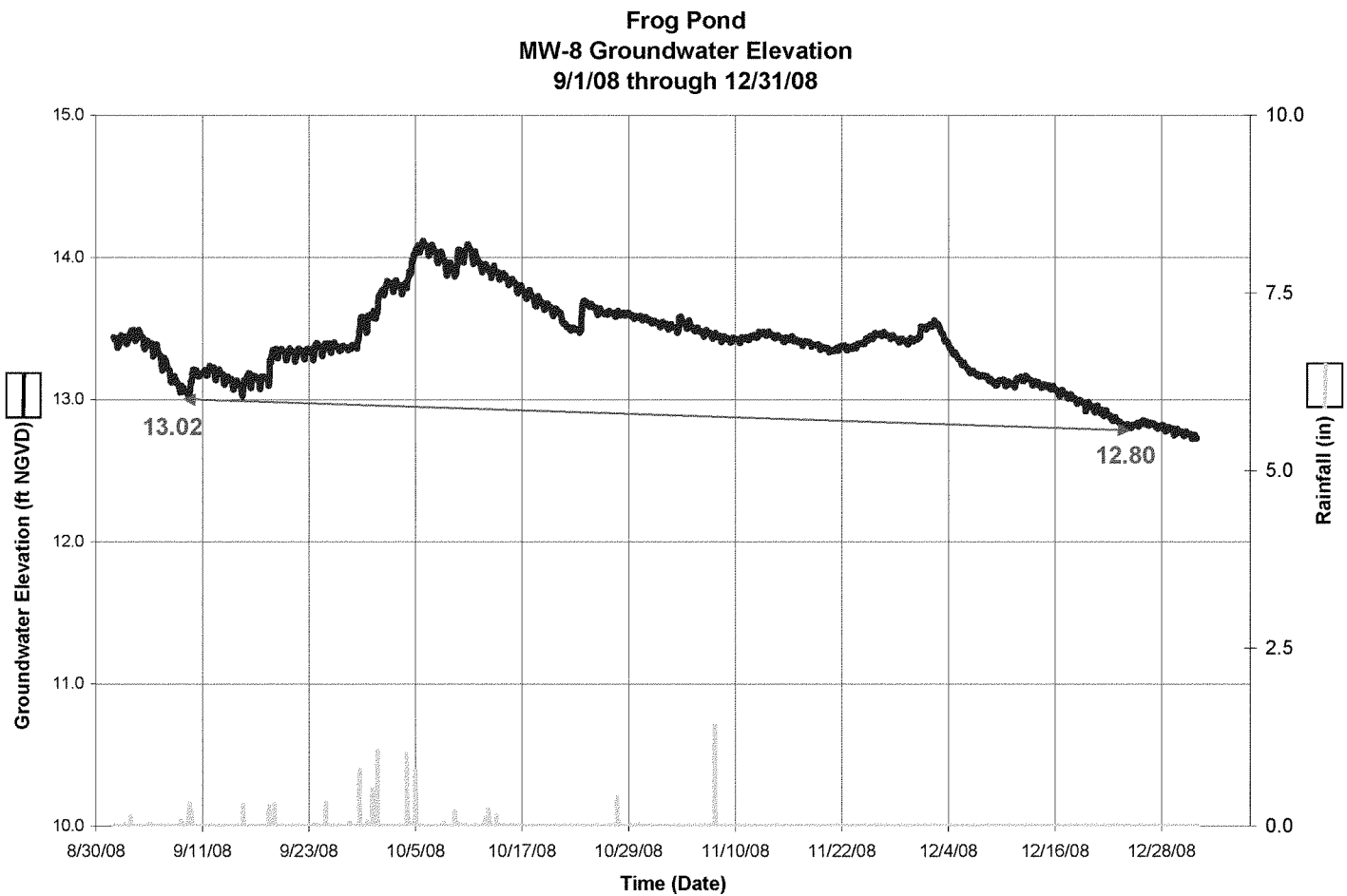
APPENDIX B4

MONITOR WELL MW-7 ELEVATION GRAPH


Frog Pond
MW-7 Groundwater Elevation
9/1/08 through 12/31/08
Groundwater Elevation (ft NGVD)
Rainfall (in)
Time (Date)
14.0
13.0
12.0
11.0
10.0
9.0
8.0
10.00
8.00
6.00
4.00
2.00
0.00
8/30/08
9/11/08
9/23/08
10/5/08
10/17/08
10/29/08
11/10/08
11/22/08
12/4/08
12/16/08
12/28/08
11.37
10.19

APPENDIX B5

MONITOR WELL MW-8 ELEVATION GRAPH


Frog Pond
MW-8 Groundwater Elevation
9/1/08 through 12/31/08
Groundwater Elevation (ft NGVD)
15.0
14.0
13.0
12.0
11.0
10.0
13.02
12.80
Rainfall (in)
10.0
7.5
5.0
2.5
0.0
8/30/08
9/11/08
9/23/08
10/5/08
10/17/08
10/29/08
11/10/08
11/22/08
12/4/08
12/16/08
12/28/08
Time (Date)

APPENDIX C

FDEP GROUNDWATER SAMPLING LOGS

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-1	SAMPLE ID: MW-1 / DATE: 10/21/08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 4.87	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.15 feet – 4.87 feet) X 0.16 gallons/foot = 1.64 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 6	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 6	PURGING INITIATED AT: 11:30	PURGING ENDED AT: 11:48	TOTAL VOLUME PURGED (gallons): 3.6

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or mS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
11:39	1.8	1.8	0.2	4.88	7.19	26.1	487	0.0	8.1	colorless	odorless
11:42	0.6	2.4	0.2	4.88	7.19	26.1	485	0.0	6.7		
11:45	0.6	3.0	0.2	4.88	7.18	26.2	484	0.0	5.1		
11:48	0.6	3.6	0.2	4.88	7.19	26.2	484	0.0	4.6		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jamie Sullivan / UES	SAMPLER(S) SIGNATURES: [signature]	SAMPLING INITIATED AT: 11:49	SAMPLING ENDED AT: 11:59
PUMP OR TUBING DEPTH IN WELL (feet): 6	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) Filtration Equipment Type: ____ FILTER SIZE: ____ µm	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-1	2	AG	1L	Ice			EPA 8081	APP
MW-1	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-1 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-2	SAMPLE ID: MW-2 / DATE: 10/21/08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 5.10	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.15 feet – 5.10 feet) X 0.16 gallons/foot = 1.61 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 7	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 7	PURGING INITIATED AT: 10:45	PURGING ENDED AT: 11:02	TOTAL VOLUME PURGED (gallons): 3.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or mS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
10:53	1.6	1.6	0.2	5.11	7.15	26.8	624	0.0	16	colorless	odorless
10:56	0.6	2.2	0.2	5.11	7.15	26.7	623	0.0	15		
10:59	0.6	2.8	0.2	5.11	7.15	26.8	615	0.0	14		
11:02	0.6	3.4	0.2	5.11	7.15	26.7	604	0.0	10		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jamie Sullivan / URS	SAMPLER(S) SIGNATURES: [signature]	SAMPLING INITIATED AT: 11:03	SAMPLING ENDED AT: 11:13
PUMP OR TUBING DEPTH IN WELL (feet): 7	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) FILTER SIZE: ____ µm Filtration Equipment Type:	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-2	2	AG	1L	Ice			EPA 8081	APP
MW-2	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-2 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-3	SAMPLE ID: MW-3 / DATE: 10-21-08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 4.15	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.15 feet – 4.15 feet) X 0.16 gallons/foot = 1.76 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 6.0	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 6.0	PURGING INITIATED AT: 7:55	PURGING ENDED AT: 8:11	TOTAL VOLUME PURGED (gallons): 4.0

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or mS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
8:02	1.75	1.75	0.25	4.16	7.24	24.3	551	15.1	1.2	clear	—
8:05	0.75	2.50	0.25	4.16	7.24	24.3	543	15.1	1.2		
8:08	0.75	3.25	0.25	4.16	7.15	24.2	532	10.0	1.1		
8:11	0.75	4.00	0.25	4.16	7.16	24.2	531	4.7	0.80		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Fred Schuknecht / URS	SAMPLER(S) SIGNATURE(S): [signature]	SAMPLING INITIATED AT: 8:12	SAMPLING ENDED AT: 9:02
PUMP OR TUBING DEPTH IN WELL (feet): 6.0	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) FILTER SIZE: ____ µm Filtration Equipment Type:	DUPLICATE: (Y) N	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-3	2 6	AG	1L	Ice			EPA 8081	APP
MW-3	1 3	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-3 (Filtered)	1 3	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP
Dup-1	2	AG	1L	Ice			EPA 8081	APP
Dup-1 (Filtered)	1 1	PE	100mL	HNO_3/Ice			Ba, Cu, Cr, Zn	APP
MW-3 (SPLIT)	6	AG	1L	Ice			EPA 8081	APP
MW-3 (SPLIT) (Filtered)	3 3	PE	300mL	HNO_3/Ice			Ba, Cu, Cr, Zn	APP

REMARKS: ELAB Split sample + MS/MSD + Dup-1 CAS MW-3 MS/MSD

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-4	SAMPLE ID: MW-4 / DATE: 10/21/08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 5.26	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.15 feet – 5.26 feet) X 0.16 gallons/foot = 1.58 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 7	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 7	PURGING INITIATED AT: 10:00	PURGING ENDED AT: 10:17	TOTAL VOLUME PURGED (gallons): 3.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or mS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
10:08	1.6	1.6	0.2	5.26	7.13	26.3	585	0.0	6.1	colorless	odorless
10:11	0.6	2.2	0.2	5.26	7.14	26.1	571	0.0	7.3		
10:14	0.6	2.8	0.2	5.26	7.14	26.0	563	0.0	8.7		
10:17	0.6	3.4	0.2	5.26	7.14	26.0	554	0.0	5.2		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jamie Sullivan / URS	SAMPLER(S) SIGNATURES:	SAMPLING INITIATED AT: 10:18	SAMPLING ENDED AT: 10:28
PUMP OR TUBING DEPTH IN WELL (feet): 7	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) FILTER SIZE: ____ µm Filtration Equipment Type:	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-4	2	AG	1L	Ice			EPA 8081	APP
MW-4	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-4 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-5	SAMPLE ID: MW-5 / DATE: 10/21/08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 5.71	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.15 feet – 5.71 feet) X 0.16 gallons/foot = 1.51 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 7.5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 7.5	PURGING INITIATED AT: 8:00	PURGING ENDED AT: 8:17	TOTAL VOLUME PURGED (gallons): 3.4

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or µS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
8:08	1.6	1.6	0.2	5.74	7.25	25.9	551	0.0	19.2	Strongly Cloudy White	odorless
8:11	0.6	2.2	0.2	5.74	7.24	25.8	552	0.0	18.4		
8:14	0.6	2.8	0.2	5.74	7.24	25.8	555	0.0	16.3		
8:17	0.6	3.4	0.2	5.74	7.25	25.8	559	0.0	15.0		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jamie Sullivan / URS	SAMPLER(S) SIGNATURES:	SAMPLING INITIATED AT: 8:19	SAMPLING ENDED AT: 8:30
PUMP OR TUBING DEPTH IN WELL (feet): 7.5	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) FILTER SIZE: ____ µm Filtration Equipment Type:	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-5	2	AG	1L	Ice			EPA 8081	APP
MW-5	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-5 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-6	SAMPLE ID: MW-6 / DATE: 10/21/08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 6.37	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
only fill out if applicable)
= (15.15 feet – 6.37 feet) X 0.16 gallons/foot = 1.40 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 8	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 8	PURGING INITIATED AT: 8:45	PURGING ENDED AT: 9:20	TOTAL VOLUME PURGED (gallons): 7.0

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or µS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
8:52	1.4	1.4	0.2	6.52	7.29	26.1	605	0.0	540	cloudy gray	odorless
8:59	1.4	2.8	0.2	6.52	7.30	26.1	637	0.0	535		
9:06	1.4	4.2	0.2	6.52	7.29	26.1	660	0.0	520		
9:13	1.4	5.6	0.2	6.52	7.29	26.1	669	0.0	520		
9:20	1.4	7.0	0.2	6.52	7.30	26.2	681	0.0	515		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jamie Sullivan / URS	SAMPLER(S) SIGNATURES:	SAMPLING INITIATED AT: 9:21	SAMPLING ENDED AT: 9:31
PUMP OR TUBING DEPTH IN WELL (feet): 8	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) FILTER SIZE: ____ µm Filtration Equipment Type:	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-6	2	AG	1L	Ice			EPA 8081	APP
MW-6	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-6 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida
WELL NO: MW-7	SAMPLE ID: MW-7 / DATE: 10-21-08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.15 feet to 15.15 feet	STATIC DEPTH TO WATER (feet): 5.05	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.15 feet – 5.05 feet) X 0.16 gallons/foot = 1.61 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 7.0	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 7.0	PURGING INITIATED AT: 10:05	PURGING ENDED AT: 10:21	TOTAL VOLUME PURGED (gallons): 4.0

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or mS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
10:12	1.75	1.75	0.25	5.06	7.56	24.9	644	1.4	20	clear	—
10:15	0.75	2.50	0.25	5.06	7.53	24.9	646	0.7	17		
10:18	0.75	3.25	0.25	5.06	7.52	24.9	646	0.2	14		
10:21	0.75	4.00	0.25	5.06	7.52	24.9	646	0.1	12		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Fred Schuknecht / URS	SAMPLER(S) SIGNATURE(S): [signature]	SAMPLING INITIATED AT: 10:22	SAMPLING ENDED AT: 10:35
PUMP OR TUBING DEPTH IN WELL (feet): 7.0	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) FILTER SIZE: ____ µm Filtration Equipment Type:	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-7	2	AG	1L	Ice			EPA 8081	APP
MW-7	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-7 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS:

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

DEP-SOP-001/01
FS 2200 Groundwater Sampling
Form FD 9000-24

GROUNDWATER SAMPLING LOG

SITE NAME: Frog Pond	SITE LOCATION: Florida City, Miami-Dade County, Florida	
WELL NO: MW-8	SAMPLE ID: MW-8	DATE: 10/21/08

PURGING DATA

WELL DIAMETER (inches): 2"	TUBING DIAMETER (inches): 3/8"	WELL SCREEN INTERVAL DEPTH: 5.08 feet to 15.08 feet	STATIC DEPTH TO WATER (feet): 3.81	PURGE PUMP TYPE OR BAILER: Peristaltic Pump

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (15.08 feet – 3.81 feet) X 0.16 gallons/foot = 1.80 gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet): 5	FINAL PUMP OR TUBING DEPTH IN WELL (feet): 5	PURGING INITIATED AT: 12:20	PURGING ENDED AT: 12:38	TOTAL VOLUME PURGED (gallons): 3.6

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (µmhos/cm or mS/cm)	DISSOLVED OXYGEN (circle mg/L or % saturation)	TURBIDITY (NTUs)	COLOR (describe)	ODOR (describe)
12:29	1.8	1.8	0.2	4.81	7.18	27.2	442	0.0	1.1	slight yellow	faint organic
12:32	0.6	2.4	0.2	4.81	7.16	27.4	440	0.0	0.6		
12:35	0.6	3.0	0.2	4.81	7.15	27.5	438	0.0	0.4		
12:38	0.6	3.6	0.2	4.81	7.15	27.5	436	0.0	0.2		

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION: Jamie Sullivan / URS	SAMPLER(S) SIGNATURES:	SAMPLING INITIATED AT: 12:39	SAMPLING ENDED AT: 12:49
PUMP OR TUBING DEPTH IN WELL (feet): 5	SAMPLE PUMP FLOW RATE (mL per minute):	TUBING MATERIAL CODE: PE	
FIELD DECONTAMINATION: Y (N)	FIELD-FILTERED: Y (N) Filtration Equipment Type: ____ FILTER SIZE: ____ µm	DUPLICATE: Y (N)	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH		
MW-8	2	AG	1L	Ice			EPA 8081	APP
MW-8	1	PE	100mL	HNO_3			Ba, Cu, Cr, Zn	APP
MW-8 (Filtered)	1	PE	100mL	Ice			Ba, Cu, Cr, Zn	APP

REMARKS: Collect Equipment Blank prior to sampling well @ 12:10.

MATERIAL CODES: AG = Amber Glass; CG = Clear Glass; PE = Polyethylene; PP = Polypropylene; S = Silicone; T = Teflon; O = Other (Specify)

SAMPLING/PURGING EQUIPMENT CODES: APP = After Peristaltic Pump; B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; RFPP = Reverse Flow Peristaltic Pump; SM = Straw Method (Tubing Gravity Drain); VT = Vacuum Trap; O = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)
pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

APPENDIX D

GROUNDWATER ANALYTICAL LABORATORY RESULTS AND CHAIN-OF-CUSTODY DOCUMENTATION

9143 Philips Highway, Suite 200 Jacksonville, FL 32256 (904) 739-2277 (904) 739-2011 fax

Columbia Analytical Services INC.
An Employee - Owned Company

November 05, 2008 Service Request No: J0805120

Ed Leding
URS Corporation
7800 Congress Ave.
Boca Raton, FL 33487

Laboratory Results for: Frog Pond-Hydrologic Evaluation/38617-098

Dear Ed:

Enclosed are the results of the sample(s) submitted to our laboratory on October 22, 2008. For your reference, these analyses have been assigned our service request number **J0805120**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. In accordance to the NELAC 2003 Standard, a statement on the estimated uncertainty of measurement of any quantitative analysis will be supplied upon request.

Please contact me if you have any questions. My extension is 4409. You may also contact me via email at CMyers@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig Myers
Project Manager

Laboratory Manager: Greg Jordan
Quality Assurance Officer: Kathy Brungard

CAS Jacksonville is NELAC-accredited by the State of Florida, #E82502 valid through 6/30/09. Other state accreditations include: Georgia, #958 valid through 6/30/08; Louisiana, #02086 valid through 6/30/09; Texas, #T104704197-06-TX valid through 5/31/08; North Carolina, #527 valid through 12/31/08; South Carolina, #96021001 valid through 6/30/08.

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	URS Corporation	**Service Request No.:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation	**Date Received:**	10/22/08
Sample Matrix:	Water		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier II data deliverables, including results of QC samples analyzed from this delivery group. When appropriate to the procedure, method blank results have been reported with each analytical test. Analytical procedures performed by the lab are validated in accordance with NELAC standards. Parameters that are included in the NELAC Fields of Testing but are not included in the lab's NELAC accreditation are identified in the discussion of each analytical procedure.

Sample Receipt

Ten water samples were received for analysis at Columbia Analytical Services on 10/22/08. The samples were received in good condition and consistent with the accompanying chain of custody form. Samples are refrigerated at 4±2°C upon receipt at the lab except for aqueous samples designated for metals analyses, which were stored at room temperature.

Organochlorine Pesticides by GC-ECD

The samples were analyzed for Organochlorine Pesticides using EPA Method 8081. No problems were observed.

Metals by ICP-MS

The samples were analyzed for Total Metals using EPA Method 6020. No problems were observed.

Approved by Craig R Hy Date 11/5/08

Florida DEP Data Qualifiers

B Results based upon colony counts outside the acceptable range.

D Measurement was made in the field.

H Value based on field kit determination; results may not be accurate.

i The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

J Estimated value (one of the following reasons is discussed in the project case narrative).
1. The result may be inaccurate because the surrogate recovery limits have been exceeded.
2. No known quality control criteria exists for the component.
3. The reported value failed to meet the established quality control criteria for either precision or accuracy.
4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD).
5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).

K Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).

L Off scale high. The analyte is above the upper limit of the linear calibration range.

M The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.

N Presumptive evidence of the analyte. Confirmation was not performed.

Q Sample held beyond the accepted holding time.

T Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.

U Indicates that the compound was analyzed for but not detected.

V Indicates that the analyte was detected in both the sample and the associated method blank.

Y The laboratory analysis was from an improperly preserved sample.

Z Too many colonies were present (TNTC). The numeric value represents the filtration volume.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Client: URS Corporation
Project: Frog Pond-Hydrologic Evaluation/38617-098

Service Request: J0805120

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
J0805120-001	MW-5	10/21/08	08:30
J0805120-002	MW-3	10/21/08	09:02
J0805120-003	MW-6	10/21/08	09:31
J0805120-004	MW-4	10/21/08	10:28
J0805120-005	MW-7	10/21/08	10:35
J0805120-006	MW-2	10/21/08	11:13
J0805120-007	MW-1	10/21/08	11:59
J0805120-008	MW-8	10/21/08	12:49
J0805120-009	DUP-1	10/21/08	00:00
J0805120-010	EQUIPMENT BLANK	10/21/08	12:10

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-5	**Units:**	ug/L
Lab Code:	J0805120-001	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	57	32-92	10/23/08	Acceptable
Decachlorobiphenyl	62	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-3	**Units:**	ug/L
Lab Code:	J0805120-002	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.022	0.0084	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.022	0.0087	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.022	0.0090	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.022	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.022	0.011	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.022	0.0072	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.022	0.0084	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.022	0.0079	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.022	0.0070	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.022	0.0089	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.022	0.0094	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.022	0.0077	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.022	0.0095	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.022	0.0084	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.022	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.022	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.022	0.0090	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.043	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	**0.014**	I	0.022	0.0097	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.022	0.0056	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.53	0.53	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	74	32-92	10/23/08	Acceptable
Decachlorobiphenyl	73	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-6	**Units:**	ug/L
Lab Code:	J0805120-003	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	55	32-92	10/23/08	Acceptable
Decachlorobiphenyl	61	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-4	**Units:**	ug/L
Lab Code:	J0805120-004	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	60	32-92	10/23/08	Acceptable
Decachlorobiphenyl	64	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-7	**Units:**	ug/L
Lab Code:	J0805120-005	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.022	0.0085	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.022	0.0088	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.022	0.0091	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.022	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.022	0.011	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.022	0.0073	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.022	0.0085	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.022	0.0080	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.022	0.0071	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.022	0.0090	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.022	0.0095	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.022	0.0078	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.022	0.0096	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.022	0.0085	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.022	0.0069	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.022	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.022	0.0091	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.043	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.022	0.0098	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.022	0.0057	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.54	0.54	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	65	32-92	10/23/08	Acceptable
Decachlorobiphenyl	69	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-2	**Units:**	ug/L
Lab Code:	J0805120-006	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	67	32-92	10/23/08	Acceptable
Decachlorobiphenyl	74	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-1	**Units:**	ug/L
Lab Code:	J0805120-007	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	53	32-92	10/23/08	Acceptable
Decachlorobiphenyl	60	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	MW-8	**Units:**	ug/L
Lab Code:	J0805120-008	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	54	32-92	10/23/08	Acceptable
Decachlorobiphenyl	61	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	DUP-1	**Units:**	ug/L
Lab Code:	J0805120-009	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0083	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0089	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.010	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0071	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0083	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0079	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0069	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0088	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0093	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0083	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0067	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0089	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.042	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0096	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0056	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.53	0.53	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	49	32-92	10/23/08	Acceptable
Decachlorobiphenyl	52	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	10/21/2008
Sample Matrix:	Water	**Date Received:**	10/22/2008

Organochlorine Pesticides by GC-ECD

Sample Name:	EQUIPMENT BLANK	**Units:**	ug/L
Lab Code:	J0805120-010	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.021	0.012	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.021	0.0098	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.021	0.0070	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.021	0.0077	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.021	0.0068	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.021	0.0086	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.021	0.0091	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.021	0.0075	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.021	0.0092	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.021	0.0081	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.021	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.021	0.014	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.021	0.0087	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.041	0.012	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.021	0.0055	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.52	0.52	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	58	32-92	10/23/08	Acceptable
Decachlorobiphenyl	67	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

Organochlorine Pesticides by GC-ECD

Sample Name:	Method Blank	**Units:**	ug/L
Lab Code:	JWG0804001-4	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.020	0.0079	1	10/23/08	10/23/08	JWG0804001	
gamma-BHC (Lindane)	ND	U	0.020	0.0082	1	10/23/08	10/23/08	JWG0804001	
beta-BHC	ND	U	0.020	0.0085	1	10/23/08	10/23/08	JWG0804001	
delta-BHC	ND	U	0.020	0.011	1	10/23/08	10/23/08	JWG0804001	
Heptachlor	ND	U	0.020	0.0096	1	10/23/08	10/23/08	JWG0804001	
Aldrin	ND	U	0.020	0.0068	1	10/23/08	10/23/08	JWG0804001	
Heptachlor Epoxide	ND	U	0.020	0.0079	1	10/23/08	10/23/08	JWG0804001	
gamma-Chlordane	ND	U	0.020	0.0075	1	10/23/08	10/23/08	JWG0804001	
alpha-Chlordane	ND	U	0.020	0.0066	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDE	ND	U	0.020	0.0084	1	10/23/08	10/23/08	JWG0804001	
Endosulfan I	ND	U	0.020	0.0089	1	10/23/08	10/23/08	JWG0804001	
Dieldrin	ND	U	0.020	0.0073	1	10/23/08	10/23/08	JWG0804001	
Endrin	ND	U	0.020	0.0090	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDD	ND	U	0.020	0.0079	1	10/23/08	10/23/08	JWG0804001	
Endosulfan II	ND	U	0.020	0.0064	1	10/23/08	10/23/08	JWG0804001	
4,4'-DDT	ND	U	0.020	0.013	1	10/23/08	10/23/08	JWG0804001	
Endrin Aldehyde	ND	U	0.020	0.0085	1	10/23/08	10/23/08	JWG0804001	
Methoxychlor	ND	U	0.040	0.011	1	10/23/08	10/23/08	JWG0804001	
Endosulfan Sulfate	ND	U	0.020	0.0092	1	10/23/08	10/23/08	JWG0804001	
Endrin Ketone	ND	U	0.020	0.0053	1	10/23/08	10/23/08	JWG0804001	
Toxaphene	ND	U	0.50	0.50	1	10/23/08	10/23/08	JWG0804001	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	61	32-92	10/23/08	Acceptable
Decachlorobiphenyl	86	13-104	10/23/08	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-5	**Units:**	ug/L
Lab Code:	J0805120-001	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	26	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	4.7	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	33	
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	22	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-3	**Units:**	ug/L
Lab Code:	J0805120-002	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	11/03/2008	11/04/2008	17	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	11/03/2008	11/04/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	11/03/2008	11/04/2008	1.6	i
Zinc	EPA 3020A	6020	10	4	1.0	11/03/2008	11/04/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-6	**Units:**	ug/L
Lab Code:	J0805120-003	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	31	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	4.9	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	19	
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	9	i

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-4	**Units:**	ug/L
Lab Code:	J0805120-004	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	20	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	0.7	i
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	Service Request:	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	Date Collected:	10/21/2008
Project Number:	38617-098	Date Received:	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-7	Units:	ug/L
Lab Code:	J0805120-005	Basis:	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	18	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	3.2	
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-2	**Units:**	ug/L
Lab Code:	J0805120-006	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	17	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	3.7	
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-1	**Units:**	ug/L
Lab Code:	J0805120-007	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	15	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	U	
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	MW-8	**Units:**	ug/L
Lab Code:	J0805120-008	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	11	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	0.5	i
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	4	i

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	DUP-1	**Units:**	ug/L
Lab Code:	J0805120-009	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	17	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	1.0	i
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER		

Total Metals

Sample Name:	EQUIPMENT BLANK	**Units:**	ug/L
Lab Code:	J0805120-010	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	0.9	i
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	1.5	i
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	N/A
Project Number:	38617-098	**Date Received:**	N/A
Matrix:	WATER		

Total Metals

Sample Name:	Method Blank	**Units:**	ug/L
Lab Code:	MB3-1029	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Barium	EPA 3020A	6020	2.0	0.5	1.0	10/29/2008	10/31/2008	U	
Barium	EPA 3020A	6020	2.0	0.5	1.0	11/03/2008	11/04/2008	0.6	i
Chromium	EPA 3020A	6020	2.0	0.8	1.0	10/29/2008	10/31/2008	U	
Chromium	EPA 3020A	6020	2.0	0.8	1.0	11/03/2008	11/04/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	10/29/2008	10/31/2008	U	
Copper	EPA 3020A	6020	2.0	0.3	1.0	11/03/2008	11/04/2008	U	
Zinc	EPA 3020A	6020	10	4	1.0	10/29/2008	10/31/2008	U	
Zinc	EPA 3020A	6020	10	4	1.0	11/03/2008	11/04/2008	U	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Frog Pond-Hydrologic Evaluation/38617-098
Sample Matrix: Water

Service Request: J0805120

Surrogate Recovery Summary
Organochlorine Pesticides by GC-ECD

Extraction Method: EPA 3510C
Analysis Method: 8081A

Units: PERCENT
Level: Low

Sample Name	Lab Code	Sur1	Sur2
MW-5	J0805120-001	57	62
MW-3	J0805120-002	74	73
MW-6	J0805120-003	55	61
MW-4	J0805120-004	60	64
MW-7	J0805120-005	65	69
MW-2	J0805120-006	67	74
MW-1	J0805120-007	53	60
MW-8	J0805120-008	54	61
DUP-1	J0805120-009	49	52
EQUIPMENT BLANK	J0805120-010	58	67
Method Blank	JWG0804001-4	61	86
MW-3MS	JWG0804001-1	61	61
MW-3DMS	JWG0804001-2	48	50
Lab Control Sample	JWG0804001-3	47	59

Surrogate Recovery Control Limits (%)

Sur1 =	Tetrachloro-m-xylene	32-92
Sur2 =	Decachlorobiphenyl	13-104

Results flagged with an asterisk (*) indicate values outside control criteria.
Results flagged with a pound (#) indicate the control criteria is not applicable.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Extracted:**	10/23/2008
Sample Matrix:	Water	**Date Analyzed:**	10/23/2008

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides by GC-ECD

Sample Name:	MW-3	**Units:**	ug/L
Lab Code:	J0805120-002	**Basis:**	NA
Extraction Method:	EPA 3510C	**Level:**	Low
Analysis Method:	8081A	**Extraction Lot:**	JWG0804001

		MW-3MS JWG0804001-1 Matrix Spike			MW-3DMS JWG0804001-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Expected**	**%Rec**	**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
alpha-BHC	ND	0.294	0.421	70	0.247	0.440	56	39-108	17	30
gamma-BHC (Lindane)	ND	0.294	0.421	70	0.247	0.440	56	41-105	17	30
beta-BHC	ND	0.282	0.421	67	0.245	0.440	56	32-115	14	30
delta-BHC	ND	0.260	0.421	62	0.227	0.440	52	23-106	13	30
Heptachlor	ND	0.331	0.421	79	0.281	0.440	64	28-111	16	30
Aldrin	ND	0.312	0.421	74	0.270	0.440	62	24-110	14	30
Heptachlor Epoxide	ND	0.320	0.421	76	0.275	0.440	63	40-111	15	30
gamma-Chlordane	ND	0.293	0.421	70	0.244	0.440	56	28-109	18	30
alpha-Chlordane	ND	0.296	0.421	70	0.244	0.440	56	32-104	19	30
4,4'-DDE	ND	0.327	0.421	78	0.271	0.440	62	26-117	19	30
Endosulfan I	ND	0.335	0.421	80	0.285	0.440	65	40-108	16	30
Dieldrin	ND	0.339	0.421	81	0.286	0.440	65	37-116	17	30
Endrin	ND	0.372	0.421	88	0.321	0.440	73	35-127	15	30
4,4'-DDD	ND	0.343	0.421	82	0.296	0.440	67	41-110	15	30
Endosulfan II	ND	0.343	0.421	82	0.292	0.440	67	42-110	16	30
4,4'-DDT	ND	0.327	0.421	78	0.276	0.440	63	27-115	17	30
Endrin Aldehyde	ND	0.302	0.421	72	0.282	0.440	64	20-116	7	30
Methoxychlor	ND	0.325	0.421	77	0.276	0.440	63	23-132	16	30
Endosulfan Sulfate	0.014	0.342	0.421	78	0.291	0.440	63	41-109	16	30
Endrin Ketone	ND	0.312	0.421	74	0.265	0.440	60	38-108	16	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0805120
Project:	Frog Pond-Hydrologic Evaluation/38617-098	**Date Extracted:**	10/23/2008
Sample Matrix:	Water	**Date Analyzed:**	10/23/2008

Lab Control Spike Summary
Organochlorine Pesticides by GC-ECD

Extraction Method:	EPA 3510C	**Units:**	ug/L
Analysis Method:	8081A	**Basis:**	NA
		Level:	Low
		Extraction Lot:	JWG0804001

	Lab Control Sample JWG0804001-3 Lab Control Spike			
Analyte Name	**Result**	**Expected**	**%Rec**	**%Rec Limits**
alpha-BHC	0.269	0.400	67	56-104
gamma-BHC (Lindane)	0.271	0.400	68	57-101
beta-BHC	0.257	0.400	64	55-97
delta-BHC	0.237	0.400	59	31-105
Heptachlor	0.252	0.400	63	52-100
Aldrin	0.232	0.400	58	45-108
Heptachlor Epoxide	0.296	0.400	74	59-103
gamma-Chlordane	0.266	0.400	67	53-107
alpha-Chlordane	0.276	0.400	69	54-104
4,4'-DDE	0.296	0.400	74	58-114
Endosulfan I	0.306	0.400	77	61-104
Dieldrin	0.306	0.400	77	57-111
Endrin	0.341	0.400	85	57-117
4,4'-DDD	0.312	0.400	78	56-116
Endosulfan II	0.313	0.400	78	50-106
4,4'-DDT	0.284	0.400	71	41-115
Endrin Aldehyde	0.275	0.400	69	51-108
Methoxychlor	0.300	0.400	75	43-123
Endosulfan Sulfate	0.306	0.400	77	56-107
Endrin Ketone	0.290	0.400	73	46-101

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	10/21/2008
Project Number:	38617-098	**Date Received:**	10/22/2008
Matrix:	WATER	**Date Extracted:**	11/03/2008
		Date Analyzed:	11/04/2008

Matrix Spike/Matrix Spike Duplicate Summary
Total Metals

Sample Name:	MW-3		**Units:**	ug/L
Lab Code:	J0805120-002	J0805120-002S	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	RPD	% Rec Acceptance Limits	Result Notes
Barium	EPA 3020	6020	2.0	50.0	50.0	17.1	64.7	62.0	95	90	4	75 - 125	
Chromium	EPA 3020	6020	2.0	50.0	50.0	U	50.7	49.6	101	99	2	75 - 125	
Copper	EPA 3020	6020	2.0	50.0	50.0	1.6	49.4	50.0	96	97	1	75 - 125	
Zinc	EPA 3020	6020	10.0	100	100	U	93.6	93.8	94	94	<1	75 - 125	

COLUMBIA ANALYTICAL SERVICES, INC

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0805120
Project Name:	Frog Pond-Hydrologic Evaluation	**Date Collected:**	N/A
Project Number:	38617-098	**Date Received:**	N/A
Matrix:	WATER	**Date Extracted:**	11/03/2008
		Date Analyzed:	11/04/2008

Laboratory Control Sample Summary
Total Metals

Sample Name:	Lab Control Sample	**Units:**	ug/L
Lab Code:	LCS1-1103	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	True Value	Results	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Barium	EPA 3020A	6020	50.0	46.0	92	80 - 120	
Barium	EPA 3020A	6020	50.0	47.7	95	80 - 120	
Chromium	EPA 3020A	6020	50.0	49.9	100	80 - 120	
Chromium	EPA 3020A	6020	50.0	48.5	97	80 - 120	
Copper	EPA 3020A	6020	50.0	50.1	100	80 - 120	
Copper	EPA 3020A	6020	50.0	47.7	95	80 - 120	
Zinc	EPA 3020A	6020	100	95.8	96	80 - 120	
Zinc	EPA 3020A	6020	100	88.6	89	80 - 120	

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: URS Corp
Service Request # J080512
Project: Frog Pond - Hydrologic Evaluation
Cooler received on 10-22-08 and opened on 10-22-08 by DMK
COURIER: CAS UPS FEDEX DHL CLIENT Tracking # 791974915760

1	Were custody seals on outside of cooler?	Yes	No	N/A
2	Were seals intact, signed and dated?	Yes	No	N/A
3	Were custody papers properly filled out?	Yes	No	N/A
4	Temperature of cooler(s) upon receipt (Should be 4 +/- 2 degrees C) 1.9 0.3 1.8			
5	Correct Temperature?	Yes	No	N/A
6	Were Ice or Ice Packs present	Yes	No	N/A
7	Did all bottles arrive in good condition (unbroken, etc....)?	Yes	No	N/A
8	Were all bottle labels complete (sample ID, preservation, etc....)?	Yes	No	N/A
9	Did all bottle labels and tags agree with custody papers?	Yes	No	N/A
10	Were the correct bottles used for the tests indicated?	Yes	No	N/A
11	Were all of the preserved bottles received with the appropriate preservative?	Yes	No	N/A

HNO3 pH<2 H2SO4 pH<2 ZnAc2/NaOH pH>9 NaOH pH>12 HCl pH<2
Preservative additions noted below

12	Were all samples received within analysis holding times?	Yes	No	N/A
13	Were VOA vials checked for absence of air bubbles? If present, note below	Yes	No	N/A
14	Where did the bottles originate?	CAS	Client	

Sample ID	Reagent	Manuf. Lot # or CAS Chem ID	ml added	Inititials

Additional comments and/or explanation of all discrepancies noted above:

Client approval to run samples if discrepancies noted: Date:

Columbia Analytical Services™

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

SR # J0805120

9143 Philips Highway, Ste 200 • Jacksonville, FL 32256 (904) 739-2277 • 800-695-7222 x06 • FAX (904) 739-2011 PAGE 1 OF 2

www.caslab.com

Project Name: Frog Pond - Hydrologic Evaluation
Project Number: 38617-098
Project Manager: Ed Leding
Email Address: Ed_Leding@urscorp.com
Company/Address: URS Corporation, 7800 Congress Ave., Suite 200, Boca Raton, FL 33487
Phone #: 561-994-6500
FAX#: 561-994-6524
Sampler's Signature:
Sampler's Printed Name: Jamie Sullivan

ANALYSIS REQUESTED (Include Method Number and [redacted]

PRESERVATIVE: 8 2 8

CLIENT SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NUMBER OF CONTAINERS: EPA 8015	Ba, Cu, Cr, Zn	Ba, Cu, Cr, Zn	REMARKS/ ALTERNATE DESCRIPTION
MW-5		10/21/08	8:30	GW	3	✓	✓	
MW-5 (Filtered)		10/21/08	8:30	GW	1		✓	Hold pending unfiltered results
MW-3		10/21/08	9:02	GW	9	✓	✓	
MW-3 (Filtered)		10/21/08	9:02	GW	3		✓	Hold pending unfiltered results
MW-6		10/21/08	9:31	GW	3	✓	✓	
MW-6 (Filtered)		10/21/08	9:31	GW	1		✓	Hold pending unfiltered results
MW-4		10/21/08	10:28	GW	3	✓	✓	
MW-4 (Filtered)		10/21/08	10:28	GW	1		✓	Hold pending unfiltered results
MW-7		10/21/08	10:35	GW	3	✓	✓	
MW-7 (Filtered)		10/21/08	10:35	GW	1		✓	Hold pending unfiltered results

Preservative Key
0. NONE
1. HCL
2. HNO_3
3. H_2SO_4
4. NaOH
5. Zn. Acetate
6. MeOH
7. $NaHSO_4$
8. Other Ice

SPECIAL INSTRUCTIONS/COMMENTS

SFWMD Project
ADaPT required!

See QAPP ☐

TURNAROUND REQUIREMENTS
___ RUSH (SURCHARGES APPLY)
✓ STANDARD
REQUESTED FAX DATE
REQUESTED REPORT DATE

REPORT REQUIREMENTS
___ I. Results Only
___ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
___ III. Results + QC and Calibration Summaries
___ IV. Data Validation Report with Raw Data
___ V. Specialized Forms / Custom Report
Edata ___ Yes ___ No

INVOICE INFORMATION
PO#
BILL TO:

SAMPLE RECEIPT: CONDITION/COOLER TEMP: _____ CUSTODY SEALS: Y N

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature	Signature	Signature	Signature	Signature	Signature
Printed Name: Jamie Sullivan	Printed Name	Printed Name	Printed Name	Printed Name	Printed Name
Firm: URS	Firm	Firm	Firm	Firm	Firm
Date/Time: 10/21/08 / 16:00	Date/Time	Date/Time	Date/Time: 10-22-08 0915	Date/Time	Date/Time

Distribution: White - Return to Originator; Yellow - Lab Copy; Pink - Retained by Client

JSCOC-06/20/08

822

Columbia Analytical Services™

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

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www.caslab.com

PAGE 2 OF 2

SR # J5805120 [redacted]

Project Name: Freyland - Hydrologic Evaluation

Project Number: 38617-098

Project Manager: Ed Leding

Email Address: Ed-Leding@urscorp.com

Company/Address: URS Corporation, 7800 Congress Ave., Suite 200, Boca Raton, FL 33487

Phone #: 561-994-6500

FAX#: 561-994-6524

Sampler's Signature:

Sampler's Printed Name: Jamie Sullivan

ANALYSIS REQUESTED (Include Method Number a [redacted]

PRESERVATIVE	8	2	8
NUMBER OF CONTAINERS	EPA 8081	Ba, Cd, Cr, Zn	Ba, Cd, Cr, Zn

Preservative Key
0. NONE
1. HCL
2. HNO_3
3. H_2SO_4
4. NaOH
5. Zn. Acetate
6. MeOH
7. $NaHSO_4$
8. Other Ice

CLIENT SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX	EPA 8081	Ba, Cd, Cr, Zn	Ba, Cd, Cr, Zn	REMARKS/ ALTERNATE DESCRIPTION
MW-2		10/21/08	11:13	GW	3 ✓	✓		
MW-2		10/21/08	11:13	GW	1	✓		Hold pending unfiltered results
MW-1		10/21/08	11:59	GW	3 ✓	✓		
MW-1		10/21/08	11:59	GW	1	✓		Hold pending unfiltered results
MW-8		10/21/08	12:49	GW	3 ✓	✓		
MW-8		10/21/08	12:49	GW	1	✓		Hold pending unfiltered results
DUP-1		10/21/08		GW	3 ✓	✓		
DUP-1 (Filtered)		10/21/08		GW	1	✓		Hold pending unfiltered results
EQUIPMENT BLANK		10/21/08	12:10	W	3 ✓	✓		

SPECIAL INSTRUCTIONS/COMMENTS

SFWMD Project
ADaPT required!

See QAPP ☐

TURNAROUND REQUIREMENTS
___ RUSH (SURCHARGES APPLY)
✓ STANDARD
REQUESTED FAX DATE
REQUESTED REPORT DATE

REPORT REQUIREMENTS
___ I. Results Only
___ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
___ III. Results + QC and Calibration Summaries
___ IV. Data Validation Report with Raw Data
___ V. Specialized Forms / Custom Report
Edata ___ Yes ___ No

INVOICE INFORMATION
PO#
BILL TO:

SAMPLE RECEIPT: CONDITION/COOLER TEMP: ____ CUSTODY SEALS: Y N

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature:	Signature:	Signature:	Signature:	Signature:	Signature:
Printed Name: Jamie Sullivan	Printed Name:	Printed Name:	Printed Name:	Printed Name:	Printed Name:
Firm: URS	Firm:	Firm:	Firm:	Firm:	Firm:
Date/Time: 10/21/08 16:00	Date/Time:	Date/Time:	Date/Time: 10/22/08 0915	Date/Time:	Date/Time:

Distribution: White - Return to Originator; Yellow - Lab Copy; Pink - Retained by Client

JSCOC-06/20/08

SR #: J 0805120 Date: 10-22-08 Initials: DM

Note that pH is checked and meets the required pH criterion listed in the column heading unless otherwise noted on cooler receipt form.

	Bottle Code																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	40mL	40mL	40mL	40mL	125mL	125mL	125mL	125mL	250mL	250mL	250mL	250mL	250mL	250mL	250mL	500mL	500mL	500mL	1L	1L	1L	1L	1L	2oz	4oz	8oz	16oz	5g	100mL	Misc.
Container	G	G	G	G	P	P	P	P	P	P	P	P	P	G	G	P	P	P	P	P	G	G	G	G	G	G	G	ENC	P	Misc.
Pres.		HCl	Sodium Thiosulfate	H2SO4		HCl	H2SO4	HNO3		H2SO4	HNO3	ZnAcetate NaOH	NaOH		HNO3		H2SO4	HNO3		HNO3		HCl	H2SO4						Sodium Thiosulfate	
Req. pH	N/A	<2	N/A	<2	N/A	<2	<2	<2	N/A	<2	<2	>9	>12	N/A	<2	N/A	<2	<2	N/A	<2	N/A	<2	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sample #	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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Pace Analytical®
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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

F08100949

Page: 1 of 1

1252252

Section A Required Client Information:

Company: URS Corporation
Address: 7800 Congress Ave., Suite 200, Boca Raton FL 33487
Email To: Ed_Leding@URSCORP.COM
Phone: 561-994-6500 Fax: 561-994-6524
Requested Due Date/TAT:

Section B Required Project Information:

Report To: Ed Leding
Copy To: Jamie Sullivan
Purchase Order No.:
Project Name: Frog Pond - Hydrologic Evaluation
Project Number: 38617-098

Section C Invoice Information:

Attention: Ed Leding
Company Name: URS Corporation
Address: 7800 Congress Ave, Suite 200 Boca Raton FL
Pace Quote Reference:
Pace Project Manager: Martha Montero
Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☑ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: FL

Section D Required Client Information

SAMPLE ID (A-Z, 0-9 / -) Sample IDs MUST BE UNIQUE

Matrix Codes MATRIX / CODE: Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

Requested Analysis Filtered (Y/N): Y/N; $ Analysis Test $: EPA 3081; Ba, Cd, Cr, Zn; Ba, Cd, Cr, Zn / CP

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED Composite Start Date	Composite Start Time	Composite End/Grab Date	Composite End/Grab Time	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N	EPA 3081	Ba, Cd, Cr, Zn	Ba, Cd, Cr, Zn	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	MW-3(SPLIT)	WT		10/21/08	9:02				9			✓					✓		✓	✓			MS/MSD
2	MW-3(SPLIT)(Filtered)	WT		10/21/08	9:02				3								✓				✓		Hold pending unfiltered results
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	SAMPLING KIT-EMPTY	9-29-08					
	[signature]	10/20/08	16:00	[signature]	10/20/08	1115	
				[signature]	10/10/08	13:50	

ORIGINAL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Jamie Sullivan

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 10/20/08

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

825

November 03, 2008

Mr. Jamie Sullivan
URS Corporation
7800 Congress Ave.
Suite 200
Boca Raton, FL 33487

RE: 38617-098/Frog Pond Hydrologic Evaluation Order No.: F08100949

Dear Mr. Jamie Sullivan:

PAS, Inc. received 2 samples on 10/22/2008 11:15:00 AM for the analyses presented in the following report.
Analyses are performed with method-required calibration and QA/QC samples whenever applicable. Method performance, which is based on the calibration and QA/QC samples, establishes the validity and certainty of the reported sample results. This data is provided along with the sample results when requested.

Thank you for this opportunity to be of service. If you have any questions regarding this data, please feel free to call me at (386) 672-5668, extension 308.

Sincerely,
Martha Montero

Martha Montero

Martha Montero
Validity unknown
Digitally signed by Martha Montero
DN: cn=Martha Montero, o=PAS, Inc., c=US
Date: 2008.11.03 19:27:17 -05'00'

Project Manager
ELAB, Inc.
P.O. Box 468
Ormond Beach, FL 32175-0468

THIS DOCUMENT MEETS NELAC STANDARDS
NELAC Certification #E83079

The following acronyms may be utilized within this report:

%REC	Percent Recovery
A	Absent
ABLK	Analytical Method Blank
CG	Confluent Growth
CGB	Confluent Growth Without Coliforms
CGC	Confluent Growth With Coliforms
DUP	Sample Duplicate
LCS	Laboratory Control Spike (may also be appended with an abbreviation indicating spiking level)
MBLK	Preparation Method Blank
MDL	Laboratory Method Detection Limit
MS	Matrix Spike (may also be appended with an abbreviation indicating spiking level)
MSD	Matrix Spike Duplicate (may also be appended with an abbreviation indicating spiking level)
P	Present
PQL	Practical Quantitation Limit
QCS	Alternate source Calibration Verification Standard (may also be reported as analytical LCS in some
RL	Reporting Limit
RPD	Relative Percent Difference
SPK	Spike
TIC	Tentatively Identified Compound
TNTC	Too Numerous To Count

The following notes may apply to analytical results within this report:

Residue (solids) analysis may employ a single, heated drying process of at least 12 hours duration in lieu of employing short, repeated drying cycles, which represents a deviation from the methodology.

Because the EPA-recommended holding time for pH, residual chlorine, chloramines and chlorine dioxide is 15 minutes from time of collection, these analyses are routinely performed outside of their EPA-recommended holding time when performed in the laboratory.

Analytical results for ammonia analysis, or calculated analytical results depending on ammonia analysis, do not include a sample distillation procedure. A study comparing distilled versus non-distilled analytical results has been performed to document the validity of the analysis without prior distillation, and represents equivalent results for the represented project matrices.

Since N-nitrosodiphenylamine decomposes in the GC inlet and cannot be chromatographically resolved from diphenylamine, these compounds are reported as a single analyte in the report.

Since m-cresol and p-cresol cannot be chromatographically resolved, these compounds are reported as a single analyte in the report.

The following certifications may apply to analytical results within this report:

Alabama	DEM	41320
Arizona	DHS	AZ0640
Colorado	DPHE	FL NELAC Reciprocity
Connecticut	DPH	PH-0216
Florida	DOH	E83079
Georgia	DNR	955
Kentucky	DEP	90050
Maine	LCP	2006032
Massachusetts	DEP	M-FL020
Michigan	DEQ	9911
Mississippi	DOH	FL NELAC Reciprocity
Nevada	EP	ELAB FL-00020
New Hampshire	DES	295805
New Jersey	DEP	FL765
New York	DOH	11608
Pennsylvania	DEP	68-00547
Puerto Rico	DOH	FL 00020
South Carolina	DHEC	96027001
Tennessee	DOH	02974
Texas	CEQ	T104704184-05-TX

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *03-Nov-08*

WorkOrder Sample Summary

CLIENT: URS Corporation
Project: 38617-098/Frog Pond Hydrologic Evaluation
Lab Order: F08100949

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
F08100949-001	MW-3 (Split)		10/21/2008 9:02:00 AM	10/22/2008
F08100949-001	MW-3 (Split)		10/21/2008 9:02:00 AM	10/22/2008
F08100949-002	MW-3 (Split) (Filtered)		10/21/2008 9:02:00 AM	10/22/2008

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87

Case Narrative

CLIENT: URS Corporation
Project: 38617-098/Frog Pond Hydrologic Evaluation
Lab Order: F08100949

I. SAMPLE RECEIVING/ CUSTODY

The samples were received and processed by the Sample Custody section of the laboratory. There were no significant logistics or quality problems unless noted below.

II. ANALYTICAL DATA

The samples were analyzed according to the laboratory's Standard Operating Procedures for the methodologies requested. There were no significant logistics or quality problems unless noted below or in the text of the report.

III. QUALITY CONTROL

There were no significant quality control problems unless noted below or in the text of the report.

SW8081 A heavy emulsion was generated during the extraction process employed in the preparation of sample MW-3 (Split) for this analysis.

SW8081 The Continuing Calibration Verification standard (CCV) recovery for target compounds Methoxychlor, decachlorobiphenyl exceeded method guidance criteria (high biased), affecting samples MW-3 (Split)MS and MW-3 (Split) MSD. Samples with detected levels of these target compounds were reported; however, the levels reported should also be considered high biased.

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *03-Nov-08*

Analytical Report

CLIENT: URS Corporation
Lab Order: F08100949
Project: 38617-098/Frog Pond Hydrologic Evaluation
Lab ID: F08100949-001

Client Sample ID: MW-3 (Split)
Collection Date: 10/21/2008 9:02:00 AM
Sample Description:
Matrix: Groundwater

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
ICP METALS		**SW6010**	PrepDate:	**10/24/2008 9:07:00 A**			Analyst: **TPI**	
Barium	0.020		0.0050	0.010	mg/L	1	10/25/08 00:16	56707
Chromium	0.0025	U	0.0025	0.0050	mg/L	1	10/25/08 00:16	56707
Copper	0.0025	U	0.0025	0.0050	mg/L	1	10/25/08 00:16	56707
Zinc	0.010	U	0.010	0.020	mg/L	1	10/25/08 00:16	56707
8081: PESTICIDES, ORGANOCHLORINE		**SW8081**	PrepDate:	**10/24/2008 8:30:00 A**			Analyst: **CL**	
Aldrin	0.00047	U	0.00047	0.0095	µg/L	1	10/25/08 03:27	56690
alpha-BHC	0.00028	U	0.00028	0.0095	µg/L	1	10/25/08 03:27	56690
beta-BHC	0.00047	U	0.00047	0.0095	µg/L	1	10/25/08 03:27	56690
delta-BHC	0.00038	U	0.00038	0.0095	µg/L	1	10/25/08 03:27	56690
gamma-BHC	0.00019	U	0.00019	0.0095	µg/L	1	10/25/08 03:27	56690
alpha-Chlordane	0.0012	U	0.0012	0.0095	µg/L	1	10/25/08 03:27	56690
gamma-Chlordane	0.0015	U	0.0015	0.0095	µg/L	1	10/25/08 03:27	56690
Chlordane	0.076	U	0.076	0.47	µg/L	1	10/25/08 03:27	56690
4,4'-DDD	0.0018	U	0.0018	0.0095	µg/L	1	10/25/08 03:27	56690
4,4'-DDE	0.00085	U	0.00085	0.0095	µg/L	1	10/25/08 03:27	56690
4,4'-DDT	0.0034	U	0.0034	0.0095	µg/L	1	10/25/08 03:27	56690
Dieldrin	0.00047	U	0.00047	0.0095	µg/L	1	10/25/08 03:27	56690
Endosulfan I	0.00066	U	0.00066	0.0095	µg/L	1	10/25/08 03:27	56690
Endosulfan II	0.00066	U	0.00066	0.0095	µg/L	1	10/25/08 03:27	56690
Endosulfan sulfate	0.016		0.00057	0.0095	µg/L	1	10/25/08 03:27	56690
Endrin	0.0016	U	0.0016	0.0095	µg/L	1	10/25/08 03:27	56690
Endrin aldehyde	0.0067	U	0.0067	0.0095	µg/L	1	10/25/08 03:27	56690
Endrin ketone	0.0010	U	0.0010	0.0095	µg/L	1	10/25/08 03:27	56690
Heptachlor	0.0014	U	0.0014	0.0095	µg/L	1	10/25/08 03:27	56690
Heptachlor epoxide	0.00038	U	0.00038	0.0095	µg/L	1	10/25/08 03:27	56690
Methoxychlor	0.0066	U	0.0066	0.0095	µg/L	1	10/25/08 03:27	56690
Toxaphene	0.27	U	0.27	0.47	µg/L	1	10/25/08 03:27	56690
Surr: Decachlorobiphenyl	82.8		0	20-155	%REC	1	10/25/08 03:27	56690
Surr: Tetrachloro-m-xylene	87.8		0	20-155	%REC	1	10/25/08 03:27	56690

Data Qualifier Code Key: U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F08100949
Project: 38617-098/Frog Pond Hydrologic Evaluation

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_W

Sample ID:	MB-56690	SampType:	MBLK	TestCode:	8081_W	Units:	µg/L	Prep Date:	10/24/2008	RunNo:	73053
Client ID:	MB-56690	Batch ID:	56690	TestNo:	SW8081		SW3510B	Analysis Date:	10/24/2008	SeqNo:	2189853

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	0.00050	U	0.00050								
alpha-BHC	0.00030	U	0.00030								
beta-BHC	0.00050	U	0.00050								
delta-BHC	0.00040	U	0.00040								
gamma-BHC	0.00020	U	0.00020								
alpha-Chlordane	0.0013	U	0.0013								
gamma-Chlordane	0.0016	U	0.0016								
Chlordane	0.080	U	0.080								
4,4'-DDD	0.0019	U	0.0019								
4,4'-DDE	0.00090	U	0.00090								
4,4'-DDT	0.0036	U	0.0036								
Dieldrin	0.00050	U	0.00050								
Endosulfan I	0.00070	U	0.00070								
Endosulfan II	0.00070	U	0.00070								
Endosulfan sulfate	0.00060	U	0.00060								
Endrin	0.0017	U	0.0017								
Endrin aldehyde	0.0071	U	0.0071								
Endrin ketone	0.0011	U	0.0011								
Heptachlor	0.0015	U	0.0015								
Heptachlor epoxide	0.00040	U	0.00040								
Methoxychlor	0.0070	U	0.0070								
Toxaphene	0.28	U	0.28								
Surr: Decachlorobiphenyl	0.52		0	0.50	0	104	20	155			
Surr: Tetrachloro-m-xylene	0.46		0	0.50	0	91.0	20	155			

Data Qualifier Code Key: U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F08100949
Project: 38617-098/Frog Pond Hydrologic Evaluation

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_W

Sample ID: **LCS-56690** SampType: **LCS** TestCode: **8081_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **73053**
Client ID: **LCS-56690** Batch ID: **56690** TestNo: **SW8081** **SW3510B** Analysis Date: **10/24/2008** SeqNo: **2189854**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	0.20		0.00050	0.25	0	80.5	10	125			
gamma-BHC	0.20		0.00020	0.25	0	81.4	10	144			
4,4'-DDT	0.48		0.0036	0.50	0	96.8	10	183			
Dieldrin	0.43		0.00050	0.50	0	86.7	10	141			
Endrin	0.45		0.0017	0.50	0	89.2	10	182			
Heptachlor	0.21		0.0015	0.25	0	82.9	10	179			
Surr: Decachlorobiphenyl	0.45		0	0.50	0	89.8	20	155			
Surr: Tetrachloro-m-xylene	0.41		0	0.50	0	81.5	20	155			

Sample ID: **F08100949-001AMS** SampType: **MS** TestCode: **8081_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **73053**
Client ID: **MW-3 (Split) MS** Batch ID: **56690** TestNo: **SW8081** **SW3510B** Analysis Date: **10/25/2008** SeqNo: **2189877**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	0.21		0.00048	0.24	0	87.5	10	125			
gamma-BHC	0.21		0.00019	0.24	0	86.7	10	144			
4,4'-DDT	0.52		0.0035	0.48	0	107	10	183			
Dieldrin	0.43		0.00048	0.48	0	90.3	10	141			
Endrin	0.43		0.0016	0.48	0	90.5	10	182			
Heptachlor	0.24		0.0014	0.24	0	98.0	10	179			
Surr: Decachlorobiphenyl	0.40		0	0.48	0	84.0	20	155			
Surr: Tetrachloro-m-xylene	0.42		0	0.48	0	88.3	20	155			

Sample ID: **F08100949-001AMSD** SampType: **MSD** TestCode: **8081_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **73053**
Client ID: **MW-3 (Split) MSD** Batch ID: **56690** TestNo: **SW8081** **SW3510B** Analysis Date: **10/25/2008** SeqNo: **2189878**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	0.20		0.00047	0.24	0	85.3	10	125	0.21	3.93	40

Data Qualifier Code Key: U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F08100949
Project: 38617-098/Frog Pond Hydrologic Evaluation

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_W

Sample ID: **F08100949-001AMSD** SampType: **MSD** TestCode: **8081_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **73053**
Client ID: **MW-3 (Split) MSD** Batch ID: **56690** TestNo: **SW8081** **SW3510B** Analysis Date: **10/25/2008** SeqNo: **2189878**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
gamma-BHC	0.20		0.00019	0.24	0	84.3	10	144	0.21	4.15	40
4,4'-DDT	0.52		0.0034	0.47	0	110	10	183	0.52	1.30	40
Dieldrin	0.43		0.00047	0.47	0	90.6	10	141	0.43	1.01	40
Endrin	0.43		0.0016	0.47	0	90.8	10	182	0.43	1.01	40
Heptachlor	0.22		0.0014	0.24	0	94.8	10	179	0.24	4.68	40
Surr: Decachlorobiphenyl	0.41		0	0.47	0	86.4	20	155	0.40	0	0
Surr: Tetrachloro-m-xylene	0.40		0	0.47	0	84.3	20	155	0.42	0	0

Data Qualifier Code Key: U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F08100949
Project: 38617-098/Frog Pond Hydrologic Evaluation

ANALYTICAL QC SUMMARY REPORT

TestCode: ICP-6010_W

Sample ID: **MB-56707** SampType: **MBLK** TestCode: **ICP-6010_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **72919**
Client ID: **MB-56707** Batch ID: **56707** TestNo: **SW6010** **SW3005A** Analysis Date: **10/24/2008** SeqNo: **2186679**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Barium	5.0	U	5.0								
Chromium	2.5	U	2.5								
Copper	2.5	U	2.5								
Zinc	10	U	10								

Sample ID: **LCS-56707** SampType: **LCS** TestCode: **ICP-6010_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **72919**
Client ID: **LCS-56707** Batch ID: **56707** TestNo: **SW6010** **SW3005A** Analysis Date: **10/24/2008** SeqNo: **2186681**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Barium	270		5.0	250	0	108	80	120			
Chromium	280		2.5	250	0	113	80	120			
Copper	260		2.5	250	0	106	80	120			
Zinc	1300		10	1200	0	106	80	120			

Sample ID: **F08100949-001BMS** SampType: **MS** TestCode: **ICP-6010_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **72919**
Client ID: **MW-3 (Split) MS** Batch ID: **56707** TestNo: **SW6010** **SW3005A** Analysis Date: **10/25/2008** SeqNo: **2186697**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Barium	280		5.0	250	20	106	75	125			
Chromium	280		2.5	250	0	110	75	125			
Copper	270		2.5	250	0	107	75	125			
Zinc	1300		10	1200	0	105	75	125			

Data Qualifier Code Key: U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F08100949
Project: 38617-098/Frog Pond Hydrologic Evaluation

ANALYTICAL QC SUMMARY REPORT

TestCode: ICP-6010_W

Sample ID: **F08100949-001BMSD** SampType: **MSD** TestCode: **ICP-6010_W** Units: **µg/L** Prep Date: **10/24/2008** RunNo: **72919**
Client ID: **MW-3 (Split) MSD** Batch ID: **56707** TestNo: **SW6010** **SW3005A** Analysis Date: **10/25/2008** SeqNo: **2186699**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Barium	280		5.0	250	20	105	75	125	5.0 U	0.707	20
Chromium	270		2.5	250	0	109	75	125	280	0.730	20
Copper	270		2.5	250	0	106	75	125	270	0.749	20
Zinc	1300		10	1200	0	104	75	125	1300	0.766	20

Data Qualifier Code Key: U Not Detected Above the MDL

EDD Summary Report by Client Sample ID

Laboratory Reporting Batch : J0805120 **Laboratory :** E82502

Client Sample ID	Lab Sample ID	Analysis Method	Analysis Type	Preparation Method	Matrix	Collection Date	Preparation Date	Analysis Date
DUP-1	J0805120-009	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
EQUIPMENT BLANK	J0805120-010	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-1	J0805120-007	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-2	J0805120-006	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-3	J0805120-002	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	11/03/2008	11/04/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-3 (Split)	F08100949-001A	EPA 8081	RES (TOT)	Gen Prep	AQUEOUS-Groundwate	10/21/2008	10/24/2008	10/25/2008
	F08100949-001B	EPA 6010	RES (TOT)	Gen Prep	AQUEOUS-Groundwate	10/21/2008	10/24/2008	10/25/2008
MW-4	J0805120-004	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-5	J0805120-001	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-6	J0805120-003	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-7	J0805120-005	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-8	J0805120-008	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Error Report NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

838

EDD Error Summary

Error Type	Number of Errors	Error Type Description
0001	0	Required field missing a value
0002	0	Invalid value entered in a standard value field
0003	0	Non-numeric value entered in a numeric field
0004	0	Incorrectly formatted date/time value
0005	0	Invalid laboratory qualifier
0006	0	Inconsistent laboratory qualifier
0007	250	MDL greater than Reporting Limit or Reporting Limit exceeds Project Library Reporting Limit
0008	0	Illogical date/time values
0009	0	Duplicate records
0010	0	Missing target analytes in sample records
0011	0	Missing method blank records in a batch
0012	0	Missing laboratory control sample records in a preparation batch
0013	0	Missing MS and/or MSD records in a method batch
0014	0	Missing laboratory duplicate records in a method batch
0015	0	Missing surrogate records in a sample
0016	0	More than one field value reported among records where only one value should be reported
0017	0	Field length restriction exceeded
0018	0	Spiked analyted reported for LCS or MS not indicated as a spike in project library.

Total number or errors : 250

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
1	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
2	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
3	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
4	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
5	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
6	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
7	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
8	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
9	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
10	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
12	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
13	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
15	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
16	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
17	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
18	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
19	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
20	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
21	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
22	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
23	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
24	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
26	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
27	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
29	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
30	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
31	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
32	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
33	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
34	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
35	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
36	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
37	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
38	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
40	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
41	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
43	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
44	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
45	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
46	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
47	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
48	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
49	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
50	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
51	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
52	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
54	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
55	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
57	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
58	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
59	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
60	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

842

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
61	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
62	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
63	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
64	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
65	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
66	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
68	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
69	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
71	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
72	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
73	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
74	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
75	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi

Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502

Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
76	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
77	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
78	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
79	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
80	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
82	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
83	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
85	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
86	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
87	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
88	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
89	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
90	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
91	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
92	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
93	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
94	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
96	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
97	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
99	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
100	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
101	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
102	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
103	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
104	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
105	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
106	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
107	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
108	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
110	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
111	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
113	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
114	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
115	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
116	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
117	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
118	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
119	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
120	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
121	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
122	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
124	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
125	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
127	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
128	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
129	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
130	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
131	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
132	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
133	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
134	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
135	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
136	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
138	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
139	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
141	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
142	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
143	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
144	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
145	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
146	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
147	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
148	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
149	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
150	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
152	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
153	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
155	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
156	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
157	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
158	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
159	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
160	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
161	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
162	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
163	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
164	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
166	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
167	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
169	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
170	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
171	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
172	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
173	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
174	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
175	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
176	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
177	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
178	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
180	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
181	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
183	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
184	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
185	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
186	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
187	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
188	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
189	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
190	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
191	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
192	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
194	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
195	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
197	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
198	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.043 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
199	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
200	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
201	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.043 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
202	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
203	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
204	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
205	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.042 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
206	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
208	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.043 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
209	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.044 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	
211	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
212	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
213	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
214	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
215	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
216	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
217	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
218	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
219	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
220	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
222	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
223	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
225	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
226	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
227	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
228	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
229	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
230	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
231	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
232	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
233	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
234	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
236	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
237	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
239	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
240	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
241	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
242	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
243	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
244	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
245	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
246	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
247	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
248	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
250	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
251	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
317	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
318	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
319	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
320	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
321	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
322	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
323	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
324	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
325	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
326	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
328	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
329	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
331	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
332	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.53 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
333	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
334	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
335	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.54 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
336	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi
Library Description: URS - Frog Pond Hydrologic Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:33

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
337	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
338	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
339	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.53 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
340	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	
342	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
343	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
344	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
345	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
346	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
347	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
348	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
349	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
350	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: URS - Frog Pond Hydrologi | **Laboratory: E82502**

Library Description: URS - Frog Pond Hydrologic Evaluation | **Report Date: 12/18/2008 17:33**

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
351	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
353	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	
354	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	

Error Report NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

EDD Error Summary

Error Type	Number of Errors	Error Type Description
0001	0	Required field missing a value
0002	0	Invalid value entered in a standard value field
0003	0	Non-numeric value entered in a numeric field
0004	0	Incorrectly formatted date/time value
0005	0	Invalid laboratory qualifier
0006	0	Inconsistent laboratory qualifier
0007	250	MDL greater than Reporting Limit or Reporting Limit exceeds Project Library Reporting Limit
0008	0	Illogical date/time values
0009	0	Duplicate records
0010	0	Missing target analytes in sample records
0011	0	Missing method blank records in a batch
0012	0	Missing laboratory control sample records in a preparation batch
0013	0	Missing MS and/or MSD records in a method batch
0014	0	Missing laboratory duplicate records in a method batch
0015	0	Missing surrogate records in a sample
0016	0	More than one field value reported among records where only one value should be reported
0017	0	Field length restriction exceeded
0018	0	Spiked analyted reported for LCS or MS not indicated as a spike in project library.

Total number or errors : 250

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E | **Laboratory: E82502**

Library Description: Groundwater Evaluation | **Report Date: 12/18/2008 17:32**

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
1	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
2	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
3	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
4	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
5	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
6	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
7	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
8	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
9	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
10	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
12	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
13	ReportingLimit	0007	The Heptachlor epoxide Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
15	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
16	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
17	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
18	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
19	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
20	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
21	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
22	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
23	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
24	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
26	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
27	ReportingLimit	0007	The Endosulfan sulfate Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
29	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
30	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
31	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
32	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
33	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
34	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
35	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
36	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
37	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
38	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
40	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
41	ReportingLimit	0007	The Aldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
43	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
44	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
45	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
46	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
47	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
48	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
49	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
50	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
51	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
52	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
54	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
55	ReportingLimit	0007	The a-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
57	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
58	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
59	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
60	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
61	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
62	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
63	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
64	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
65	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
66	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
68	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
69	ReportingLimit	0007	The b-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
71	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
72	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
73	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
74	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
75	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
76	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
77	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
78	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
79	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
80	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
82	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
83	ReportingLimit	0007	The d-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
85	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
86	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
87	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
88	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
89	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
90	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
91	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
92	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
93	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
94	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
96	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
97	ReportingLimit	0007	The Endosulfan II Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
99	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
100	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
101	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
102	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
103	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
104	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
105	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
106	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
107	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
108	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
110	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
111	ReportingLimit	0007	The 4,4'-DDT Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
113	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
114	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
115	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
116	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
117	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
118	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
119	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
120	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
121	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
122	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
124	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
125	ReportingLimit	0007	The a-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
127	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
128	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
129	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
130	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
131	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
132	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
133	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
134	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
135	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
136	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
138	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
139	ReportingLimit	0007	The g-Chlordane Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
141	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
142	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
143	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
144	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
145	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
146	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
147	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
148	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
149	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
150	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E | **Laboratory: E82502**

Library Description: Groundwater Evaluation | **Report Date: 12/18/2008 17:32**

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
152	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
153	ReportingLimit	0007	The Endrin ketone Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
155	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
156	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
157	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
158	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
159	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
160	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
161	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
162	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
163	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
164	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
166	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
167	ReportingLimit	0007	The g-BHC Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
169	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
170	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
171	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
172	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
173	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
174	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
175	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
176	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
177	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
178	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
180	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
181	ReportingLimit	0007	The Dieldrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
183	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
184	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
185	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
186	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

875

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
187	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
188	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
189	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
190	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
191	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
192	ReportingLimit	0007	The Endrin Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
194	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
195	ReportingLimit	0007	The Endrin Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
197	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
198	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.043 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
199	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
200	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
201	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.043 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
202	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
203	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
204	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
205	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.042 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
206	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.041 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
208	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.043 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
209	ReportingLimit	0007	The Methoxychlor Reporting Limit value of 0.044 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.04 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E | **Laboratory: E82502**

Library Description: Groundwater Evaluation | **Report Date: 12/18/2008 17:32**

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
211	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
212	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
213	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
214	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
215	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
216	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
217	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
218	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
219	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
220	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
222	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
223	ReportingLimit	0007	The 4,4'-DDD Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
225	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
226	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
227	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
228	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
229	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
230	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
231	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
232	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
233	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
234	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
236	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
237	ReportingLimit	0007	The 4,4'-DDE Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
239	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
240	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
241	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
242	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
243	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
244	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
245	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
246	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
247	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
248	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
250	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
251	ReportingLimit	0007	The Endrin aldehyde Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
317	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
318	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
319	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
320	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
321	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
322	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
323	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
324	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
325	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
326	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
328	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
329	ReportingLimit	0007	The Heptachlor Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
331	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
332	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.53 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
333	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
334	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
335	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.54 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
336	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
337	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
338	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
339	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.53 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
340	ReportingLimit	0007	The Toxaphene Reporting Limit value of 0.52 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.5 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
342	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
343	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

883

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

Inconsistent field value errors

Record	Field	Type	Description	Lab Comments
344	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
345	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
346	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
347	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
348	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
349	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
350	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
351	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.021 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
353	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.
354	ReportingLimit	0007	The Endosulfan I Reporting Limit value of 0.022 ug/L reported in this record for Method EPA 8081 in Matrix AQUEOUS-Groundwater exceeds the project library reporting limit of 0.02 ug/L (corrected for dilution, if applicable).	MRL is elevated due to less than optimal sample volume provided by the client. Optimal volume for this analysis is 1000mL.

EDD Error Detail NELAC Protocol
Lab Reporting Batch ID: J0501452

Project Library: Frog Pond - Groundwater E
Library Description: Groundwater Evaluation

Laboratory: E82502
Report Date: 12/18/2008 17:32

885

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : DUP-1
Sample Date : 10/21/2008
Lab Sample ID: J0805120-009

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	17	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	1	ug/L	i	Yes	U								U	W2
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0083	ug/L	U	Yes										
4,4'-DDE	TOT	0.0088	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0083	ug/L	U	Yes										
a-Chlordane	TOT	0.0069	ug/L	U	Yes										
Aldrin	TOT	0.0071	ug/L	U	Yes										
b-BHC	TOT	0.0089	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0077	ug/L	U	Yes										
Endosulfan I	TOT	0.0093	ug/L	U	Yes										
Endosulfan II	TOT	0.0067	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0096	ug/L	U	Yes										
Endrin	TOT	0.0094	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0089	ug/L	U	Yes										
Endrin ketone	TOT	0.0056	ug/L	U	Yes										
g-BHC	TOT	0.0086	ug/L	U	Yes										
g-Chlordane	TOT	0.0079	ug/L	U	Yes										
Heptachlor	TOT	0.010	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0083	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.53	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation** **Library Used:** **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : EQUIPMENT BLANK
Sample Date : 10/21/2008
Lab Sample ID: J0805120-010

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	0.9	ug/L	i	Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	1.5	ug/L	i	Yes										
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Library Used: **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-1
Sample Date : 10/21/2008
Lab Sample ID: J0805120-007

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	15	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	0.3	ug/L	U	Yes										
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation** **Library Used:** **URS - Frog Pond Hydrologi**

888

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-2
Sample Date : 10/21/2008
Lab Sample ID: J0805120-006

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	17	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	3.7	ug/L		Yes	U								U	W2
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Library Used: **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-3
Sample Date : 10/21/2008
Lab Sample ID: J0805120-002

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	17	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	1.6	ug/L	I	Yes	U								U	
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0084	ug/L	U	Yes										
4,4'-DDE	TOT	0.0089	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0084	ug/L	U	Yes										
a-Chlordane	TOT	0.0070	ug/L	U	Yes										
Aldrin	TOT	0.0072	ug/L	U	Yes										
b-BHC	TOT	0.0090	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0077	ug/L	U	Yes										
Endosulfan I	TOT	0.0094	ug/L	U	Yes										
Endosulfan II	TOT	0.0068	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.014	ug/L	I	Yes										
Endrin	TOT	0.0095	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0090	ug/L	U	Yes										
Endrin ketone	TOT	0.0056	ug/L	U	Yes										
g-BHC	TOT	0.0087	ug/L	U	Yes										
g-Chlordane	TOT	0.0079	ug/L	U	Yes										
Heptachlor	TOT	0.011	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0084	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.53	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation** **Library Used:** **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-3 (Split)
Sample Date : 10/21/2008
Lab Sample ID: F08100949-001A

Lab Report Batch : F08100949
Analysis Type: *RES (TOT)*

Lab ID : E83079
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analysis Method : *EPA 8081* **Dilution:** *1*

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
4,4'-DDD	TOT	0.0018	ug/L	U	YES										
4,4'-DDE	TOT	0.00085	ug/L	U	YES										
4,4'-DDT	TOT	0.0034	ug/L	U	YES										
a-BHC	TOT	0.00028	ug/L	U	YES										
a-Chlordane	TOT	0.0012	ug/L	U	YES										
Aldrin	TOT	0.00047	ug/L	U	YES										
b-BHC	TOT	0.00047	ug/L	U	YES										
Chlordane	TOT	0.076	ug/L	U	YES										
d-BHC	TOT	0.00038	ug/L	U	YES										
Dieldrin	TOT	0.00047	ug/L	U	YES										
Endosulfan I	TOT	0.00066	ug/L	U	YES										
Endosulfan II	TOT	0.00066	ug/L	U	YES										
Endosulfan sulfate	TOT	0.016	ug/L		YES										
Endrin	TOT	0.0016	ug/L	U	YES										
Endrin aldehyde	TOT	0.0067	ug/L	U	YES										
Endrin ketone	TOT	0.001	ug/L	U	YES										
g-BHC	TOT	0.00019	ug/L	U	YES										
g-Chlordane	TOT	0.0015	ug/L	U	YES										
Heptachlor	TOT	0.0014	ug/L	U	YES										
Heptachlor epoxide	TOT	0.00038	ug/L	U	YES										
Methoxychlor	TOT	0.0066	ug/L	U	YES										
Toxaphene	TOT	0.27	ug/L	U	YES										

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-3 (Split)
Sample Date : 10/21/2008
Lab Sample ID: F08100949-001B

Lab Report Batch : F08100949
Analysis Type: *RES (TOT)*

Lab ID : E83079
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analysis Method : *EPA 6010* **Dilution:** *1*

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Barium	TOT	20	ug/L		YES										
Chromium	TOT	2.5	ug/L	U	YES										
Copper	TOT	2.5	ug/L	U	YES										
Zinc	TOT	10	ug/L	U	YES										

892

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-4
Sample Date : 10/21/2008
Lab Sample ID: J0805120-004

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	20	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	0.7	ug/L	i	Yes	U								U	W2
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Library Used: **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-5
Sample Date : 10/21/2008
Lab Sample ID: J0805120-001

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	26	ug/L		Yes										
Chromium	TOT	4.7	ug/L		Yes										
Copper	TOT	33	ug/L		Yes										
Zinc	TOT	22	ug/L		Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation** **Library Used:** **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-6
Sample Date : 10/21/2008
Lab Sample ID: J0805120-003

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	31	ug/L		Yes										
Chromium	TOT	4.9	ug/L		Yes										
Copper	TOT	19	ug/L		Yes										
Zinc	TOT	9	ug/L	i	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Library Used: **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-7
Sample Date : 10/21/2008
Lab Sample ID: J0805120-005

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	18	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	3.2	ug/L		Yes	U								U	W2
Zinc	TOT	4	ug/L	U	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0085	ug/L	U	Yes										
4,4'-DDE	TOT	0.0090	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0085	ug/L	U	Yes										
a-Chlordane	TOT	0.0071	ug/L	U	Yes										
Aldrin	TOT	0.0073	ug/L	U	Yes										
b-BHC	TOT	0.0091	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0078	ug/L	U	Yes										
Endosulfan I	TOT	0.0095	ug/L	U	Yes										
Endosulfan II	TOT	0.0069	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0098	ug/L	U	Yes										
Endrin	TOT	0.0096	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0091	ug/L	U	Yes										
Endrin ketone	TOT	0.0057	ug/L	U	Yes										
g-BHC	TOT	0.0088	ug/L	U	Yes										
g-Chlordane	TOT	0.0080	ug/L	U	Yes										
Heptachlor	TOT	0.011	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0085	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.54	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation** **Library Used:** **URS - Frog Pond Hydrologi**

Sample Qualification Report with Reason Codes (All Results sorted by Client Sample ID)

Client Sample ID : MW-8
Sample Date : 10/21/2008
Lab Sample ID: J0805120-008

Lab Report Batch : J0805120
Analysis Type: *RES/TOT (TOT)*

Lab ID : E82502
Sample Matrix : AQUEOUS-Grou

Reviewed By / Date : SB 12/19/2008

Approved By / Date : SB 12/19/2008

Analyte Name	Total or Dissolved	Result	Result Units	Lab Qualifiers	Reportable Result	Overall Val Qual	HT	MB	LCS	MS	Lab Dup	Surr	Det Limit	Field QC	Reason Codes
Analysis Method : *EPA 6020*			**Dilution: *1***												
Barium	TOT	11	ug/L		Yes										
Chromium	TOT	0.8	ug/L	U	Yes										
Copper	TOT	0.5	ug/L	i	Yes	U								U	W2
Zinc	TOT	4	ug/L	i	Yes										
Analysis Method : *EPA 8081*			**Dilution: *1***												
4,4'-DDD	TOT	0.0081	ug/L	U	Yes										
4,4'-DDE	TOT	0.0086	ug/L	U	Yes										
4,4'-DDT	TOT	0.014	ug/L	U	Yes										
a-BHC	TOT	0.0081	ug/L	U	Yes										
a-Chlordane	TOT	0.0068	ug/L	U	Yes										
Aldrin	TOT	0.0070	ug/L	U	Yes										
b-BHC	TOT	0.0087	ug/L	U	Yes										
d-BHC	TOT	0.012	ug/L	U	Yes										
Dieldrin	TOT	0.0075	ug/L	U	Yes										
Endosulfan I	TOT	0.0091	ug/L	U	Yes										
Endosulfan II	TOT	0.0066	ug/L	U	Yes										
Endosulfan sulfate	TOT	0.0094	ug/L	U	Yes										
Endrin	TOT	0.0092	ug/L	U	Yes										
Endrin aldehyde	TOT	0.0087	ug/L	U	Yes										
Endrin ketone	TOT	0.0055	ug/L	U	Yes										
g-BHC	TOT	0.0084	ug/L	U	Yes										
g-Chlordane	TOT	0.0077	ug/L	U	Yes										
Heptachlor	TOT	0.0098	ug/L	U	Yes										
Heptachlor epoxide	TOT	0.0081	ug/L	U	Yes										
Methoxychlor	TOT	0.012	ug/L	U	Yes										
Toxaphene	TOT	0.52	ug/L	U	Yes										

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Library Used: **URS - Frog Pond Hydrologi**

EDD Summary Report by Client Sample ID

Laboratory Reporting Batch : J0805120 **Laboratory :** E82502

Client Sample ID	Lab Sample ID	Analysis Method	Analysis Type	Preparation Method	Matrix	Collection Date	Preparation Date	Analysis Date
DUP-1	J0805120-009	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
EQUIPMENT BLANK	J0805120-010	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-1	J0805120-007	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-2	J0805120-006	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-3	J0805120-002	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	11/03/2008	11/04/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-3 (Split)	F08100949-001A	EPA 8081	RES (TOT)	Gen Prep	AQUEOUS-Groundwate	10/21/2008	10/24/2008	10/25/2008
	F08100949-001B	EPA 6010	RES (TOT)	Gen Prep	AQUEOUS-Groundwate	10/21/2008	10/24/2008	10/25/2008
MW-4	J0805120-004	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-5	J0805120-001	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-6	J0805120-003	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-7	J0805120-005	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008
MW-8	J0805120-008	EPA 6020	RES/TOT (TOT)	3020A	AQUEOUS-Groundwate	10/21/2008	10/29/2008	10/31/2008
		EPA 8081	RES/TOT (TOT)	3510	AQUEOUS-Groundwate	10/21/2008	10/23/2008	10/23/2008

Project Number and Name: **38617-098 - Frog Pond - Hydrologic Evaluation**

Equipment Blank Outlier Report

ary: URS - Frog Pond Hydrologi

Laboratory ID:	E82502	Lab Reporting Batch:	J0805120
Preparation Method:	3020A	Preparation Date:	10/29/2008 11:00
Analytical Method:	EPA 6020	Analysis Date:	10/31/2008 14:37
Blank Sample ID:	EQUIPMENT BLANK	Preparation Batch:	76867

Equipment Blank Result:

	Total Or Dissolved	Result	MDL	Reporting Limit	Units	Lab Qual
Barium						
	TOT	0.9	0.5	2	ug/L	i

No samples were qualified for this Barium contamination.

Copper						
	TOT	1.5	0.3	2	ug/L	i

The following samples were qualified as non-detect due to the Copper contamination.

Client Sample ID	Lab Sample ID	Total Or Dissolved	Dilution	Result	Lab Qual	Result Units
DUP-1	J0805120-009	TOT	1	1	i	ug/L
MW-2	J0805120-006	TOT	1	3.7		ug/L
MW-3	J0805120-002	TOT	1	1.6	i	ug/L
MW-4	J0805120-004	TOT	1	0.7	i	ug/L
MW-7	J0805120-005	TOT	1	3.2		ug/L
MW-8	J0805120-008	TOT	1	0.5	i	ug/L

Field Duplicate Outlier Report* (non-qualifying outliers)

Lab Report Batch: J0805120 **Lab ID:** E82502

Field Sample: MW-3
Field Sample Duplicate: DUP-1
Matrix ID: AQUEOUS-Groundw

		Total Or Dissolved	Result	Reporting Limit	MDL	Units	Lab Qualifier	RPD	RPD Criteria
Analysis Method EPA 6020									
Copper	Sample result:	TOT	1.6	2	0.3		i		
	Duplicate result:	TOT	1	2	0.3	ug/L	i	**46**	20
Analysis Method EPA 8081									
Endosulfan sulfate	Sample result:	TOT	0.014	0.022	0.0097		I		
	Duplicate result:	TOT	0.016	0.0095	0.00057	ug/L		**13**	20
Endosulfan sulfate	Sample result:	TOT	0.014	0.022	0.0097		I		
	Duplicate result:	TOT	0.0096	0.021	0.0096	ug/L	U	**200**	20

*Outlier report also includes analytes detected in the parent sample but not in the duplicate sample or vice versa. In this case, RPD value for the field duplicate defaults to 200. RPD values that exceed project requirements do not qualify samples.

Project Number and Name: **Frog Pond - Hydrologic Evaluation - Frog Pond - Hydrologic Evaluation**

URS

Additional Soil Investigations
Frog Pond
State Road 27
Florida City, Miami-Dade County, Florida

Prepared for:
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

URS Corporation
7800 Congress Avenue
Boca Raton, FL 33487

URS Job # 38617-355

March 30, 2009

URS

March 30, 2009

Mr. Robert J. Taylor
Lead Environmental Engineer
Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

RE: Additional Soil Investigations
Frog Pond
State Road 27
Florida City, Miami-Dade County, Florida
Job # 38617-355

Dear Mr. Taylor:

Herewith transmitted is URS Corporation's (URS') report of the Additional Soil Investigations of the Frog Pond, approximately 1,380 acres of land, located west of Florida City in Miami-Dade County, Florida. The Additional Soil Investigations focused specifically on 350-acres of land located in the southwest portion of the Frog Pond. This report has been prepared in accordance with URS' proposal to the South Florida Water Management District (District) and Work Order No. 47. A copy of this report has been submitted to the U.S. Fish and Wildlife Service and the Florida Department of Environmental Protection – Southeast District.

URS appreciates the opportunity to support the District on this important project. If you have any questions with the information contained in this report, please contact URS at your convenience.

Respectfully Submitted,

URS Corporation

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Projects Director

7800 Congress Avenue
Suite 200
Boca Raton, FL 33487
561 994 6500 Tel
561 994 6524 Fax

URS

March 30, 2009

Robert Frakes, Ph.D.
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, FL 32960

RE: Additional Soil Investigations
Frog Pond
State Road 27
Florida City, Miami-Dade County, Florida
Job # 38617-355

Dear Dr. Frakes:

URS Corporation (URS) is pleased to present this report of the Additional Soil Investigations of the Frog Pond, approximately 1,380 acres of land, located west of Florida City in Miami-Dade County, Florida. The Additional Soil Investigations focused specifically on 350-acres of land located in the southwest portion of the Frog Pond. Included with this report is the evaluation of additional data collected using the Newfields January 2009 Ecological Risk Assessment for the Frog Pond.

If you have any questions with the information contained in this report, please contact URS at your convenience.

Respectfully Submitted,

URS Corporation

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Projects Director

c: Robert Taylor, District
Joseph Lurix, FDEP Southeast District

7800 Congress Avenue
Suite 200
Boca Raton, FL 33487
561 994 6500 Tel
561 994 6524 Fax

URS

March 30, 2009

Joseph Lurix
Florida Department of Environmental Protection, Southeast District
400 North Congress Avenue
West Palm Beach, Florida 33401

RE: Additional Soil Investigations
Frog Pond
State Road 27
Florida City, Miami-Dade County, Florida
Job # 38617-355

Dear Mr. Lurix:

URS Corporation (URS) is pleased to present this report of the Additional Soil Investigations of the Frog Pond, approximately 1,380 acres of land, located west of Florida City in Miami-Dade County, Florida. The Additional Soil Investigations focused specifically on 350-acres of land located in the southwest portion of the Frog Pond. Included with this report is the evaluation of additional data collected using the Newfields January 2009 Ecological Risk Assessment for the Frog Pond.

If you have any questions with the information contained in this report, please contact URS at your convenience.

Respectfully Submitted,

URS Corporation

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Projects Director

c: Robert Taylor, District
Robert Frakes, Ph.D., U.S. Fish and Wildlife Service, Vero Beach, FL

7800 Congress Avenue
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TABLE OF CONTENTS

1.0 INTRODUCTION / BACKGROUND 1
2.0 OBJECTIVE 3
3.0 METHODOLOGY 3
3.1 Soil Sampling Locations 3
3.2 Soil Boring Installation and Sampling 3
3.3 Soil Analysis 4
3.4 Applicable Regulatory Standards 4
4.0 ADDITIONAL SOIL INVESTIGATION RESULTS 5
4.1 Agrochemicals 5
4.2 Metals 6
4.3 Total Organic Carbon 6
5. 0 EVALUATION OF ADDITIONAL DATA COLLECTED 6
6. 0 CONCLUSIONS AND RECOMMENDATIONS 8
7. 0 REREFENCES 10

LIST OF FIGURES

Figure 1 General Site Vicinity Map
Figure 2 Site Map and Grid Locations

Figure 3 Organochlorine Pesticides Analytical Results Concentration Map
Figure 4 Previous Organochlorine Pesticides Analytical Results Concentration Map

Figure 5 Chlorinated Herbicides, Organophosphorous Pesticides and Triazine Herbicides, and Paraquat Analytical Results Concentration Map
Figure 6 Previous Chlorinated Herbicides, Organophosphorous Pesticides and Triazine Herbicides, and Paraquat Analytical Results Concentration Map

Figure 7 Organochlorine Pesticides TEC/PEC Exceedance Map
Figure 8 4,4-DDE Soil Analytical Results Map
Figure 9 4,4-DDT Soil Analytical Results Map
Figure 10 Total Chlordane Soil Analytical Results Map
Figure 11 Endosulfan (alpha + beta + sulfate) Soil Analytical Results Map

Figure 12 8 RCRA Metals, Copper, and Zinc Analytical Results Concentration Map
Figure 13 Previous 8 RCRA Metals, Copper and Zinc Analytical Results Concentration Map

Figure 14 8 RCRA Metals, Copper, and Zinc TEC/PEC Exceedance Map
Figure 15 Barium Soil Analytical Results Map
Figure 16 Cadmium Soil Analytical Results Map
Figure 17 Chromium Soil Analytical Results Map
Figure 18 Lead Soil Analytical Results Map
Figure 19 Copper Soil Analytical Results Map
Figure 20 Zinc Soil Analytical Results Map

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LIST OF TABLES

Table 1	Summary of Pesticide, Herbicide, Paraquat, and Metal Soil Analytical Results
Table 2	Summary of Previous Pesticide, Herbicide, Paraquat, and Metal Soil Analytical Results
Table 3	Summary of Total Organic Carbon Soil Analytical Results

APPENDICES

Appendix A	Correspondence
Appendix B	Soil Boring GPS Coordinates
Appendix C	Soil Analytical Laboratory Reports and Chain of Custody Records
Appendix D	Site Specific (Equilibrium partitioning) Based Sediment Quality Guideline Calculations
Appendix E	Evaluation of Additional Data collected by URS in January 2009 for Ecological Risk Assessment of Frog Pond Site Soils

ADDITIONAL SOIL INVESTIGATIONS
FROG POND

1.0 INTRODUCTION / BACKGROUND

URS Corporation (URS) is please to present the results of Additional Soil Investigations conducted at the Frog Pond, located west of Florida City in Miami-Dade County, Florida. The Additional Soil Investigations focused specifically on 350-acres of land located in the southwest portion of the Frog Pond. The Frog Pond is located in Sections 30 and 31, Township 57 South, Range 37 East, and Sections 6 and 7, Township 58 South, Range 37 East. It is URS' understanding that the South Florida Water Management District (District) is proposing to construct a 570- acre water detention area as a northern component of the C-111 Spreader Canal project.

In 2006, URS conducted a Limited Phase II Environmental Site Assessment (ESA) on 1,380-acres at the Frog Pond. The majority of the acreage was use for cultivation. Vegetable crops being cultivated included okra and beans. To evaluate 1,380-acres within the initial footprint of the water detention area, which was previously referred to as a "leaky reservoir", URS collected 29 composite soil samples using the United States Fish and Wildlife Service (Service) and District sampling protocol for agricultural areas.

The Phase II ESA soil sample analytical results identified 10 chemicals of potential environmental concern (COPEC) present within the 1,380 acres, of which three posed a risk to the Service's trustee species.

<u>Copper</u> — Concentrations of copper, above the Service's interim value of 85 milligrams per kilograms (mg/kg) were exceeded in composite soil samples collected in 24 grids. These concentrations ranged from 93 mg/kg to 320 mg/kg.

<u>4,4-DDE</u> — Concentrations of 4,4-DDE exceeded the Sediment Quality Assessment Guideline (SQAG) Probable Effects Concentration (PEC) of 31 micrograms per kilogram (µg/kg) in composite soil samples collected in two grids. The concentrations were exhibited at 54 µg/kg and 59 µg/kg.

<u>Zinc</u> — Concentrations of zinc exceeded the SQAG Threshold Effects Concentration (TEC) of 120 mg/kg in composite soil samples collected in 17 grids. These concentrations ranged from 120 mg/kg to 250 mg/kg.

Other organochlorine pesticides (EPA Method 8081) were detected as well as several of the 8 RCRA metals. No chlorinated herbicides (EPA Method 8151) or organophosphorous pesticides (EPA Method 8141) were detected above laboratory detection limits. Low levels of paraquat were detected below the site specific SQAG. Selenium was not exhibited above the laboratory detection limits.

Due to the large volume of impacted soil, the most feasible method to reduce the potential ecological risk associated with the presence of 4,4-DDE, copper, and zinc in soils is to re-locate the soils outside the footprint of the project area; that is, to scrape the soils down to the limestone bedrock and transport the soils outside the area which is to be flooded in the future. In order to evaluate the effectiveness of scraping the soils, URS proposed a pilot test on a 5-acre plot. The Service reviewed the results of the

Phase II ESA and approved the proposed Pilot Study. A copy of the Service's review letter is included in **Appendix A**.

In 2007, URS had planned to conduct the Pilot Test within Grid 5, which exhibited the highest 4,4-DDE concentration of 59 µg/kg, as well as relatively high copper concentration of 220 mg/kg. Following a review of the District files, however, URS determined that as of 2007, all of the acreage within the proposed water detention area was currently being leased, and therefore the proposed Pilot Study within Grid 5 was not feasible. Based on the lease information, URS identified an alternative area outside the leased properties to conduct the Pilot Study. This area is located immediately to the west and adjacent to Grids 21 and 26 of the "leaky reservoir" (detention area). A new 50-acre Grid was established immediately west of Grids 21 and 26 and identified as Grid 30. In order to determine a presence of copper and zinc within Grid 30, URS, collected 27 discrete soil samples from 20 soil boring locations from 0 to 6-inches below land surface (bls) and from six inches to auger refusal, which typically occurred at 8 inches bls.

The results confirmed the elevated concentrations of copper and zinc within Grid 30. However, no DDT analytes were detected and only low levels of other organochlorine pesticides were exhibited in the soil samples. Copper and zinc in samples collected at depth from 0 to 6-inches bls ranged form 145 mg/kg to 271 mg/kg, and from 68 mg/kg to 201 mg/kg, respectively. Both copper and zinc concentrations, in general, decreased in the samples collected below the six inch interval. Based on the soil data, the selected 50-acre Grid 30 was deemed acceptable to conduct the Pilot Test. A 5-acre Pilot Study Test Area was determined based on the highest concentrations of copper exhibited in the discrete soil sample locations collected during the evaluation of Grid 30.

Following the soil scraping and relocating activities within the 5-acre Pilot Study Area, discrete soil samples were collected from the residual soils remaining on top of the limestone bedrock and in the solution cavities/depressions within the limestone bedrock, in order to evaluate the effectiveness of the corrective actions. Based on the Pilot Study, WRS Infrastructure and Environmental, Inc. and Compass Environmental (WRScompass) and NewFields conducted laboratory simulations which involved the leaching of pesticides and metals into the sediment and surface water, and toxicity and bioassay tests, and vertical and spatial evaluation of copper impacts were conducted by URS within the Pilot Test Area. Using the laboratory simulations, bioassay and toxicity test results as well as the vertical and spatial soil data an Ecological Risk Assessment (ERA) was formulated for the 1,380-acres at the Frog Pond. This document was submitted by NewFields to the Service and the FDEP on January 29, 2009. As of this date the ERA is currently being review by the aforementioned regulatory agencies.

The ERA indicated that soil scraping would effectively reduce the mass and concentration of copper in the agricultural soils, and would be adequate to effectively reduce risk to the Everglades snail kite, benthic macroinvertebrates and other aquatic-feeding birds that may inhabit any habitat created by the construction of a water detention area at the site.

Following the Phase II ESA and Pilot Study the footprint of the water detention area has been modified. Recent design changes have shifted the water detention area to the west, resulting in an area of 350-acres, which has not been evaluated with respect to residual agrochemicals and soil addendums. A general site vicinity map is included as **Figure 1**. A site map illustrating the current project boundary is included as **Figure 2**.

2.0 OBJECTIVE

The objective of the Additional Soil Investigation is to evaluate the potential presence of soil impacts within the western 350-acre footprint of the proposed water detention area at the Frog Pond associated with present and past site operations. The scope of the Additional Soil Investigation has been evaluated based on the future use of the property.

3.0 METHODOLOGY

The following sections detail the general field and laboratory methodology used for soil sampling and analysis, during the Additional Soil Investigations at the Frog Pond. Prior to implementing the sampling, a proposal, dated December 17, 2008, was submitted to the District and Service for review.

3.1 Soil Sampling Locations

Because farming practices on the 350-acres are similar to the surrounding 1,380-acres previously samples and in order to determine contaminant distribution and concentration of the agricultural area, URS sampled the additional 350-acres following the District and Service's sampling protocol as given in the document entitled *Protocol for Assessment, Remediation and Post-Remediation Monitoring for Environmental Contaminants on Everglades Restoration Projects*. Seven, 50-acre grids were established for the additional 350-acres. Each 50-acre grid was then subdivided into ten, 5-acre plots or sub-grids. Within each of the 5-acre sub-grids, a five aliquot subset, close proximity discrete soil sample was collected at 10 locations in each of the 7, 50-acre grids. The subset samples were collected from 0 to 6-inches bls. The 10 subset samples were thoroughly mixed together to form one composite soil sample for each grid. Samples from the grids were labeled G-30 through G-35. A site map illustrating the grid locations is provided as **Figure 2**.

The field sampling procedure consisted of mobilizing to each grid and confirming the location of the 50-acre grid using a portable Global Positioning Satellite (GPS) receiver and then mobilizing to each sub sample location. At each subset sample location, a soil boring was advanced from 0 to 6-inches bls, using a stainless steel hand auger a soil sample was collected and then placed in a Teflon bag. Each subset location was recorded utilizing the GPS receiver and marked with an orange survey flag. Sample locations were logged utilizing units of Latitude (north) and Longitude (west) in North American Datum (NAD) 83 in order to enable future confirmation of the assessed site conditions. A copy of the soil boring GPS coordinates are provided in **Appendix B**.

3.2 Soil Boring Installation and Sampling

At each grid, one dedicated, pre-cleaned stainless steel hand auger, stainless steel spoon, and 10 quart stainless steel bowl were used to collect the five aliquot subset close proximity composite discrete soil samples at each of the 10 subset sample locations in each of the 7, 50-acre grids. Decontamination of the stainless steel equipment between sub-sample locations was not conducted since sub-samples would be later mixed together to form a single composite. Immediately following the collection of the grids 10 sub-samples, the Teflon bag containing the soil sample was sealed with duct tape, labeled with the grid identification number, sample date and time, and placed on ice for transportation to a centralized area. Between grids, sampling equipment was decontaminated in the centralized mixing area using standard procedures to prevent cross-contamination between grids.

To ensure that no cross contamination of the samples occur, a two-person sample team was utilized. A clean area was centrally located away from the sampling areas, and consisted of sample coolers, decontamination area, and a sample mixing and preparation area. The ground in the area was covered with visqueen to minimize the potential of cross contamination. The decontamination area and used sample equipment was located away from the mixing and preparation area. Decontamination consisted of prewashing the equipment with tap water, washing equipment with an alconox solution, rinsing with deionized water, sprayed with alcohol, and a final rinsing with deionized water.

At the centralized mixing and preparation area, the samples were mixed within the Teflon bag and then transferred into a stainless steel bowl and further mixed with a stainless steel spoon. Composite samples were then collected from the thoroughly mixed soil and placed in laboratory supplied bottleware. Labels were affixed to each bottle depicting the project name, grid number, date and time sampled, and the required laboratory analysis. Each sample was then preserved on ice in a cooler and submitted to Columbia Analytical Services, Inc. (CAS) following chain of custody procedures for analysis of the Constituents of Potential Concern (COPC). Additional samples were submitted to Pace Analytical Services, Inc. (PAS) for quality assurance/quality control.

3.3 Soil Analysis

The soil samples were submitted under chain-of-custody procedures to CAS, a State and District approved laboratory for analysis of organochlorine pesticides by EPA Method 8081, organophosphorous pesticides including atrazine and simazine by EPA Method 8141, chlorinated herbicides by EPA Method 8151, paraquat by EPA Method 549.2-Mod., the 8 Resource Conservation and Recovery Act (RCRA) Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and for copper and zinc. One split sample was submitted to PAS for quality assurance/quality control and analyzed for the same constituents listed above. In addition, PAS analyzed all the grid samples for total organic carbon (TOC) by EPA Method 9060. A copy of the soil analytical results and chain of custody records is included in **Appendix C**.

3.4 Applicable Regulatory Standards

Considering that the former and current agricultural areas will be converted into a water detention area and the area inundated with water, the principal component of this investigation is to identify constituents that potentially or adversely affect the ecological environment. Since the soils may eventually become sediment post-inundation and may routinely flood, the soil contaminant concentrations were compared to consensus-based Threshold Effect Concentrations (TEC) and Probable Effect Concentrations (PEC) as described in Table 5.1 of *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater-Ecosystems*, published by MacDonald Environmental Sciences, Ltd. for the Florida Department of Environmental Protection (FDEP) in 2003. For copper, URS used the Service's interim PEC value of 85 mg/kg.

Sediment quality assessment guidelines have not been developed for several chemicals detected in the soil samples collected during this project, specifically aldrin, alpha-hexachlorocyclohexane (alpha-BHC), beta-BHC, delta-BHC, endosulfan (alpha, beta and sulfate), paraquat, and pentachlorophenol. An SQAG has been developed for gamma-BHC, which is more toxic that other isomers of BHC. Therefore the concentrations of alpha-, beta-, and delta-BHCs were compared to the gamma-BHC SQAG. Site specific

SQAGs were calculated using equilibrium portioning methodology for aldrin, endosulfan (alpha, beta, and sulfate), paraquat, and pentachlorophenol. See **Appendix D** for information concerning the site specific SQAGs.

In addition to the established SQAGs, soil contaminant concentrations were also compared to the SCTL Residential Direct Exposure values as provided in the Chapter 62-777, Florida Administrative Code (FAC).

4.0 ADDITIONAL SOIL INVESTIGATION RESULTS

On January 13, 2009, soil samples were collected from seven grids during the Additional Soil Investigation in order to evaluate the potential presence of soil impacts within the western 350-acre footprint of the water detention area at the Frog Pond. The results and evaluation of the soil samples collected during the course of the Additional Soil Investigation are included in the following sections.

4.1 Agrochemicals

The composite soil samples collected from grid G-36 exhibited the organochlorine pesticide 4,4-DDE at 0.062 µg/kg. This concentration is below the SQAG TEC level of 3.2 µg/kg. 4,4-DDE was not detected in the remaining grids G-30 through G-35, above laboratory detection limits.

Endosulfan (alpha and/or sulfate) concentrations were exhibited in four of the seven grids, G-31, G-33, G-34, and G-36, below the site specific SQAG level of 9.14 µg/kg. These concentrations ranged from 0.26 µg/kg to 4.4 µg/kg. Endosulfan was not detected in the remaining grids G-30, G-32, and G-35 above laboratory detection limits. Other organochlorine pesticide parameters analyzed were below laboratory detection limits (BDL). Laboratory analytical results for Paraquat, Chlorinated Herbicides, Organophosphorous Pesticides including atrazine and simazine were BDL.

Figure 3 illustrates the Organochlorine Pesticides (EPA Method 8081) soil analytical results. Review of the soil data collected from the additional 350-acres show that the organochlorine pesticides detected and concentrations are, in general, consistent with the soil data collected in 2006 from the surrounding 1,380-acres. **Figure 4** illustrates the 2006 Organochlorine Pesticides soil analytical results.

Review of the soil data collected from the additional 350-acres that were sampled also show that the herbicides, including atrazine and simonize, organophosphorous pesticides and paraquat detected and the concentrations are, in general, consistent with the soil data collected in 2006 from the surrounding 1,380-acres. **Figure 5** illustrates the herbicide, organophosphorous pesticides and paraquat analytical results for the soils collected from the 350-acres and **Figure 6** illustrates the 2006 herbicide, organophosphorous pesticides and paraquat analytical results.

Figure 7 is a map that illustrates the soil samples which had organochlorine pesticides parameters that exceeded the TEC/PEC SQAGs collected for the Additional Soil Investigation and the soil samples that were collected during the Phase II ESA in 2006. Figures **8, 9, 10 and 11** illustrate the individual 4,4-DDE, 4,4-DDT, total chlordane, and endosulfan soil analytical results for the Additional Soil Investigation and for the Phase II ESA in 2006. A summary of the pesticide, herbicide, and paraquat analytical results for the Additional Soil Investigation are included in **Table 1**. A summary of the previous pesticide, herbicide, and paraquat 2006 analytical results are included in **Table 2**.

4.2 Metals

Elevated levels of copper, above the Service's Interim value of 85 mg/kg, were detected in composite soil samples collected in four G-30, G-34, G-35, and G-36. The copper concentrations ranged from 136 mg/kg to 224 mg/kg. The highest copper concentration was exhibited in grid G-35. Concentrations of copper above the SQAG TEC of 32 mg/kg were detected in the remaining three grids G-31, G-32, and G-33 composite samples.

Barium was detected in the composite soil sample collected from grid G-32 at 25 mg/kg, above the SQAG TEC of 20 mg/kg. Concentrations of chromium exceeding the SQAG TEC level of 43 mg/kg was detected in four grids G-33, G-34, G-35, and G-36 ranging from 47 mg/kg to 58 mg/kg. Concentrations of zinc exceeding the SQAG TEC level of 120 mg/kg was detected in two grids G-35 and G-36 at 124 mg/kg and 138 mg/kg, respectively. Arsenic exceeded the SQAG TEC of 9.8 mg/kg in grid G-36 at 12 mg/kg and exceeded the SCTL Residential Direct Exposure of 2.1 mg/kg in grids G-30 through G-36 ranging from 6.0 mg/kg to 12 mg/kg.

Concentrations of cadmium, lead, mercury, selenium, and silver were either below their respective SQAG TEC, SCTL, or BDL.

Figure 12 illustrates the analytical results concentration of the 8 RCRA Metals, Copper, and Zinc, for the Additional Soil Investigation, and **Figure 13** illustrates the previous 8 RCRA Metals, Copper, and Zinc analytical results collected during the Phase II ESA in 2006.

Figure 14 illustrates the Additional Soil Investigation 8 RCRA Metals, copper, and zinc TEC/PEC exceedances and includes concentrations exhibited in the Phase II ESA in 2006. **Figures 15** through **20** illustrates the barium, cadmium, chromium, lead, copper, and zinc analytical results, respectively, for the Additional Soil Investigation and includes concentrations exhibited in the Phase II ESA in 2006.

4.3 Total Organic Carbon

The composite soil samples were analyzed for Total Organic Carbon (TOC). This data was used in the ERA for food chain modeling to predict risks to the Service's trust resources. The TOC concentrations ranged from 62,000 mg/kg to 120,000 mg/kg. A summary of the TOC analytical results are included in **Table 3**.

5. 0 EVALUATION OF ADDITIONAL DATA COLLECTED

The additional soil data collected from the 350-acres were evaluated by NewFields using the ERA. The ERA calculated by Newfields concluded that the data collected from the additional grids were similar to the ERA results of the surrounding 1,380 acres and in the residual soils after scraping in the Pilot Study area. That is, no unacceptable risk was observed for the Everglades snail kite or other Service Trustee species if soil scraping is conducted.

Based on the additional grid samples, the ERA concluded that soil scraping may not be necessary to meet risk management goals within Grids 31, 32, and 33 since copper concentrations do not exceed the snail

kite benchmark of 85 mg/kg. However, scraping is recommended for the remaining areas within the water detention area footprint. The Evaluation of Additional Data collected by URS in January 2009 for Ecological Risk Assessment of Frog Pond Site Soils by NewFields is included in **Appendix E**.

Based on the results of the Pilot Test, the soil sampling, and the ERA, the District is planning on scraping the soils within the footprint of the water detention area down to the limestone, and using this material for construction of the water detention area berms or possibly placing the excavated soils east of the project towards the C-111 Canal. URS is currently formulating a Soil Management Plan for the relocation of the impacted soils within the water detention area. URS is working with WRScompass, who is designing the water detention area, on the potential areas for the placement of the impacted soils. The Soil Management Plan will detail the management of the soils during excavation and relocation, detail the areas where soils will be re-located, and outline the confirmation soil sampling approach. The confirmation soil samples will be collected to document the effectiveness of the soil scraping, with respect to copper, other soil addendum metals and agrochemicals that remain in the residual soils that are present within the footprint of the water detention area. The plan will be submitted to the Service and FDEP for review.

6.0 CONCLUSIONS AND RECOMMENDATIONS

URS has completed the Additional Soil Investigations of 350-acres which was previously not sampled as part of the water detention area at the Frog Pond. Recent design changes have shifted the water detention area to the west, resulting in 350-acres which have not been evaluated with respect to residual agrochemicals and soil addendums. The Additional Soil Investigations consisted of collecting and evaluating composite samples from seven, 50-acre grids. This sampling methodology is consistent with the sampling conducted in 2006 on the surrounding 1,380-acres. Seven composite samples were collected from seven, 50-acre grids identified as G-30 through G-36.

Elevated levels of copper were exhibited in composite soil samples collected in four grids G-30, G-34, G-35, and G-36 above the Service's Interim value of 85 mg/kg and above the SQAG TEC of 32 mg/kg in the remaining three grids G-31, G-32, and G-33.

Concentrations of arsenic, barium, chromium, and zinc were detected in one or more composite soil sample above the SQAG TEC of 9.8 mg/kg, 20 mg/kg, 43 mg/kg, and 120 mg/kg, respectively. Arsenic also exceeded the SCTL Residential Direct Exposure of 2.1 mg/kg in grids G-30 through G-36.

Organochlorine pesticides, organophosphorous pesticides, and chlorinated herbicide compounds, and paraquat were exhibited below SQAGs or were BDL. Concentrations of cadmium, lead, mercury, selenium, and silver were either below their respective SQAG TEC or BDL.

The additional grid TOC concentrations ranged from 62,000 mg/kg to 120,000 mg/kg.

Following the collection of the additional seven (7), 50-acre grids, Newfields completed an Evaluation of Additional Data collected by URS in January 2009 for Ecological Risk Assessment of Frog Pond Site Soils. The ERA results of the additional grids were similar to the ERA results for the surrounding 1,380 acres and for the residual soils in the Pilot Study area. The calculated ERA concluded that there would be no unacceptable risk for either the Everglades snail kite or other of the Service's trustee species if soil scraping is conducted. The ERA also concluded that soil scraping may not be necessary to meet risk management goals within Grids 31, 32, and 33 since copper concentrations do not exceed the snail kite benchmark. However, scraping is recommended for the remaining areas of the revised water detention area footprint.

Based on the results of the Phase II ESA, Pilot Study, and Additional Soil Investigations, URS recommends scraping the impacted soils from within the water detention area footprint. The ERA indicated that select grids may not require scraping, specifically Grids 31, 32, and 33. URS is currently working with WRScompass to determine if soils left in place would affect the operation of the water detention area. In the event that the soils can remain in place, the Service must provide concurrence on leaving the soils within the water detention area footprint.

The maximum area to be scraped is approximately 620-acres, which includes Grids 30 through 36 and portions of Grids 3, 8, 9, 14, 15, 20, 21, 26, 27, 28, and 29. The estimated amount of soils that will be excavated, based on 6-inch thickness of soils throughout the Frog Pond, is 500,150 cubic yards. URS recommends that the excavated soil be used for the construction of the water detention area berms. A second option is to relocate the soils outside the footprint of the project area.

URS is currently formulating a Soil Management Plan which details the soil scraping, relocation, and confirmation sampling. Due to concentrations of arsenic and copper which were detected in the soil above the SCTLs, the excavated soils will need to be managed and relocated to an area which will limit exposure to the general public. URS is working with WRScompass, who is

designing the water detention area, and the District on the placement of the excavated soils within the berms or in an area of the Frog Pond in such a manner that will limit exposure pathways. Upon completion of the Soil Management Plan, the plan should be submitted to the Service and FDEP for review.

7.0 REREFENCES

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Chapter 62-770, Florida Administrative Code, Petroleum Contamination Site Cleanup Criteria

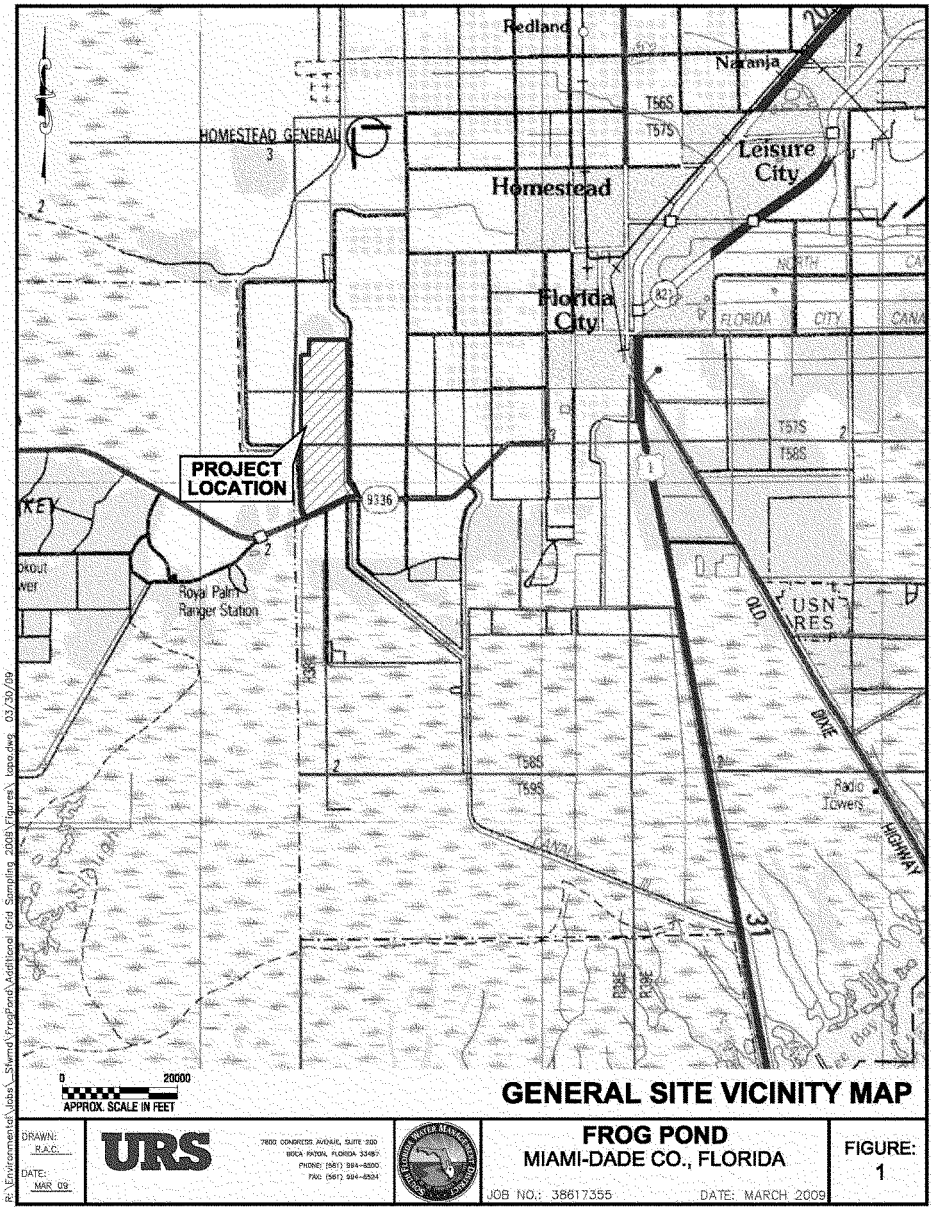
Chapter 62-777, Florida Administrative Code, Contaminate Cleanup Target Levels

Chapter 62-780, Florida Administrative Code, Contaminate Site Cleanup Criteria

Maps

United States Geological Survey, 1984 (Photorevised 1970), 7.5 minute topographic map, *Royal Palm Ranger Station*, Florida Quadrangle; Department. of Interior, Geological Survey, Scale 1:24,000.

FIGURES



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DRAWN: R.A.C. DATE: MAR 09	URS	7800 CONGRESS AVENUE, SUITE 200 BOCA RATON, FLORIDA 33487 PHONE: (561) 994-6500 FAX: (561) 994-6524	**FROG POND** MIAMI-DADE CO., FLORIDA JOB NO.: 38617355 DATE: MARCH 2009	FIGURE: 1

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DATE: MARCH 2009

FROG POND
MIAMI-DADE CO., FLORIDA

SITE MAP AND GRID LOCATIONS

FIGURE: 2

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FROG POND
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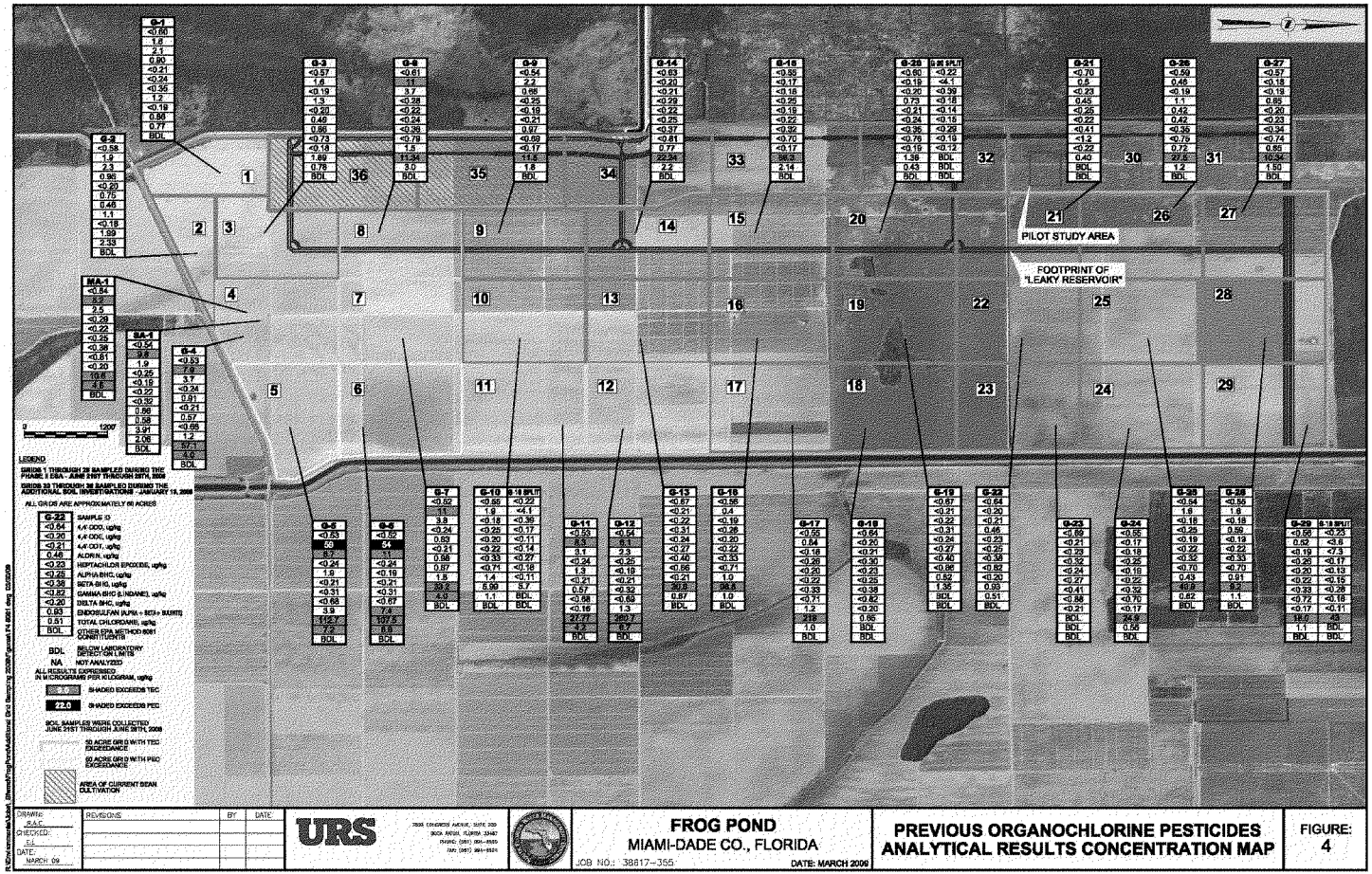
ORGANOCHLORINE PESTICIDES
ANALYTICAL RESULTS
CONCENTRATION MAP

FIGURE: 3



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PREVIOUS ORGANOCHLORINE PESTICIDES ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 4

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CHLORINATED HERBICIDES, ORGANOPHOSPHOROUS PESTICIDES & TRIAZINE HERBICIDES, & PARAQUAT ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 5

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PREVIOUS CHLORINATED HERBICIDES, ORGANOPHOSPHOROUS PESTICIDES & TRIAZINE HERBICIDES, & PARAQUAT ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 6

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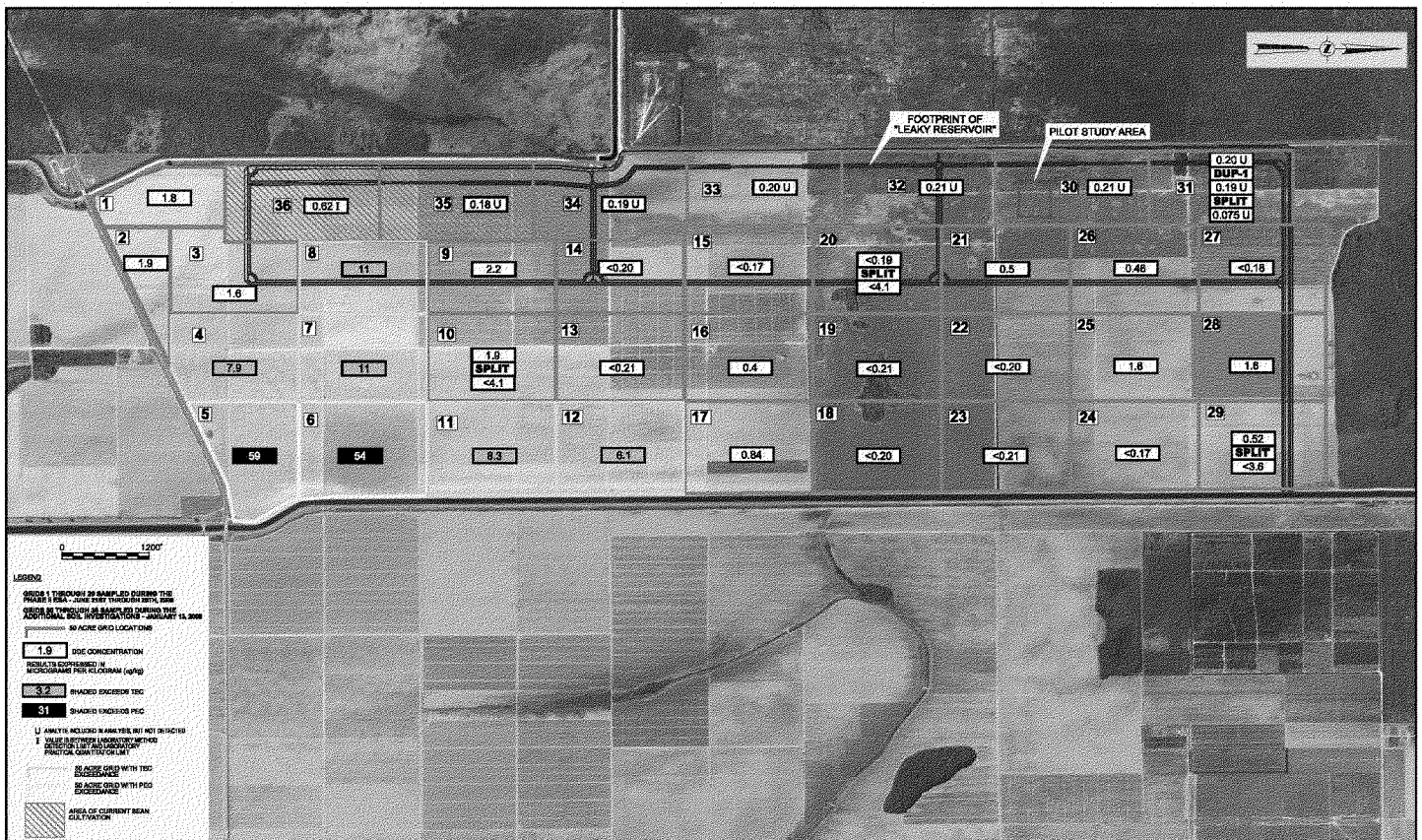
ORGANOCHLORINE PESTICIDES TEC/PEC EXCEEDANCE MAP

FIGURE: 7



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4,4-DDE
SOIL ANALYTICAL RESULTS MAP

FIGURE: 8

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4,4-DDT
SOIL ANALYTICAL RESULTS MAP

FIGURE: 9

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TOTAL CHLORDANE
SOIL ANALYTICAL RESULTS MAP

FIGURE: 10

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ENDOSULFAN (ALPHA + BETA + SULFATE) SOIL ANALYTICAL RESULTS MAP

FIGURE: 11

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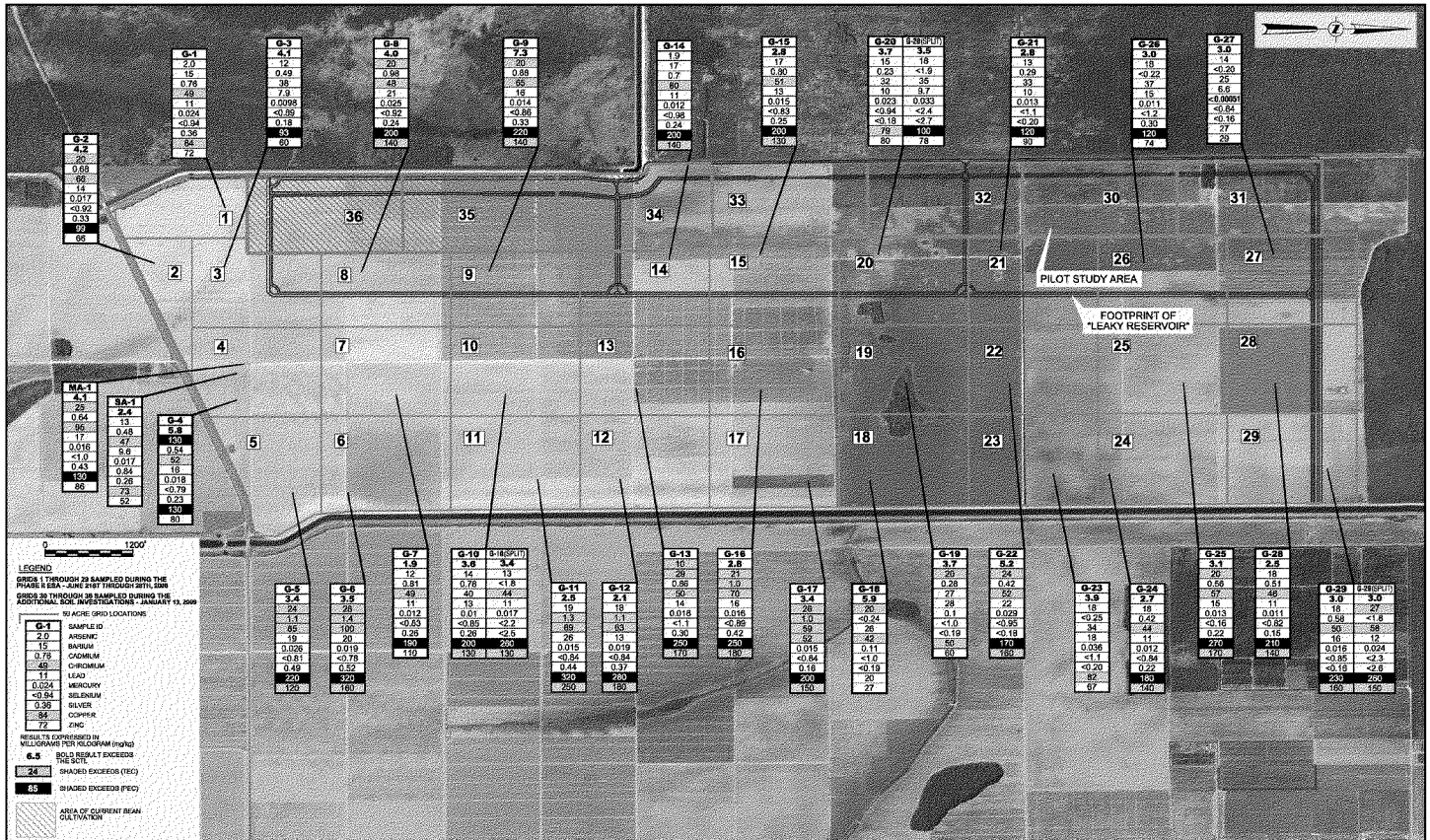
8 RCRA METALS, COPPER, AND ZINC ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 12



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DATE: MARCH 09			

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FROG POND
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-355 DATE: MARCH 2009

PREVIOUS
8 RCRA METALS, COPPER, AND ZINC
ANALYTICAL RESULTS CONCENTRATION MAP

FIGURE: 13

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FROG POND
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JOB NO.: 38616-355 DATE: MARCH 2009

8 RCRA METALS, COPPER, & ZINC TEC/PEC EXCEEDANCE MAP

FIGURE: 14

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FROG POND
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-355 DATE: MARCH 2009

BARIUM
SOIL ANALYTICAL RESULTS MAP

FIGURE: 15

R:\Environmental\John_Sherm\Frogpond\Additional Grid Sampling 2009\Figures\ F15 BARIUM.dwg 03/30/09

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CADMIUM
SOIL ANALYTICAL RESULTS MAP

FIGURE: 16

R:\Environmental\Jobs_Stems\Frog Pond\Additional Grid Sampling 2009\Figures\F16 CADMIUM.dwg 03/30/09

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FROG POND
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-355 DATE: MARCH 2009

CHROMIUM
SOIL ANALYTICAL RESULTS MAP

FIGURE: 17

B:\Environmental\Jobs_Sites\FrogPond\Additional Grid Sampling 2009\Figures\17_CHROMIUM.dwg 03/10/09

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DATE: MARCH 09			

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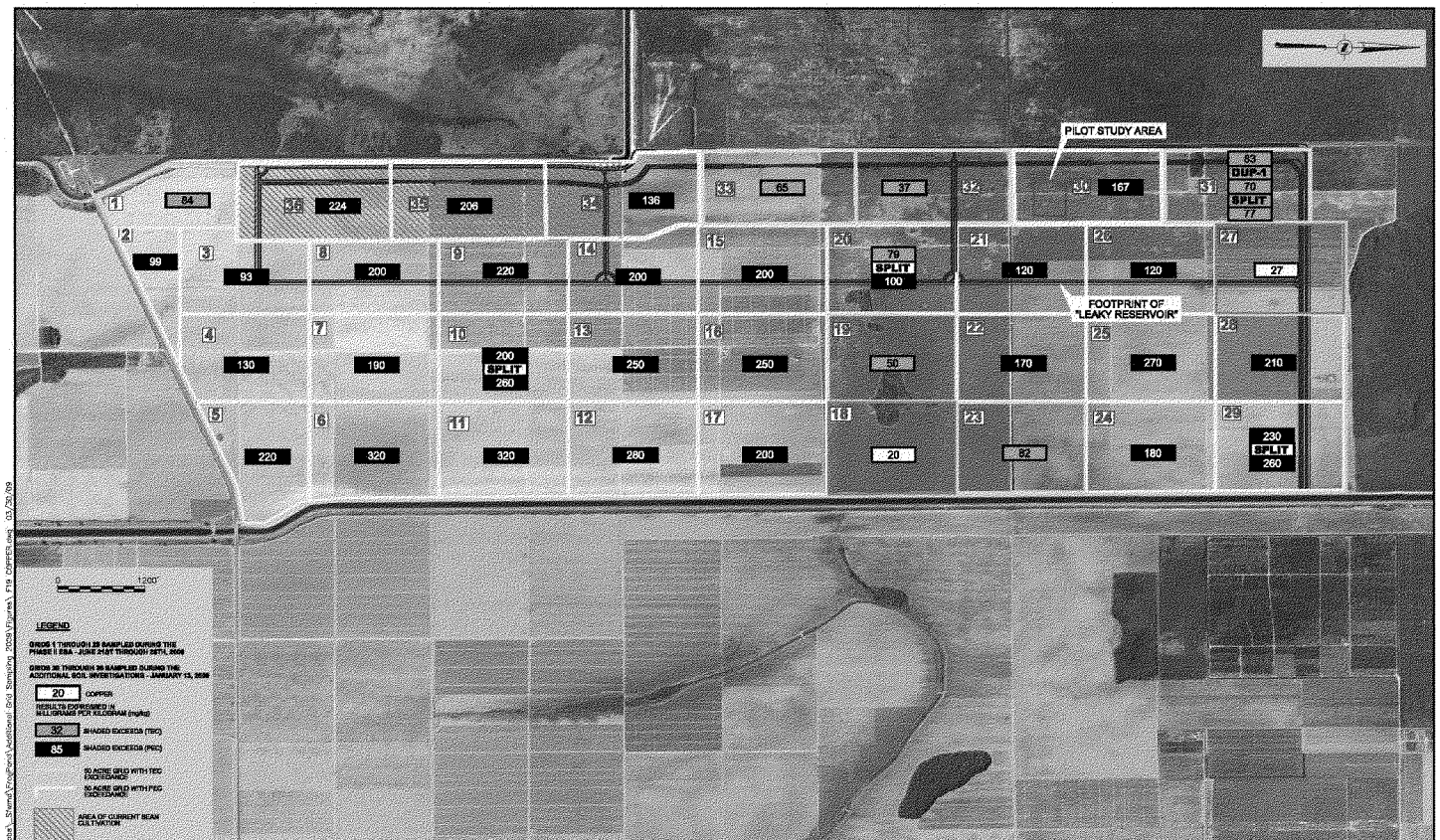
FROG POND
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-355 DATE: MARCH 2009

LEAD
SOIL ANALYTICAL RESULTS MAP

FIGURE: 18

R:\Environmental\Jobs_Stand\Frog Pond\Additional Grid Sampling 2009\Figures\ F18 lead.dwg 03/30/09



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DATE: MARCH 09

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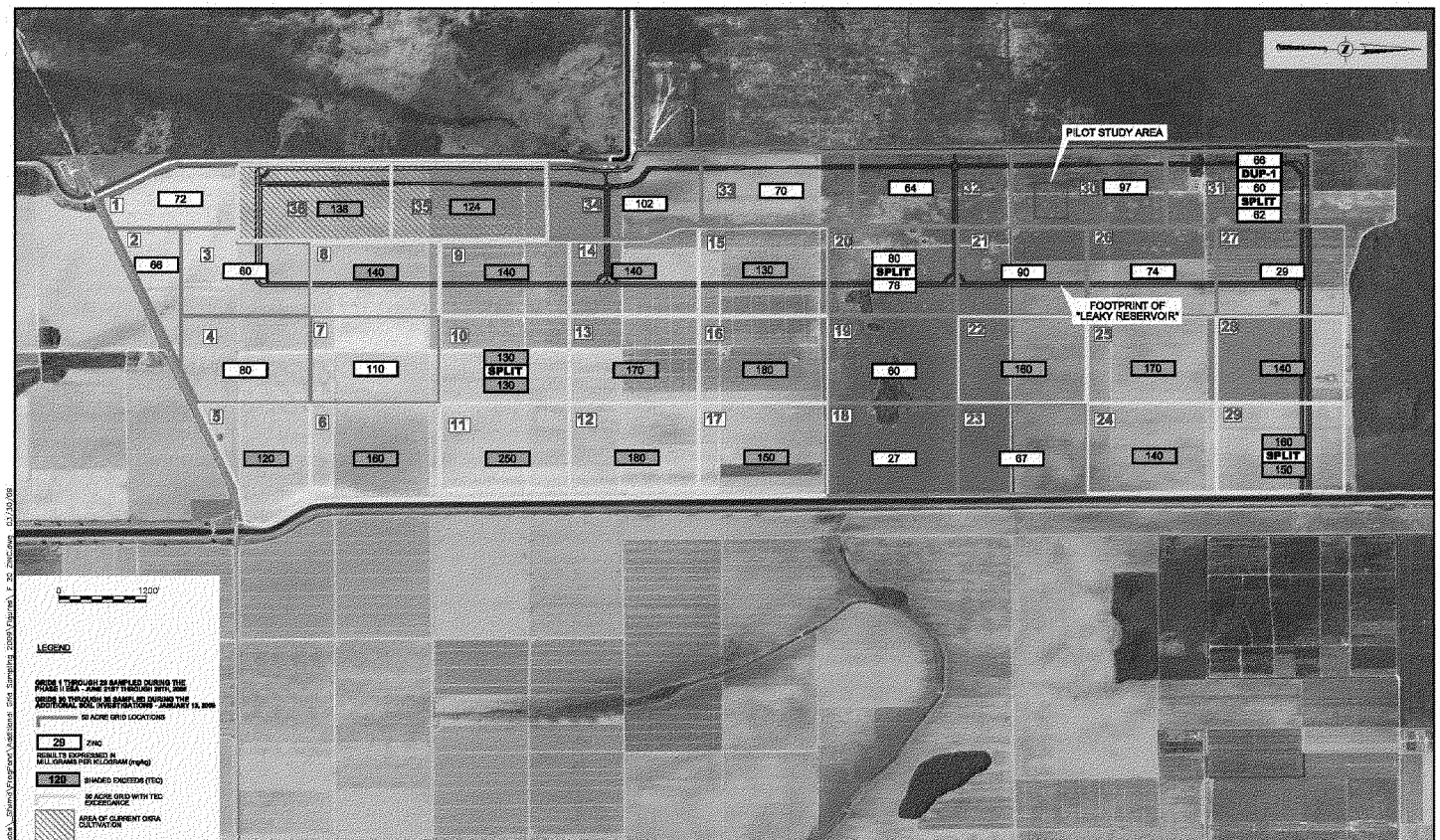
FROG POND
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-355 DATE: MARCH 2009

COPPER
SOIL ANALYTICAL RESULTS MAP

FIGURE: 19

e:\Environmental Jobs_Storm\Frog Pond\Additional Soil Sampling 2009\Figures\ Fig COPPER.mxd 03/30/09



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FROG POND
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-355 DATE: MARCH 2009

ZINC
SOIL ANALYTICAL RESULTS MAP

FIGURE: 20

TABLES

TABLE 1
SUMMARY OF PESTICIDE, HERBICIDE, PARAQUAT, AND METAL SOIL ANALYTICAL RESULTS
FROG POND
ADDITIONAL SOIL INVESTIGATIONS - 2009
FLORIDA CITY, MIAMI-DADE COUNTY, FLORIDA
Job No. 38617-355
January 13, 2009

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS			G-30	G-31	DUP-1	G-31(SPLIT) [3]	G-32	G-33	G-34	G-35	G-36
Laboratory Analysis	TEC[1]	PEC[1]	SCTL[2]									
EPA Method 8081A (µg/kg)												
4,4-DDD	4.9	28	4,200	0.66 U	0.64 U	0.63 U	0.16 U	0.69 U	0.64 U	0.61 U	0.58 U	0.54 U
4,4-DDE	3.2	31	2,900	0.21 U	0.20 U	0.19 U	0.075 U	0.21 U	0.20 U	0.19 U	0.18 U	0.62 I
4,4-DDT	4.2	63	2,900	0.22 U	0.21 U	0.21 U	0.12 U	0.23 U	0.21 U	0.20 U	0.19 U	0.18 U
Aldrin	268#	---	60	0.31 U	0.29 U	0.29 U	0.072 U	0.32 U	0.30 U	0.28 U	0.27 U	0.25 U
Dieldrin	1.9	62	60	0.39 U	0.37 U	0.37 U	0.049 U	0.41 U	0.38 U	0.36 U	0.34 U	0.32 U
Heptachlor Epoxide	2.6	16	100	0.23 U	0.22 U	0.22 U	0.14 U	0.24 U	0.23 U	0.22 U	0.21 U	0.19 U
Alpha-BHC	2.4	---	100	0.28 U	0.25 U	0.25 U	0.085 U	0.27 U	0.25 U	0.24 U	0.23 U	0.21 U
Beta-BHC	2.4	---	500	0.39 U	0.37 U	0.37 U	0.095 U	0.41 U	0.38 U	0.36 U	0.34 U	0.32 U
Gamma-BHC (Lindane)	2.4	5.0	700	0.85 U	0.81 U	0.80 U	0.18 U	0.89 U	0.82 U	0.78 U	0.74 U	0.69 U
Delta-BHC	2.4	---	24,000	0.21 U	0.20 U	0.19 U	0.11 U	0.21 U	0.20 U	0.19 U	0.18 U	0.17 U
Endosulfan (alpha+beta+sulfate)	9.14 #	---	450,000	0.84 U	0.80 U	0.78 U	0.26 I	0.87 U	2.5	4.88	0.73 U	0.85 I
Alpha-Chlordane	3.2	18	2,800	0.21 U	0.20 U	0.19 U	0.046 U	0.21 U	0.20 U	0.19 U	0.18 U	0.17 U
Gamma-Chlordane	3.2	18	2,800	1.1 U	1.1 U	0.99 U	0.084 U	1.1 U	1.1 U	0.97 U	0.92 U	0.85 U
Chlordane, Total	3.2	18	2,800	1.31 U	1.30 U	1.18 U	0.130 U	1.31 U	1.30 U	1.16 U	1.10 U	1.02 U
Other EPA Method 8081 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8151 scanned by 8321 (µg/Kg)												
All EPA 8151 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8141 scan by 8270SLI (µg/Kg)												
Atrazine (Triazine Herbicide)	0.30	---	4,300	21 U	20 U	19 U	21 U	21 U	20 U	19 U	18 U	17 U
Simazine (Triazine Herbicide)	0.34	---	7,800	20 U	19 U	18 U	16 U	19 U	19 U	17 U	16 U	16 U
All Other EPA 8141 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 549.2Mod (mg/Kg)												
Paraquat	5.646 #	---	340	0.076 U	0.071 U	0.069 U	0.029 U	0.075 U	0.071 U	0.067 U	0.062 U	0.06 U
8 RCRA Metals - EPA Method 6010B (mg/Kg)												
Arsenic	9.8	33	2.1	**6.1**	**6.0**	**6.3**	1.1	**6.9**	**8.0**	**6.4**	**7.2**	12
Barium	20	60	120	19	17	16	14	25	19	19	17	17
Cadmium	1.0	5.0	82	0.1 U	0.1 U	0.1 U	0.16 I	0.1 U	0.1 U	0.1 U	0.1 U	0.3 I
Chromium	43	110	210	37	34	32	20	39	39	56	47	58
Lead	36	130	400	6.4	3.5	3.3	8.0	5.7	8.0	8.7	7.9	11
Mercury (EPA Method 7471A)	0.18	1.1	3	0.028 I	0.035	0.023 I	0.020 I	0.024 I	0.028 I	0.029 I	0.023 I	0.025 I
Selenium	1.0*	---	440	0.7 U	0.7 U	0.7 U	1.9 U	0.7 U	0.7 U	0.7 U	0.6 U	0.6 U
Silver	1.0	2.2	410	0.3 U	0.3 U	0.3 U	0.64 U	0.4 U	0.3 U	0.3 U	0.3 U	0.3 U
Other Metals - EPA Method 6010B (mg/kg)												
Copper	32	85**	150	**167**	53	71	73	97	86	136	**206**	**224**
Zinc	120	460	26,000	67	66	60	62	64	70	102	124	138

Notes:

[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Table 5.1 (MacDonald *et al.* 2003)

[2] FAC Chapter 62-777, Table 2-Technical Background Document, Direct Exposure Residential Soil Cleanup Target Levels (SCTLs)

[3] Split - Soil sample was submitted to Pace Analytical Services, Inc. (PAS) (formerly ELAB, Inc.) for analysis

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

* U.S. Fish and Wildlife Service - Personal Communication

** U.S. Fish and Wildlife Service Interim Value

\# Site Specific (Equilibrium Partitioning Based) Sediment Quality Guideline

µg/Kg = micrograms per Kilogram

mg/Kg = milligrams per Kilogram

--- = Not Applicable and/or guidance concentrations have not been established

U - Analyte included in analysis, but not detected

I - value between laboratory method detection limit (MDL) and laboratory practical quantitation limit (PQL)

BDL= Below Laboratory Detection Limit

Atrazine and Simazine resulting data were reported as being greater than Threshold Effect Concentration (TEC)

BOLD - Sample analytical result exceeded the SCTL

Sample analytical result exceeded the TEC

Sample analytical result exceeded the PEC

TABLE 2
SUMMARY OF PREVIOUS PESTICIDE, HERBICIDE, PARAQUAT, AND METAL SOIL ANALYTICAL RESULTS
FROG POND
PHASE I/II ENVIRONMENTAL SITE ASSESSMENT - 2006
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615-864

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS			G-1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-10 (SPLIT)	G-11	G-12	G-13	G-14	G-15	G-16	G-17
Laboratory Analysis	TEC[1]	PEC[1]	SCTL[2]	6/21/06	6/21/06	6/21/06	6/21/06	6/21/06	6/21/06	6/21/06	6/21/06	6/22/06	6/22/06	6/22/06	6/22/06	6/22/06	6/22/06	6/22/06	6/22/06	6/22/06	6/22/06
EPA Method 6081A (µg/kg)																					
4,4-DDD	4.9	28	4,200	<0.60	<0.58	<0.57	<0.53	<0.53	<0.52	<0.52	<0.61	<0.54	<0.55	<0.22	<0.53	<0.54	<0.67	<0.63	<0.55	<0.56	<0.55
4,4-DDE	3.2	31	2,900	1.8	1.9	1.6	7.9	**59**	**54**	11	11	2.2	1.9	<4.1	3.3	6.1	<0.21	<0.20	<0.17	0.40	0.84
4,4-DDT	4.2	63	2,900	2.1	2.3	<0.19	3.7	8.7	11	3.8	3.7	0.66	<0.18	<0.39	3.1	2.3	1.3	<0.21	<0.18	<0.19	<0.18
Aldrin	286[3]	---	60	0.90	0.95	1.3	<0.24	<0.24	<0.24	<0.24	<0.28	<0.25	<0.25	<0.17	<0.24	<0.25	<0.31	<0.29	<0.25	<0.26	<0.26
Dieldrin	1.9	62	60	<0.35	<0.34	<0.34	<0.31	<0.31	<0.31	<0.31	<0.36	0.50	<0.33	<0.22	<0.31	<0.32	<0.40	<0.37	<0.32	<0.33	<0.33
Heptachlor Epoxide	2.5	16	100	<0.21	<0.20	<0.20	0.91	1.9	<0.19	0.83	<0.22	<0.19	<0.20	<0.11	1.3	<0.19	<0.24	<0.22	<0.19	<0.20	<0.20
Alpha-BHC	2.4	---	100	<0.24	0.75	0.49	<0.21	<0.21	<0.21	<0.21	<0.24	<0.21	<0.22	<0.14	<0.21	<0.21	<0.27	<0.25	<0.22	<0.22	<0.22
Beta-BHC	2.4	---	500	<0.35	0.46	0.86	0.57	<0.31	<0.31	0.98	<0.36	0.97	<0.33	<0.27	0.57	<0.32	<0.40	<0.37	<0.32	<0.33	<0.33
Gamma-BHC (Lindane)	2.4	5.0	700	1.2	1.1	<0.73	<0.68	<0.68	1.5	0.87	<0.79	<0.69	<0.71	<0.18	<0.68	<0.69	<0.86	<0.81	<0.70	<0.71	<0.71
Delta-BHC	2.4	---	24,000	<0.19	<0.18	<0.18	1.2	3.9	7.4	1.8	1.5	<0.17	1.4	<0.11	<0.16	1.3	<0.21	0.77	<0.17	1.0	1.2
Endosulfan (alpha+beta+sulfate)	9.14*	---	450,000	0.86	1.99	1.89	57.1	112.7	107.5	33.2	11.34	11.6	5.99	5.7	27.77	260.7	30.6	22.24	66.3	98.6	218
Alpha-Chlordane	3.2	18	2,800	0.77	0.83	0.78	1.9	3.6	2.9	2.0	1.6	1.8	1.1	<0.11	2.4	3.2	0.87	1.2	1.2	<0.17	<0.17
Gamma-Chlordane	3.2	18	2,800	<0.94	1.5	<0.90	2.1	3.7	4.0	2.0	1.5	<0.85	<0.87	<0.28	1.8	2.5	<1.1	1.0	0.94	1.0	1.0
Chlordane, Total	3.2	18	2,800	0.77	2.33	0.78	4.0	7.2	6.9	4.0	3.0	1.8	1.1	<0.39	4.2	5.7	0.87	2.2	2.14	1.0	1.0
Other EPA Method 8081 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8151 (µg/Kg)																					
Pentachlorophenol (PCP)	10,631*	---	720	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
All Other EPA 8151 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8141 scan by 8270 (mg/Kg)																					
Atrazine (Triazine Herbicide)	0.00030	---	4.3	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.0200	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Simazine (Triazine Herbicide)	0.00034	---	7.8	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.0300	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
All Other EPA 8141 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 549.2-Mod (mg/Kg)																					
Paraquat	5.646[3]	---	340	<0.05	<0.05	0.88	0.99	1.2	2.2	1.5	1.4	1.5	1.3	NA	2.1	1.9	1.4	1.2	2.1	1.9	1.4
8 RCRA Metals - EPA Method 6020 (mg/Kg)																					
Arsenic	9.8	33	2.1	2.0	**4.2**	**4.1**	**5.8**	**3.4**	**3.5**	1.9	**4.0**	**7.3**	**3.6**	**3.4**	**2.5**	**2.1**	10	1.9	**2.9**	**2.8**	**3.4**
Barium	20	60	120	15	29	12	**130**	24	26	12	29	29	14	13	19	18	29	17	17	21	26
Cadmium	1.0	5.0	82	0.76	0.68	0.49	0.54	1.1	1.4	0.81	0.98	0.88	0.78	<1.6	1.3	1.1	0.86	0.70	0.80	1.0	1.0
Chromium	43	110	210	49	66	38	52	85	100	49	48	65	40	44	69	63	50	60	51	70	59
Lead	36	130	400	11	14	7.9	16	19	20	11	21	16	13	11	26	13	14	11	13	16	62
Mercury (EPA Method 7471)	0.18	1.1	3	0.024	0.017	0.0098	0.018	0.026	0.019	0.012	0.025	0.014	0.010	0.017	0.015	0.019	0.016	0.012	0.015	0.016	0.018
Selenium	1.0*	---	440	<0.94	<0.92	<0.89	<0.79	<0.81	<0.78	<0.83	<0.92	<0.86	<0.85	<2.2	<0.84	<0.84	<1.1	<0.98	<0.83	<0.89	<0.84
Silver	1.0	2.2	410	0.36	0.33	0.18	0.23	0.49	0.52	0.26	0.24	0.33	0.26	<2.5	0.44	0.37	0.30	0.24	0.25	0.42	0.33
Other Metals - EPA Method 6020 (mg/Kg)																					
Copper	32	85**	150	84	**99**	**93**	**130**	**220**	**320**	**190**	**200**	**220**	**200**	**280**	**320**	**280**	**250**	**200**	**200**	**250**	**200**
Zinc	120	460	26,000	72	66	60	80	120	160	110	140	140	130	130	250	180	170	140	130	180	150

Notes:

[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Table 5.1 (MacDonald*et al* 2003)

[2] FAC Chapter 62-777, Table 2-Technical Background Document, Direct Exposure Residential Soil Cleanup Target Levels (SCTLs)

Split - Soil sample was split with US Biosystems for analysis

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

* U.S. Fish and Wildlife Service - Personal Communication

** U.S. Fish and Wildlife Service Interim Value

[3] Site Specific (Equilibrium Partitioning Based) Sediment Quality Guideline

µg/Kg = micrograms per Kilogram

mg/Kg = milligrams per Kilogram

--- = Not Applicable and/or guidance concentrations have not been established

NA = Not Analyzed

BDL= Below Laboratory Detection Limit

Chlorpyrifos was detected in the split sample G-10 at 2.8 ug/kg, Terbufos was detected in G-21 at 0.16 ug/kg

BOLD - Sample analytical result exceeded the SCTL

Sample analytical result exceeded the TEC

Sample analytical result exceeded the PEC

TABLE 2 (*continued*)
SUMMARY OF PREVIOUS PESTICIDE, HERBICIDE, PARAQUAT, AND METAL SOIL ANALYTICAL RESULTS
FROG POND
PHASE I/II ENVIRONMENTAL SITE ASSESSMENT - 2006
MIAMI-DADE COUNTY, FLORIDA
Job No. 38615-964

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS			G-18	G-19	G-20	G-20 (SPLIT)	G-21	G-22	G-23	G-24	G-25	G-26	G-27	G-28	G-29	G-29 (SPLIT)	MA-1	SA-1
Laboratory Analysis	TEC[1]	PEC[1]	SCTL[2]	6/23/2006	6/23/2006	6/23/2006	6/22/2006	6/23/2006	6/23/2006	6/23/2006	6/23/2006	6/23/2006	6/28/2006	6/28/2006	6/28/2006	6/28/2006	6/28/2006	6/21/2006	6/21/2006
EPA Method 8081A (µg/kg)																			
4,4-DDD	4.9	28	4,200	<0.64	<0.67	<0.60	<0.24	<0.70	<0.64	<0.69	<0.55	<0.54	<0.59	<0.57	<0.55	<0.56	<0.23	<0.64	<0.54
4,4-DDE	3.2	31	2,900	<0.20	<0.21	<0.19	<0.24	0.50	<0.20	<0.21	<0.17	1.6	0.46	<0.18	1.6	0.52	<3.6	5.2	9.8
4,4-DDT	4.2	63	2,900	<0.21	<0.22	<0.20	<0.42	<0.23	<0.21	<0.23	<0.18	<0.18	<0.19	<0.19	<0.18	<0.19	<7.3	2.5	1.9
Aldrin	286[a]	---	60	<0.30	<0.31	0.73	<0.18	0.45	0.46	<0.32	<0.25	<0.25	1.1	0.65	0.59	<0.26	<0.17	<0.29	<0.25
Dieldrin	1.9	62	60	<0.38	<0.40	<0.35	<0.24	0.55	<0.38	<0.41	<0.32	<0.32	0.46	<0.34	<0.33	<0.33	<0.23	<0.38	<0.32
Heptachlor Epoxide	2.5	16	100	<0.23	<0.24	<0.21	<0.12	<0.25	<0.23	<0.24	<0.19	<0.19	0.42	<0.20	<0.19	<0.20	<0.11	<0.22	<0.19
Alpha-BHC	2.4	---	100	<0.25	<0.27	0.51	<0.15	<0.28	<0.25	<0.27	<0.22	<0.22	0.42	<0.23	<0.22	<0.22	<0.15	<0.25	<0.22
Beta-BHC	2.4	---	500	<0.38	<0.40	<0.35	<0.29	<0.41	<0.38	<0.41	<0.32	<0.32	<0.35	<0.34	<0.33	<0.33	<0.28	<0.38	<0.32
Gamma-BHC (Lindane)	2.4	5.0	700	<0.82	<0.86	<0.76	<0.19	<0.90	<0.82	<0.88	<0.70	<0.70	<0.75	<0.73	<0.70	<0.72	<0.18	<0.81	0.86
Delta-BHC	2.4	---	24,000	<0.20	0.82	<0.19	<0.12	<0.22	<0.20	<0.21	<0.17	0.43	0.72	0.65	0.91	<0.17	<0.11	<0.20	0.58
Endosulfan (alpha+beta+sulfate)	9.14[a]	---	450,000	0.65	1.35	1.38	<0.49	0.40	0.93	<0.87	24.9	40.9	27.5	10.34	9.2	18.0	43	10.6	3.91
Alpha-Chlordane	3.2	18	2,800	<0.20	<0.21	0.43	<0.12	<0.22	0.51	<0.21	0.55	0.62	1.2	1.5	1.1	1.1	<0.12	3.2	0.86
Gamma-Chlordane	3.2	18	2,800	<1.1	<1.1	<0.94	<0.63	<1.2	<1.1	<1.1	<0.87	<0.86	<0.93	<0.90	<0.87	<0.88	<0.29	1.6	1.2
Chlordane, Total	3.2	18	2,800	<1.30	<1.31	0.43	<0.75	<1.42	0.51	<1.31	0.55	0.62	1.2	1.5	1.1	1.1	<0.41	4.8	2.06
Other EPA Method 8081 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8151 scanned by 8321 (µg/Kg)																			
Pentachlorophenol (PCP)	10,631[a]	---	720	<0.9	<0.9	<0.9	NA	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	NA	<0.9	<0.9
All Other EPA 8151 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8141 scan by 8270SLI (mg/Kg)																			
Atrazine (Triazine Herbicide)	0.30	---	4,300	<0.014	<0.014	<0.014	<0.0200	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.0200	<0.014	<0.014
Simazine (Triazine Herbicide)	0.34	---	7,800	<0.013	<0.013	<0.013	<0.0300	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.0300	<0.013	<0.013
All Other EPA 8141 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 549.2-Mod (mg/Kg)																			
Paraquat	5.646[a]	---	340	0.12	0.27	1.1	NA	2.4	2.4	1.6	2.3	3.1	1.7	1.2	2.6	2.6	NA	<0.05	<0.05
8 RCRA Metals - EPA Method 6010B (mg/Kg)																			
Arsenic	9.8	33	2.1	**5.9**	**3.7**	**3.7**	**3.5**	**2.8**	**5.2**	**3.9**	**2.7**	**3.1**	**3.0**	**3.0**	**2.5**	**3.0**	**3.0**	**4.1**	**2.4**
Barium	20	60	120	20	20	15	18	13	24	18	18	20	18	14	18	18	27	25	13
Cadmium	1.0	5.0	82	<0.24	0.28	0.23	<1.9	0.29	0.42	<0.25	0.42	0.56	<0.22	<0.20	0.51	0.58	<1.8	0.64	0.48
Chromium	43	110	210	26	27	32	35	33	52	34	44	57	37	25	46	50	58	95	47
Lead	36	130	400	42	28	10	9.7	10	22	18	11	15	15	6.6	11	16	12	17	9.6
Mercury	0.18	1.1	3	0.11	0.10	0.023	0.033	0.013	0.029	0.036	0.012	0.013	0.011	<0.00051	0.011	0.016	0.024	0.016	0.017
Selenium	1.0*	---	440	<1.0	<1.0	<0.94	<2.4	<1.1	<0.95	<1.1	<0.84	<0.85	<0.91	<0.84	<0.82	<0.85	<2.3	<1.0	0.84
Silver	1.0	2.2	410	<0.19	<0.19	<0.18	<2.7	<0.20	<0.18	<0.20	0.22	0.22	<0.17	<0.16	0.25	0.30	<2.6	0.43	0.26
Other Metals - EPA Method 6010B (mg/Kg)																			
Copper	32	85**	150	20	50	79	**100**	**120**	**170**	82	**180**	**270**	**120**	27	**210**	**230**	**260**	**130**	73
Zinc	120	460	26,000	27	60	80	78	90	160	67	140	170	74	29	140	160	150	86	52

Notes:

[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Table 5.1 (MacDonald*et al* 2003)

[2] FAC Chapter 62-777, Table 2-Technical Background Document, Direct Exposure Residential Soil Cleanup Target Levels (SCTLs)

Split - Soil sample was split with US Biosystems for analysis

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

* U.S. Fish and Wildlife Service - Personal Communication

** U.S. Fish and Wildlife Service Interim Value

[a] Site Specific (Equilibrium Partitioning Based) Sediment Quality Guideline

µg/Kg = micrograms per Kilogram

mg/Kg = milligrams per Kilogram

--- = Not Applicable and/or guidance concentrations have not been established

NA = Not Analyzed

BDL= Below Laboratory Detection Limit

Chlorpyrifos was detected in the split sample G-10 at 2.8 ug/kg, Terbufos was detected in G-21 at 0.16 ug/kg

BOLD - Sample analytical result exceeded the SCTL

Sample analytical result exceeded the TEC

Sample analytical result exceeded the PEC

TABLE 3

SUMMARY OF TOTAL ORGANIC CARBON SOIL ANALYTICAL RESULTS

FROG POND

ADDITIONAL SOIL INVESTIGATIONS - 2009

FLORIDA CITY, MIAMI-DADE COUNTY, FLORIDA

Job No. 38617-355

January 13, 2009

SAMPLE IDENTIFICATION	G-30	G-31	G-32	G-33	G-34	G-35	G-36
Laboratory Analysis							
Total Organic Carbon - EPA Method 9060 (mg/kg)	**120,000**	**94,000**	**96,000**	**63,000**	**77,000**	**62,000**	**100,000**

Notes:

mg/kg = milligrams per kilogram

Soil samples were submitted to Pace Analytical Services, Inc. (PAS) (formerly ELAB, Inc.) for analysis

APPENDIX A

CORRESPONDENCE

38615-964

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 1, 2007

Robert Taylor
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the document entitled "Limited Phase II Environmental Site Assessment Report, Frog Pond, State Road 27, Miami-Dade County, Florida," prepared by URS Corporation (URS). This document reports the findings from the limited sampling investigation conducted on this 1,380-acre property, which is proposed for use in constructing a "leaky reservoir". Historically the property has been used for the cultivation of various row crops, but at the time of the assessment there was only a small (60 acres) area planted with okra.

A previous Phase I/II Environmental Site Assessment was conducted on the entire 5,216-acre property by Dames and Moore. This 1995 assessment identified petroleum contamination at stained areas and metals contamination at burn areas. Impacted soils from these areas were excavated and removed.

The current Phase I Environmental Site Assessment identified three areas of concern that required Phase II investigations. These areas included the agricultural area, mixing area, and staging area. Using established procedures for field sampling in agricultural areas, 29 fifty-acre composite soil samples were collected from the agricultural area. One composite sample was collected from both the mixing and staging area. These composites were comprised of four and five discrete samples, respectively. Analytical results were compared to Florida Department of Environmental Protection Sediment Quality Assessment Guidelines and the Florida Administrative Code Soil Cleanup Target Levels.

Several pesticides and metals were detected in soil samples collected from the agricultural area. Of the 29 grids sampled, 7 exceeded the SQAG threshold effects concentration (TEC) (3.2 ug/kg) for 4,4'-DDE, 2 of which (59 μg/kg and 54 μg/kg) also exceeded the SQAG probable effects concentration (PEC) (31 ug/kg). Concentrations of 4,4'-DDT, total chlordane, and delta BHC were above their TECs in some of the grids. Endosulfan, which currently has no SQAG, was detected at concentrations above the calculated site-specific SQAG in 19 grids. Low levels of aldrin (0.45-1.3 μg/kg) and paraquat (0.12-3.1 μg/kg) were detected below their respective site-specific SQAGs (268 μg/kg and 5,646 μg/kg). Extensive copper contamination was identified, with 24 of the grids exceeding the 85 mg/kg interim screening value for the protection

TAKE PRIDE® IN AMERICA

of the endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*). Chromium, zinc, barium, and lead were detected at concentrations above their TECs in 21, 17, 8, and 2 grids, respectively. The calculated 95 percent upper confidence limit (UCL) for 4,4'-DDE (18 µg/kg), endosulfan (73 µg/kg), chromium (57 mg/kg), and zinc (136 mg/kg) exceeded their TEC or site-specific SQAG and the 95 percent UCL for copper (203 mg/kg) exceeded the PEC (150 mg/kg). A screening level ecological risk assessment found that levels of 4,4'-DDE, copper, and zinc presented risk to Service trust resources.

It is believed that the rocky soils of the Frog Pond Property may impede the excavation of contaminated soils. URS recommended performing a pilot test to determine if contaminated soils can be effectively removed from the rocky soils within the agricultural area. URS proposed removing soils to the vertical extent of contamination or bedrock in a 50-acre grid with the highest copper concentration. Lithology below the excavated soils would then be evaluated. Confirmatory samples will also be analyzed for 4,4'-DDE and zinc, since these constituents are co-located within the same grids as the copper contamination. If the pilot test is successful, then URS proposed that the excavated soils would be used on-site for the construction of berms, levies, or roads.

The composite sample from the mixing area detected the pesticides 4,4'-DDE (5.2 µg/kg) and chlordane (4.8 µg/kg) slightly above their TEC (3.2 µg/kg) and endosulfan (10.6 µg/kg) above its calculated site-specific SQAG (9.14 µg/kg). The metals barium (25 mg/kg) and chromium (95 mg/kg) exceeded their respective TECs (20 mg/kg and 43 mg/kg) and copper (130 mg/kg) was above the interim screening value (85 mg/kg). Since the mixing area is co-located within grid #4 of the agricultural area, remediation will be in conjunction with corrective actions in the cultivated fields.

The soil sampled from the staging area found 4,4'-DDE (9.8 µg/kg), chromium (47 mg/kg), and copper (73 mg/kg) at concentrations above their respective TECs (3.2 µg/kg, 43 mg/kg, and 32 mg/kg). Since the staging area is co-located within grid #4 of the agricultural area, remediation will be in conjunction with corrective actions in the cultivated fields.

After reviewing the analytical data, the Service concurs with the proposed pilot study to determine if copper, 4,4'-DDE, and zinc contamination can be successfully removed from the limestone soils of the Frog Pond Property. If the excavation is effective and the soils are used in the construction of site features outside of the reservoir, then we agree that proper engineering controls, such as capping with clean fill, may be necessary to insure that SCTL direct exposure standards are met.

Thank you for the opportunity to provide comments regarding the Frog Pond Property. If you have any questions, please contact Emily Boughner at 772-562-3909, extension 335.

Sincerely yours,

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:
Service, Vero Beach, Florida (Lorraine Heisler) electronic copy only
URS, Boca Raton, Florida (Edward Leding)

APPENDIX B

SOIL BORING GPS COORDINATES

APPENDIX B
SOIL BORING GPS COORDINATES
FROG POND
ADDITIONAL SOIL INVESTIGATIONS - 2009
FLORIDA CITY, MIAMI-DADE COUNTY, FLORIDA
Job No. 38617-355
January 13, 2009

SAMPLE IDENTIFICATION	LATITUDE	LONGITUDE
GRID-30		
GRID-30-SS-1	N25.43375	W80.57184
GRID-30-SS-2	N25.43472	W80.57191
GRID-30-SS-3	N25.43571	W80.57187
GRID-30-SS-4	N25.43665	W80.57182
GRID-30-SS-5	N25.43765	W80.57182
GRID-30-SS-6	N25.43761	W80.57309
GRID-30-SS-7	N25.43661	W80.57294
GRID-30-SS-8	N25.43565	W80.57282
GRID-30-SS-9	N25.43467	W80.57285
GRID-30-SS-10	N25.43366	W80.57288
GRID-31		
GRID-31-SS-1	N25.43956	W80.57196
GRID-31-SS-2	N25.44049	W80.57193
GRID-31-SS-3	N25.44146	W80.57187
GRID-31-SS-4	N25.44242	W80.57191
GRID-31-SS-5	N25.44340	W80.57190
GRID-31-SS-6	N25.44337	W80.57320
GRID-31-SS-7	N25.44240	W80.57319
GRID-31-SS-8	N25.44145	W80.57321
GRID-31-SS-9	N25.44023	W80.57307
GRID-31-SS-10	N25.43953	W80.57305
GRID-32		
GRID-32-SS-1	N25.42800	W80.57205
GRID-32-SS-2	N25.42892	W80.57204
GRID-32-SS-3	N25.42989	W80.57199
GRID-32-SS-4	N25.43083	W80.57211
GRID-32-SS-5	N25.43190	W80.57201
GRID-32-SS-6	N25.43158	W80.57335
GRID-32-SS-7	N25.43090	W80.57316
GRID-32-SS-8	N25.42981	W80.57313
GRID-32-SS-9	N25.42889	W80.57312
GRID-32-SS-10	N25.42795	W80.57309
GRID-33		
GRID-33-SS-1	N25.42221	W80.57193
GRID-33-SS-2	N25.42309	W80.57195
GRID-33-SS-3	N25.42407	W80.57195
GRID-33-SS-4	N25.42512	W80.57196
GRID-33-SS-5	N25.42604	W80.57207
GRID-33-SS-6	N25.42602	W80.57308
GRID-33-SS-7	N25.42500	W80.57296
GRID-33-SS-8	N25.42406	W80.57302
GRID-33-SS-9	N25.42310	W80.57303
GRID-33-SS-10	N25.42208	W80.57309

Notes:
Coordinates were collected in decimal degrees using North American Datum (NAD) 83
Sample locations are marked with orange survey flags

APPENDIX B
SOIL BORING GPS COORDINATES
FROG POND
ADDITIONAL SOIL INVESTIGATIONS - 2009
FLORIDA CITY, MIAMI-DADE COUNTY, FLORIDA
Job No. 38617-355
January 13, 2009

SAMPLE IDENTIFICATION	LATITUDE	LONGITUDE
GRID-34		
GRID-34-SS-1	N25.41634	W80.57144
GRID-34-SS-2	N25.41722	W80.57143
GRID-34-SS-3	N25.41841	W80.57159
GRID-34-SS-4	N25.41933	W80.57196
GRID-34-SS-5	N25.42023	W80.57199
GRID-34-SS-6	N25.42022	W80.57307
GRID-34-SS-7	N25.41938	W80.57308
GRID-34-SS-8	N25.41235	W80.57241
GRID-34-SS-9	N25.41724	W80.57252
GRID-34-SS-10	N25.41632	W80.57240
GRID-35		
GRID-35-SS-1	N25.41050	W80.57142
GRID-35-SS-2	N25.41128	W80.57137
GRID-35-SS-3	N25.41275	W80.57146
GRID-35-SS-4	N25.41359	W80.57143
GRID-35-SS-5	N25.41438	W80.57143
GRID-35-SS-6	N25.41435	W80.57248
GRID-35-SS-7	N25.41352	W80.57239
GRID-35-SS-8	N25.41273	W80.57245
GRID-35-SS-9	N25.41117	W80.57236
GRID-35-SS-10	N25.41051	W80.57250
GRID-36		
GRID-36-SS-1	N25.40467	W80.57143
GRID-36-SS-2	N25.40554	W80.57140
GRID-36-SS-3	N25.40631	W80.57142
GRID-36-SS-4	N25.40756	W80.57144
GRID-36-SS-5	N25.40863	W80.57146
GRID-36-SS-6	N25.40861	W80.57254
GRID-36-SS-7	N25.40756	W80.57249
GRID-36-SS-8	N25.40631	W80.57248
GRID-36-SS-9	N25.40553	W80.57239
GRID-36-SS-10	N25.40468	W80.57242

Notes:
Coordinates were collected in decimal degrees using North American Datum (NAD) 83
Sample locations are marked with orange survey flags

APPENDIX C

SOIL ANALYTICAL LABORATORY REPORTS AND CHAIN OF CUSTODY RECORDS

9143 Philips Highway, Suite 200 Jacksonville, FL 32256 (904) 739-2277 (904) 739-2011 fax

Columbia Analytical Services INC.
An Employee - Owned Company

January 28, 2009

Service Request No: J0900163

Ed Leding
URS Corporation
7800 Congress Ave.
Boca Raton, FL 33487

Laboratory Results for: Frog Pond/38617-355

Dear Ed:

Enclosed are the results of the sample(s) submitted to our laboratory on January 14, 2009. For your reference, these analyses have been assigned our service request number **J0900163**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. In accordance to the NELAC 2003 Standard, a statement on the estimated uncertainty of measurement of any quantitative analysis will be supplied upon request.

Please contact me if you have any questions. My extension is 4409. You may also contact me via email at CMyers@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig Myers
Project Manager

Laboratory Manager: Greg Jordan
Quality Assurance Officer: Kathy Brungard

CAS Jacksonville is NELAC-accredited by the State of Florida, #E82502 valid through 6/30/09. Other state accreditations include: Georgia, #958 valid through 6/30/09; Louisiana, #02086 valid through 6/30/09; Texas, #T104704197-06-TX valid through 5/31/09; North Carolina, #527 valid through 12/31/08; South Carolina, #96021001 valid through 6/30/09.

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	URS Corporation	**Service Request No.:**	J0900163
Project:	Frog Pond	**Date Received:**	1/14/09
Sample Matrix:	Water/Soil		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier II data deliverables, including results of QC samples analyzed from this delivery group. When appropriate to the procedure, method blank results have been reported with each analytical test. Analytical procedures performed by the lab are validated in accordance with NELAC standards. Parameters that are included in the NELAC Fields of Testing but are not included in the lab's NELAC accreditation are identified in the discussion of each analytical procedure.

Sample Receipt

One water and eight soil samples were received for analysis at Columbia Analytical Services on 1/14/09. The samples were received in good condition and consistent with the accompanying chain of custody form. Samples are refrigerated at 4±2°C upon receipt at the lab except for aqueous samples designated for metals analyses, which were stored at room temperature.

Organochlorine Pesticides by GC-ECD

The samples were analyzed for Organochlorine Pesticides using EPA Method 8081. The following observations were made regarding this delivery group.

Matrix Spike Recovery Exceptions

The upper control criterion was exceeded for the following analyte in Duplicate Matrix Spike (DMS) G-31DMS: 4,4'-DDT. The analyte in question was not detected in the associated field samples. Recovery in the Laboratory Control Sample (LCS) was acceptable indicating the analytical batch was in control. No further corrective action was appropriate.

Metals by ICP-OES/CVAA

The samples were analyzed for Total Metals using EPA Methods 6010B/7470A/7471A. No problems were observed.

Matrix Spike Recovery Exceptions

The duplicate matrix spike recovery of Silver for sample G-31 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicates the analytical batch was in control. The matrix spike outlier suggests a potential high bias in this matrix. No further corrective action was appropriate.

Sample Notes and Discussion

The original report contained false positive results for Silver. After extensive review of data and reanalysis of the samples by ICP and ICP-MS, it was determined that the extremely high concentrations of Calcium contributed to an evaluated background level that was interpreted as Silver. The interference was corrected for by using a Silver standard spiked with approximately the same concentration of Calcium as the samples. The original Laboratory

Approved by Amy R Hy **Date** 2/6/09

Control Sample contained 24.6 mg/Kg Silver with 98% recovery without the excessive Calcium correction. After the correction was placed in the method, that same reference standard contained 24.9 mg/Kg Silver with 100 % recovery, therefore verifying the correction.

Batch QC Notes and Discussion

Some quality control samples (i.e., Dup/Spike or MS/DMS samples) were performed using samples from another sample delivery group (SDG). The frequency requirement for quality control sample analysis was consistent with the project's requirements. Matrix specific quality control results have no bearing on sample data from a different matrix or location. Therefore, control of the batch has been evaluated using the method blank and the laboratory control sample.

Subcontracted Analytical Parameters

The samples were delivered to Sun Labs in Tampa, FL on 1/15/09 for Organophosphorus Pesticides, Herbicides, and Paraquat determination. The certified analytical report has been included in its entirety in Appendix A: Subcontracted Analytical Results.

Approved by Craig R Hy **Date** 2/6/09

Florida DEP Data Qualifiers

B Results based upon colony counts outside the acceptable range.

D Measurement was made in the field.

H Value based on field kit determination; results may not be accurate.

i The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

J Estimated value (one of the following reasons is discussed in the project case narrative).
1. The result may be inaccurate because the surrogate recovery limits have been exceeded.
2. No known quality control criteria exist for the component.
3. The reported value failed to meet the established quality control criteria for either precision or accuracy.
4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD).
5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).

K Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).

L Off scale high. The analyte is above the upper limit of the linear calibration range.

M The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.

N Presumptive evidence of the analyte. Confirmation was not performed.

Q Sample held beyond the accepted holding time.

T Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.

U Indicates that the compound was analyzed for but not detected.

V Indicates that the analyte was detected in both the sample and the associated method blank.

Y The laboratory analysis was from an improperly preserved sample.

Z Too many colonies were present (TNTC). The numeric value represents the filtration volume.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Client: URS Corporation
Project: Frog Pond/38617-355

Service Request: J0900163

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
J0900163-001	G-30	1/13/09	12:15
J0900163-002	G-31	1/13/09	10:40
J0900163-003	G-32	1/13/09	13:30
J0900163-004	G-33	1/13/09	14:30
J0900163-005	G-34	1/13/09	13:10
J0900163-006	G-35	1/13/09	11:35
J0900163-007	G-36	1/13/09	10:15
J0900163-008	DUP-1	1/13/09	00:00
J0900163-009	Equipment Blank-1	1/13/09	15:00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Water

Service Request: J0900163
Date Collected: 01/13/2009
Date Received: 01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name: Equipment Blank-1
Lab Code: J0900163-009

Units: ug/L
Basis: NA

Extraction Method: EPA 3510C
Analysis Method: 8081A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.021	0.0081	1	01/16/09	01/20/09	JWG0900248	
gamma-BHC (Lindane)	ND	U	0.021	0.0084	1	01/16/09	01/20/09	JWG0900248	
beta-BHC	ND	U	0.021	0.0087	1	01/16/09	01/20/09	JWG0900248	
delta-BHC	ND	U	0.021	0.012	1	01/16/09	01/20/09	JWG0900248	
Heptachlor	ND	U	0.021	0.0098	1	01/16/09	01/20/09	JWG0900248	
Aldrin	ND	U	0.021	0.0070	1	01/16/09	01/20/09	JWG0900248	
Heptachlor Epoxide	ND	U	0.021	0.0081	1	01/16/09	01/20/09	JWG0900248	
gamma-Chlordane	ND	U	0.021	0.0077	1	01/16/09	01/20/09	JWG0900248	
alpha-Chlordane	ND	U	0.021	0.0068	1	01/16/09	01/20/09	JWG0900248	
4,4'-DDE	ND	U	0.021	0.0086	1	01/16/09	01/20/09	JWG0900248	
Endosulfan I	ND	U	0.021	0.0091	1	01/16/09	01/20/09	JWG0900248	
Dieldrin	ND	U	0.021	0.0075	1	01/16/09	01/20/09	JWG0900248	
Endrin	ND	U	0.021	0.0092	1	01/16/09	01/20/09	JWG0900248	
4,4'-DDD	ND	U	0.021	0.0081	1	01/16/09	01/20/09	JWG0900248	
Endosulfan II	ND	U	0.021	0.0066	1	01/16/09	01/20/09	JWG0900248	
4,4'-DDT	ND	U	0.021	0.014	1	01/16/09	01/20/09	JWG0900248	
Endrin Aldehyde	ND	U	0.021	0.0087	1	01/16/09	01/20/09	JWG0900248	
Methoxychlor	ND	U	0.041	0.012	1	01/16/09	01/20/09	JWG0900248	
Endosulfan Sulfate	ND	U	0.021	0.0094	1	01/16/09	01/20/09	JWG0900248	
Endrin Ketone	ND	U	0.021	0.0055	1	01/16/09	01/20/09	JWG0900248	
Toxaphene	ND	U	0.52	0.52	1	01/16/09	01/20/09	JWG0900248	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	71	32-92	01/20/09	Acceptable
Decachlorobiphenyl	60	13-104	01/20/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Water

Service Request: J0900163
Date Collected: NA
Date Received: NA

Organochlorine Pesticides by GC-ECD

Sample Name: Method Blank
Lab Code: JWG0900248-1

Units: ug/L
Basis: NA

Extraction Method: EPA 3510C
Analysis Method: 8081A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	0.020	0.0079	1	01/16/09	01/20/09	JWG0900248	
gamma-BHC (Lindane)	ND	U	0.020	0.0082	1	01/16/09	01/20/09	JWG0900248	
beta-BHC	ND	U	0.020	0.0085	1	01/16/09	01/20/09	JWG0900248	
delta-BHC	ND	U	0.020	0.011	1	01/16/09	01/20/09	JWG0900248	
Heptachlor	ND	U	0.020	0.0096	1	01/16/09	01/20/09	JWG0900248	
Aldrin	ND	U	0.020	0.0068	1	01/16/09	01/20/09	JWG0900248	
Heptachlor Epoxide	ND	U	0.020	0.0079	1	01/16/09	01/20/09	JWG0900248	
gamma-Chlordane	ND	U	0.020	0.0075	1	01/16/09	01/20/09	JWG0900248	
alpha-Chlordane	ND	U	0.020	0.0066	1	01/16/09	01/20/09	JWG0900248	
4,4'-DDE	ND	U	0.020	0.0084	1	01/16/09	01/20/09	JWG0900248	
Endosulfan I	ND	U	0.020	0.0089	1	01/16/09	01/20/09	JWG0900248	
Dieldrin	ND	U	0.020	0.0073	1	01/16/09	01/20/09	JWG0900248	
Endrin	ND	U	0.020	0.0090	1	01/16/09	01/20/09	JWG0900248	
4,4'-DDD	ND	U	0.020	0.0079	1	01/16/09	01/20/09	JWG0900248	
Endosulfan II	ND	U	0.020	0.0064	1	01/16/09	01/20/09	JWG0900248	
4,4'-DDT	ND	U	0.020	0.013	1	01/16/09	01/20/09	JWG0900248	
Endrin Aldehyde	ND	U	0.020	0.0085	1	01/16/09	01/20/09	JWG0900248	
Methoxychlor	ND	U	0.040	0.011	1	01/16/09	01/20/09	JWG0900248	
Endosulfan Sulfate	ND	U	0.020	0.0092	1	01/16/09	01/20/09	JWG0900248	
Endrin Ketone	ND	U	0.020	0.0053	1	01/16/09	01/20/09	JWG0900248	
Toxaphene	ND	U	0.50	0.50	1	01/16/09	01/20/09	JWG0900248	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	54	32-92	01/20/09	Acceptable
Decachlorobiphenyl	65	13-104	01/20/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Soil

Service Request: J0900163
Date Collected: 01/13/2009
Date Received: 01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name: G-30
Lab Code: J0900163-001

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3550
Analysis Method: 8081A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.5	0.26	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.5	0.85	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.5	0.39	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.5	0.21	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.5	0.68	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.5	0.31	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.5	0.23	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.5	1.1	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.5	0.21	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.5	0.21	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.5	0.25	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.5	0.39	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.5	0.29	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.5	0.66	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.5	0.31	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.5	0.22	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.5	0.29	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.9	0.23	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	ND	U	2.5	0.28	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.5	0.45	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	49	25	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	65	34-104	01/22/09	Acceptable
Decachlorobiphenyl	66	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Collected:**	01/13/2009
Sample Matrix:	Soil	**Date Received:**	01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name:	G-31	**Units:**	ug/Kg
Lab Code:	J0900163-002	**Basis:**	Dry
Extraction Method:	EPA 3550	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.4	0.25	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.4	0.81	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.4	0.37	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.4	0.20	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.4	0.65	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.4	0.29	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.4	0.22	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.4	1.1	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.4	0.20	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.4	0.20	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.4	0.24	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.4	0.37	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.4	0.28	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.4	0.64	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.4	0.29	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.4	0.21	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.4	0.28	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.7	0.22	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	ND	U	2.4	0.27	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.4	0.43	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	47	24	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	82	34-104	01/22/09	Acceptable
Decachlorobiphenyl	79	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Collected:**	01/13/2009
Sample Matrix:	Soil	**Date Received:**	01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name:	G-32	**Units:**	ug/Kg
Lab Code:	J0900163-003	**Basis:**	Dry
Extraction Method:	EPA 3550	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.6	0.27	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.6	0.89	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.6	0.41	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.6	0.21	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.6	0.71	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.6	0.32	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.6	0.24	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.6	1.1	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.6	0.21	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.6	0.21	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.6	0.26	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.6	0.41	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.6	0.30	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.6	0.69	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.6	0.32	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.6	0.23	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.6	0.30	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	5.1	0.24	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	ND	U	2.6	0.29	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.6	0.47	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	51	26	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	69	34-104	01/22/09	Acceptable
Decachlorobiphenyl	67	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Soil

Service Request: J0900163
Date Collected: 01/13/2009
Date Received: 01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name: G-33
Lab Code: J0900163-004

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3550
Analysis Method: 8081A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.4	0.25	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.4	0.82	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.4	0.38	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.4	0.20	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.4	0.66	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.4	0.30	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.4	0.23	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.4	1.1	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.4	0.20	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.4	0.20	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.4	0.24	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.4	0.38	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.4	0.28	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.4	0.64	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.4	0.30	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.4	0.21	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.4	0.28	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.8	0.23	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	**2.5**		2.4	0.27	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.4	0.44	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	48	24	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	58	34-104	01/22/09	Acceptable
Decachlorobiphenyl	65	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Soil

Service Request: J0900163
Date Collected: 01/13/2009
Date Received: 01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name: G-34
Lab Code: J0900163-005

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3550
Analysis Method: 8081A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.3	0.24	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.3	0.78	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.3	0.36	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.3	0.19	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.3	0.62	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.3	0.28	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.3	0.22	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.3	0.97	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.3	0.19	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.3	0.19	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.3	0.23	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.3	0.36	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.3	0.27	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.3	0.61	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	**0.48**	I	2.3	0.28	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.3	0.20	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.3	0.27	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.5	0.22	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	**4.4**		2.3	0.25	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.3	0.41	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	45	23	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	59	34-104	01/22/09	Acceptable
Decachlorobiphenyl	55	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Soil

Service Request: J0900163
Date Collected: 01/13/2009
Date Received: 01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name: G-35
Lab Code: J0900163-006

Units: ug/Kg
Basis: Dry

Extraction Method: EPA 3550
Analysis Method: 8081A

Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.2	0.23	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.2	0.74	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.2	0.34	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.2	0.18	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.2	0.59	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.2	0.27	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.2	0.21	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.2	0.92	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.2	0.18	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.2	0.18	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.2	0.22	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.2	0.34	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.2	0.25	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.2	0.58	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.2	0.27	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.2	0.19	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.2	0.25	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.3	0.21	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	ND	U	2.2	0.24	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.2	0.39	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	43	22	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	76	34-104	01/22/09	Acceptable
Decachlorobiphenyl	81	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Collected:**	01/13/2009
Sample Matrix:	Soil	**Date Received:**	01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name:	G-36	**Units:**	ug/Kg
Lab Code:	J0900163-007	**Basis:**	Dry
Extraction Method:	EPA 3550	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.0	0.21	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.0	0.69	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.0	0.32	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.0	0.17	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.0	0.55	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.0	0.25	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.0	0.19	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.0	0.85	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.0	0.17	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	**0.62**	I	2.0	0.17	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.0	0.20	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.0	0.32	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.0	0.24	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.0	0.54	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.0	0.25	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.0	0.18	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.0	0.24	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.0	0.19	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	**0.85**	I	2.0	0.23	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.0	0.37	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	40	20	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	71	34-104	01/22/09	Acceptable
Decachlorobiphenyl	60	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Collected:**	01/13/2009
Sample Matrix:	Soil	**Date Received:**	01/14/2009

Organochlorine Pesticides by GC-ECD

Sample Name:	DUP-1	**Units:**	ug/Kg
Lab Code:	J0900163-008	**Basis:**	Dry
Extraction Method:	EPA 3550	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	2.3	0.25	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	2.3	0.80	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	2.3	0.37	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	2.3	0.19	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	2.3	0.64	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	2.3	0.29	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	2.3	0.22	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	2.3	0.99	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	2.3	0.19	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	2.3	0.19	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	2.3	0.23	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	2.3	0.37	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	2.3	0.28	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	2.3	0.63	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	2.3	0.29	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	2.3	0.21	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	2.3	0.28	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	4.6	0.22	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	ND	U	2.3	0.26	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	2.3	0.42	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	46	23	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	63	34-104	01/22/09	Acceptable
Decachlorobiphenyl	64	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Collected:**	NA
Sample Matrix:	Soil	**Date Received:**	NA

Organochlorine Pesticides by GC-ECD

Sample Name:	Method Blank	**Units:**	ug/Kg
Lab Code:	JWG0900276-4	**Basis:**	Dry
Extraction Method:	EPA 3550	**Level:**	Low
Analysis Method:	8081A		

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
alpha-BHC	ND	U	1.7	0.18	1	01/19/09	01/22/09	JWG0900276	
gamma-BHC (Lindane)	ND	U	1.7	0.59	1	01/19/09	01/22/09	JWG0900276	
beta-BHC	ND	U	1.7	0.27	1	01/19/09	01/22/09	JWG0900276	
delta-BHC	ND	U	1.7	0.14	1	01/19/09	01/22/09	JWG0900276	
Heptachlor	ND	U	1.7	0.47	1	01/19/09	01/22/09	JWG0900276	
Aldrin	ND	U	1.7	0.21	1	01/19/09	01/22/09	JWG0900276	
Heptachlor Epoxide	ND	U	1.7	0.16	1	01/19/09	01/22/09	JWG0900276	
gamma-Chlordane	ND	U	1.7	0.73	1	01/19/09	01/22/09	JWG0900276	
alpha-Chlordane	ND	U	1.7	0.14	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDE	ND	U	1.7	0.14	1	01/19/09	01/22/09	JWG0900276	
Endosulfan I	ND	U	1.7	0.17	1	01/19/09	01/22/09	JWG0900276	
Dieldrin	ND	U	1.7	0.27	1	01/19/09	01/22/09	JWG0900276	
Endrin	ND	U	1.7	0.20	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDD	ND	U	1.7	0.46	1	01/19/09	01/22/09	JWG0900276	
Endosulfan II	ND	U	1.7	0.21	1	01/19/09	01/22/09	JWG0900276	
4,4'-DDT	ND	U	1.7	0.15	1	01/19/09	01/22/09	JWG0900276	
Endrin Aldehyde	ND	U	1.7	0.20	1	01/19/09	01/22/09	JWG0900276	
Methoxychlor	ND	U	3.4	0.16	1	01/19/09	01/22/09	JWG0900276	
Endosulfan Sulfate	ND	U	1.7	0.19	1	01/19/09	01/22/09	JWG0900276	
Endrin Ketone	ND	U	1.7	0.31	1	01/19/09	01/22/09	JWG0900276	
Toxaphene	ND	U	34	17	1	01/19/09	01/22/09	JWG0900276	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Tetrachloro-m-xylene	65	34-104	01/22/09	Acceptable
Decachlorobiphenyl	50	39-107	01/22/09	Acceptable

Comments:

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: WATER

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: Equipment Blank-1
Lab Code: J0900163-009

Units: ug/L
Basis: N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3010A	6010B	10.0	2.0	1.0	01/15/2009	01/16/2009	U	
Barium	EPA 3010A	6010B	10.0	1.0	1.0	01/15/2009	01/16/2009	U	
Cadmium	EPA 3010A	6010B	10.0	1.0	1.0	01/15/2009	01/27/2009	U	
Chromium	EPA 3010A	6010B	10.0	1.0	1.0	01/15/2009	01/16/2009	U	
Copper	EPA 3010A	6010B	10.0	2.0	1.0	01/15/2009	01/16/2009	U	
Lead	EPA 3010A	6010B	10.0	2.0	1.0	01/15/2009	01/16/2009	U	
Mercury	METHOD	7470A	0.50	0.08	1.0	01/15/2009	01/15/2009	U	
Selenium	EPA 3010A	6010B	50.0	4.0	1.0	01/15/2009	01/16/2009	4.5	i
Silver	EPA 3010A	6010B	10.0	3.0	1.0	01/15/2009	01/16/2009	U	
Zinc	EPA 3010A	6010B	20.0	2.0	1.0	01/15/2009	01/16/2009	2.8	i

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: WATER

Service Request: J0900163
Date Collected: N/A
Date Received: N/A

Total Metals

Sample Name: Method Blank
Lab Code: MB2-0115

Units: ug/L
Basis: N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3010A	6010B	10.0	2.0	1.0	01/15/2009	01/16/2009	U	
Barium	EPA 3010A	6010B	10.0	1.0	1.0	01/15/2009	01/16/2009	U	
Cadmium	EPA 3010A	6010B	10.0	1.0	1.0	01/15/2009	01/27/2009	U	
Chromium	EPA 3010A	6010B	10.0	1.0	1.0	01/15/2009	01/16/2009	U	
Copper	EPA 3010A	6010B	10.0	2.0	1.0	01/15/2009	01/16/2009	U	
Lead	EPA 3010A	6010B	10.0	2.0	1.0	01/15/2009	01/16/2009	U	
Mercury	METHOD	7470A	0.50	0.08	1.0	01/15/2009	01/15/2009	U	
Selenium	EPA 3010A	6010B	50.0	4.0	1.0	01/15/2009	01/16/2009	U	
Silver	EPA 3010A	6010B	10.0	3.0	1.0	01/15/2009	01/16/2009	U	
Zinc	EPA 3010A	6010B	20.0	2.0	1.0	01/15/2009	01/16/2009	2.1	i

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-30
Lab Code: J0900163-001

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.4	0.2	1.0	01/16/2009	01/16/2009	6.1	
Barium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	19	
Cadmium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	37	
Copper	EPA 3050B	6010B	1.4	0.2	1.0	01/16/2009	01/16/2009	167	
Lead	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	6.4	
Mercury	METHOD	7471A	0.034	0.003	1.0	01/16/2009	01/16/2009	0.028	i
Selenium	EPA 3050B	6010B	6.8	0.7	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.4	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.7	0.1	1.0	01/16/2009	01/16/2009	97	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-31
Lab Code: J0900163-002

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.3	0.2	1.0	01/16/2009	01/16/2009	6.0	
Barium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	17	
Cadmium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	34	
Copper	EPA 3050B	6010B	1.3	0.2	1.0	01/16/2009	01/16/2009	83	
Lead	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	3.5	
Mercury	METHOD	7471A	0.034	0.003	1.0	01/16/2009	01/16/2009	0.035	
Selenium	EPA 3050B	6010B	6.7	0.7	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.3	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.7	0.1	1.0	01/16/2009	01/16/2009	66	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-32
Lab Code: J0900163-003

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.4	0.2	1.0	01/16/2009	01/16/2009	6.9	
Barium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	25	
Cadmium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	39	
Copper	EPA 3050B	6010B	1.4	0.2	1.0	01/16/2009	01/16/2009	37	
Lead	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	5.7	
Mercury	METHOD	7471A	0.037	0.003	1.0	01/16/2009	01/16/2009	0.024	i
Selenium	EPA 3050B	6010B	7.1	0.7	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.4	0.4	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.8	0.1	1.0	01/16/2009	01/16/2009	64	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-33
Lab Code: J0900163-004

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.4	0.2	1.0	01/16/2009	01/16/2009	8.0	
Barium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	19	
Cadmium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	56	
Copper	EPA 3050B	6010B	1.4	0.2	1.0	01/16/2009	01/16/2009	65	
Lead	EPA 3050B	6010B	1.4	0.1	1.0	01/16/2009	01/16/2009	8.0	
Mercury	METHOD	7471A	0.034	0.003	1.0	01/16/2009	01/16/2009	0.028	i
Selenium	EPA 3050B	6010B	6.8	0.7	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.4	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.7	0.1	1.0	01/16/2009	01/16/2009	70	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-34
Lab Code: J0900163-005

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.3	0.2	1.0	01/16/2009	01/16/2009	6.4	
Barium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	19	
Cadmium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	56	
Copper	EPA 3050B	6010B	1.3	0.2	1.0	01/16/2009	01/16/2009	136	
Lead	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	8.7	
Mercury	METHOD	7471A	0.032	0.003	1.0	01/16/2009	01/16/2009	0.029	i
Selenium	EPA 3050B	6010B	6.5	0.7	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.3	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.6	0.1	1.0	01/16/2009	01/16/2009	102	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-35
Lab Code: J0900163-006

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.2	0.2	1.0	01/16/2009	01/16/2009	7.2	
Barium	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/16/2009	17	
Cadmium	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/16/2009	47	
Copper	EPA 3050B	6010B	1.2	0.2	1.0	01/16/2009	01/16/2009	206	
Lead	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/16/2009	7.9	
Mercury	METHOD	7471A	0.030	0.002	1.0	01/16/2009	01/16/2009	0.023	i
Selenium	EPA 3050B	6010B	6.1	0.6	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.2	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.5	0.1	1.0	01/16/2009	01/16/2009	124	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: G-36
Lab Code: J0900163-007

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.2	0.2	1.0	01/16/2009	01/16/2009	12	
Barium	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/16/2009	17	
Cadmium	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/19/2009	0.3	i
Chromium	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/16/2009	58	
Copper	EPA 3050B	6010B	1.2	0.2	1.0	01/16/2009	01/16/2009	224	
Lead	EPA 3050B	6010B	1.2	0.1	1.0	01/16/2009	01/16/2009	11	
Mercury	METHOD	7471A	0.028	0.002	1.0	01/16/2009	01/16/2009	0.025	i
Selenium	EPA 3050B	6010B	5.8	0.6	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.2	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.3	0.1	1.0	01/16/2009	01/16/2009	138	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: 1/13/2009
Date Received: 1/14/2009

Total Metals

Sample Name: DUP-1
Lab Code: J0900163-008

Units: mg/Kg
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.3	0.2	1.0	01/16/2009	01/16/2009	6.3	
Barium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	16	
Cadmium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	32	
Copper	EPA 3050B	6010B	1.3	0.2	1.0	01/16/2009	01/16/2009	70	
Lead	EPA 3050B	6010B	1.3	0.1	1.0	01/16/2009	01/16/2009	3.3	
Mercury	METHOD	7471A	0.033	0.003	1.0	01/16/2009	01/16/2009	0.023	i
Selenium	EPA 3050B	6010B	6.6	0.7	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.3	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.7	0.1	1.0	01/16/2009	01/16/2009	60	

COLUMBIA ANALYTICAL SERVICES, INC

Analytical Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: SOIL

Service Request: J0900163
Date Collected: N/A
Date Received: N/A

Total Metals

Sample Name: Method Blank
Lab Code: MBS1-0116

Units: mg/Kg
Basis: N/A

Analyte	Prep Method	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Arsenic	EPA 3050B	6010B	1.0	0.2	1.0	01/16/2009	01/16/2009	U	
Barium	EPA 3050B	6010B	1.0	0.1	1.0	01/16/2009	01/16/2009	U	
Cadmium	EPA 3050B	6010B	1.0	0.1	1.0	01/16/2009	01/19/2009	U	
Chromium	EPA 3050B	6010B	1.0	0.1	1.0	01/16/2009	01/16/2009	U	
Copper	EPA 3050B	6010B	1.0	0.2	1.0	01/16/2009	01/16/2009	U	
Lead	EPA 3050B	6010B	1.0	0.1	1.0	01/16/2009	01/16/2009	U	
Mercury	METHOD	7471A	0.025	0.002	1.0	01/16/2009	01/16/2009	U	
Selenium	EPA 3050B	6010B	5.0	0.5	1.0	01/16/2009	01/16/2009	U	
Silver	EPA 3050B	6010B	1.0	0.3	1.0	01/16/2009	02/02/2009	U	
Zinc	EPA 3050B	6010B	2.0	0.1	1.0	01/16/2009	01/16/2009	U	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Frog Pond
Project Number : 38617-355
Sample Matrix : SOIL

Service Request : J0900163
Date Collected : 01/13/09
Date Received : 01/14/09

Solids, Total

Analysis Method : 160.3 MOD
Test Notes :

Units : PERCENT
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date/Time Analyzed	Result	Result Notes
G-30	J0900163-001	0.1	0.1	1	01/14/09 13:15	70	
G-31	J0900163-002	0.1	0.1	1	01/14/09 13:15	73	
G-32	J0900163-003	0.1	0.1	1	01/14/09 13:15	67	
G-33	J0900163-004	0.1	0.1	1	01/14/09 13:15	72	
G-34	J0900163-005	0.1	0.1	1	01/14/09 13:15	76	
G-35	J0900163-006	0.1	0.1	1	01/14/09 13:15	80	
G-36	J0900163-007	0.1	0.1	1	01/14/09 13:15	86	
DUP-1	J0900163-008	0.1	0.1	1	01/14/09 13:15	74	

Report By: Palimi

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Water

Service Request: J0900163

Surrogate Recovery Summary
Organochlorine Pesticides by GC-ECD

Extraction Method: EPA 3510C
Analysis Method: 8081A

Units: PERCENT
Level: Low

Sample Name	Lab Code	Sur1	Sur2
Equipment Blank-1	J0900163-009	71	60
Method Blank	JWG0900248-1	54	65
Lab Control Sample	JWG0900248-3	62	62

Surrogate Recovery Control Limits (%)

Sur1 =	Tetrachloro-m-xylene	32-92
Sur2 =	Decachlorobiphenyl	13-104

Results flagged with an asterisk (*) indicate values outside control criteria.
Results flagged with a pound (#) indicate the control criteria is not applicable.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Frog Pond/38617-355
Sample Matrix: Soil

Service Request: J0900163

Surrogate Recovery Summary
Organochlorine Pesticides by GC-ECD

Extraction Method: EPA 3550
Analysis Method: 8081A

Units: PERCENT
Level: Low

Sample Name	Lab Code	Sur1	Sur2
G-30	J0900163-001	65	66
G-31	J0900163-002	82	79
G-32	J0900163-003	69	67
G-33	J0900163-004	58	65
G-34	J0900163-005	59	55
G-35	J0900163-006	76	81
G-36	J0900163-007	71	60
DUP-1	J0900163-008	63	64
Method Blank	JWG0900276-4	65	50
G-31MS	JWG0900276-1	60	67
G-31DMS	JWG0900276-2	75	71
Lab Control Sample	JWG0900276-3	65	60

Surrogate Recovery Control Limits (%)

Sur1 =	Tetrachloro-m-xylene	34-104
Sur2 =	Decachlorobiphenyl	39-107

Results flagged with an asterisk (*) indicate values outside control criteria.
Results flagged with a pound (#) indicate the control criteria is not applicable.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Extracted:**	01/19/2009
Sample Matrix:	Soil	**Date Analyzed:**	01/22/2009

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides by GC-ECD

Sample Name:	G-31	**Units:**	ug/Kg
Lab Code:	J0900163-002	**Basis:**	Dry
Extraction Method:	EPA 3550	**Level:**	Low
Analysis Method:	8081A	**Extraction Lot:**	JWG0900276

		G-31MS JWG0900276-1 Matrix Spike			G-31DMS JWG0900276-2 Duplicate Matrix Spike					
Analyte Name	**Sample Result**	**Result**	**Expected**	**%Rec**	**Result**	**Expected**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
alpha-BHC	ND	10.5	18.3	58	11.9	18.3	65	22-125	12	30
gamma-BHC (Lindane)	ND	9.73	18.3	53	12.5	18.3	69	25-109	25	30
beta-BHC	ND	11.6	18.3	63	12.4	18.3	68	10-122	7	30
delta-BHC	ND	11.0	18.3	60	13.0	18.3	71	10-112	17	30
Heptachlor	ND	12.6	18.3	69	14.2	18.3	78	11-101	13	30
Aldrin	ND	11.9	18.3	65	13.8	18.3	76	16-117	15	30
Heptachlor Epoxide	ND	13.6	18.3	74	13.5	18.3	74	33-116	1	30
gamma-Chlordane	ND	13.9	18.3	76	15.3	18.3	84	10-128	10	30
alpha-Chlordane	ND	13.9	18.3	76	15.5	18.3	85	28-106	11	30
4,4'-DDE	ND	13.0	18.3	71	16.1	18.3	88	33-103	22	30
Endosulfan I	ND	15.0	18.3	82	15.3	18.3	84	37-103	2	30
Dieldrin	ND	12.8	18.3	70	15.5	18.3	85	47-101	19	30
Endrin	ND	13.8	18.3	76	14.4	18.3	79	33-124	4	30
4,4'-DDD	ND	13.6	18.3	75	16.5	18.3	90	50-107	19	30
Endosulfan II	ND	14.0	18.3	77	15.5	18.3	85	19-109	10	30
4,4'-DDT	ND	13.8	18.3	76	16.0	18.3	88 *	10-86	15	30
Endrin Aldehyde	ND	13.0	18.3	71	15.3	18.3	84	17-99	16	30
Methoxychlor	ND	16.9	18.3	93	17.9	18.3	98	10-137	6	30
Endosulfan Sulfate	ND	13.8	18.3	76	16.0	18.3	88	25-90	15	30
Endrin Ketone	ND	15.2	18.3	83	14.6	18.3	80	26-84	4	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Extracted:**	01/16/2009
Sample Matrix:	Water	**Date Analyzed:**	01/20/2009

Lab Control Spike Summary
Organochlorine Pesticides by GC-ECD

Extraction Method:	EPA 3510C	**Units:**	ug/L
Analysis Method:	8081A	**Basis:**	NA
		Level:	Low
		Extraction Lot:	JWG0900248

	Lab Control Sample JWG0900248-3 Lab Control Spike			
Analyte Name	**Result**	**Expected**	**%Rec**	**%Rec Limits**
alpha-BHC	0.237	0.400	59	56-104
gamma-BHC (Lindane)	0.240	0.400	60	57-101
beta-BHC	0.238	0.400	60	55-97
delta-BHC	0.247	0.400	62	31-105
Heptachlor	0.270	0.400	68	52-100
Aldrin	0.268	0.400	67	45-108
Heptachlor Epoxide	0.265	0.400	66	59-103
gamma-Chlordane	0.281	0.400	70	53-107
alpha-Chlordane	0.286	0.400	72	54-104
4,4'-DDE	0.297	0.400	74	58-114
Endosulfan I	0.289	0.400	72	61-104
Dieldrin	0.294	0.400	74	57-111
Endrin	0.266	0.400	67	57-117
4,4'-DDD	0.307	0.400	77	56-116
Endosulfan II	0.287	0.400	72	50-106
4,4'-DDT	0.306	0.400	77	41-115
Endrin Aldehyde	0.238	0.400	60	51-108
Methoxychlor	0.307	0.400	77	43-123
Endosulfan Sulfate	0.309	0.400	77	56-107
Endrin Ketone	0.283	0.400	71	46-101

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0900163
Project:	Frog Pond/38617-355	**Date Extracted:**	01/19/2009
Sample Matrix:	Soil	**Date Analyzed:**	01/22/2009

Lab Control Spike Summary
Organochlorine Pesticides by GC-ECD

Extraction Method:	EPA 3550	**Units:**	ug/Kg
Analysis Method:	8081A	**Basis:**	Dry
		Level:	Low
		Extraction Lot:	JWG0900276

	Lab Control Sample JWG0900276-3 Lab Control Spike			
Analyte Name	**Result**	**Expected**	**%Rec**	**%Rec Limits**
alpha-BHC	8.20	13.3	62	50-92
gamma-BHC (Lindane)	7.83	13.3	59	50-93
beta-BHC	8.67	13.3	65	56-87
delta-BHC	8.33	13.3	63	47-93
Heptachlor	9.40	13.3	71	51-92
Aldrin	8.67	13.3	65	49-96
Heptachlor Epoxide	9.70	13.3	73	61-89
gamma-Chlordane	9.57	13.3	72	52-92
alpha-Chlordane	9.93	13.3	75	53-89
4,4'-DDE	10.1	13.3	76	52-101
Endosulfan I	10.3	13.3	77	58-91
Dieldrin	10.1	13.3	76	59-102
Endrin	9.97	13.3	75	59-111
4,4'-DDD	10.3	13.3	77	59-103
Endosulfan II	10.3	13.3	77	55-95
4,4'-DDT	11.3	13.3	85	48-97
Endrin Aldehyde	9.40	13.3	71	37-99
Methoxychlor	10.6	13.3	80	47-115
Endosulfan Sulfate	10.3	13.3	77	57-93
Endrin Ketone	10.2	13.3	77	54-90

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0900163
Project Name:	Frog Pond	**Date Collected:**	01/13/2009
Project Number:	38617-355	**Date Received:**	01/14/2009
Matrix:	SOIL	**Date Extracted:**	01/16/2009
		Date Analyzed:	01/16/2009

Matrix Spike/Matrix Spike Duplicate Summary
Total Metals

Sample Name:	G-31		**Units:**	mg/Kg
Lab Code:	J0900163-002	J0900163-002S	**Basis:**	Dry

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	RPD	% Rec Acceptance Limits	Result Notes
Arsenic	EPA 3050	6010B	1.3	66.6	66.6	6.0	74.1	77.6	101	108	5	75 - 125	
Barium	EPA 3050	6010B	1.3	133.0	133.0	16.8	144.0	154.0	95	103	7	75 - 125	
Cadmium	EPA 3050	6010B	1.3	66.6	66.6	U	67.0	67.5	100	101	1	75 - 125	
Chromium	EPA 3050	6010B	1.3	66.6	66.6	34.0	93.6	98.2	89	96	5	75 - 125	
Copper	EPA 3050	6010B	1.3	66.6	66.6	83.5	140.0	154.0	84	106	10	75 - 125	
Lead	EPA 3050	6010B	1.3	133.0	133.0	3.5	127.0	133.0	92	97	5	75 - 125	
Mercury	METHOD	7471A	0.034	0.339	0.339	0.035	0.310	0.312	80	82	1	75 - 125	
Selenium	EPA 3050	6010B	6.7	66.6	66.6	U	63.2	65.2	94	98	3	75 - 125	
Silver	EPA 3050	6010B	2.7	16.6	16.6	U	19.0	21.2	113	128	11	75 - 125	
Zinc	EPA 3050	6010B	2.7	66.6	66.6	66.4	126.0	137.0	89	106	8	75 - 125	

COLUMBIA ANALYTICAL SERVICES, INC

QA/QC Report

Client: URS Corporation
Project Name: Frog Pond
Project Number: 38617-355
Matrix: WATER

Service Request: J0900163
Date Collected: N/A
Date Received: N/A
Date Extracted: 01/15/2009
Date Analyzed: 01/16/2009

Laboratory Control Sample Summary
Total Metals

Sample Name: Lab Control Sample
Lab Code: LCS2-0115

Units: ug/L
Basis: N/A

Analyte	Prep Method	Analysis Method	True Value	Results	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Arsenic	EPA 3010A	6010B	2000	1900	95	80 - 120	
Barium	EPA 3010A	6010B	4000	3930	98	80 - 120	
Cadmium	EPA 3010A	6010B	2000	1980	99	80 - 120	
Chromium	EPA 3010A	6010B	2000	1940	97	80 - 120	
Copper	EPA 3010A	6010B	2000	1900	95	80 - 120	
Lead	EPA 3010A	6010B	4000	3860	96	80 - 120	
Mercury	METHOD	7470A	5.00	5.48	110	80 - 120	
Selenium	EPA 3010A	6010B	2000	1830	92	80 - 120	
Silver	EPA 3010A	6010B	500	458	92	80 - 120	
Zinc	EPA 3010A	6010B	2000	2040	102	80 - 120	

COLUMBIA ANALYTICAL SERVICES, INC

QA/QC Report

Client:	URS Corporation	**Service Request:**	J0900163
Project Name:	Frog Pond	**Date Collected:**	N/A
Project Number:	38617-355	**Date Received:**	N/A
Matrix:	SOIL	**Date Extracted:**	01/16/2009
		Date Analyzed:	01/16/2009

Laboratory Control Sample Summary
Total Metals

Sample Name:	Lab Control Sample	**Units:**	mg/Kg
Lab Code:	LCS1-0116	**Basis:**	N/A

Analyte	Prep Method	Analysis Method	True Value	Results	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Arsenic	EPA 3050B	6010B	100.0	100.0	100	80 - 120	
Barium	EPA 3050B	6010B	200.0	208.0	104	80 - 120	
Cadmium	EPA 3050B	6010B	100.0	95.7	96	80 - 120	
Chromium	EPA 3050B	6010B	100.0	104.0	104	80 - 120	
Copper	EPA 3050B	6010B	100.0	101.0	101	80 - 120	
Lead	EPA 3050B	6010B	200.0	203.0	102	80 - 120	
Mercury	METHOD	7471A	0.250	0.239	96	80 - 120	
Selenium	EPA 3050B	6010B	100.0	96.2	96	80 - 120	
Silver	EPA 3050B	6010B	25.0	24.9	100	80 - 120	
Zinc	EPA 3050B	6010B	100.0	102.0	102	80 - 120	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Frog Pond
Project Number : 38617-355
Sample Matrix : SOIL

Service Request : J0900163
Date Collected : 01/13/09
Date Received : 01/14/09
Date Extracted : NA
Date Analyzed : 01/14/09

Duplicate Summary
Inorganic Parameters

Sample Name : G-30
Lab Code : J0900163-001DUP
Test Notes :

Units : PERCENT
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total	160.3 MOD	0.1	70	72	71	3	

Report By: Palimi

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: URS Corp. Service Request # J09001163
Project: Frog Pond
Cooler received on 1.14.09 and opened on 1.14.09 by GB
COURIER: CAS UPS FEDEX DHL CLIENT Tracking #797248372146

1	Were custody seals on outside of cooler?	Yes	No	N/A
2	Were seals intact, signed and dated?	Yes	No	N/A
3	Were custody papers properly filled out?	Yes	No	N/A
4	Temperature of cooler(s) upon receipt (Should be 4 +/- 2 degrees C)	1.2°C		
5	Correct Temperature?	Yes	No	N/A
6	Were Ice or Ice Packs present	Yes	No	N/A
7	Did all bottles arrive in good condition (unbroken, etc....)?	Yes	No	N/A
8	Were all bottle labels complete (sample ID, preservation, etc....)?	Yes	No	N/A
9	Did all bottle labels and tags agree with custody papers? GB 1.14.9	Yes	No	N/A
10	Were the correct bottles used for the tests indicated?	Yes	No	N/A
11	Were all of the preserved bottles received with the appropriate preservative?	Yes	No	N/A

HNO3 pH<2 H2SO4 pH<2 ZnAc2/NaOH pH>9 NaOH pH>12 HCl pH<2
Preservative additions noted below

12	Were all samples received within analysis holding times?	Yes	No	N/A
13	Were VOA vials checked for absence of air bubbles? If present, note below	Yes	No	N/A
14	Where did the bottles originate?	CAS	Client	

Sample ID	Reagent	Manuf. Lot # or CAS Chem ID	ml added	Inititials

Additional comments and/or explanation of all discrepancies noted above: Used sampling times from labels: G30-12:15, G31-10:40, G32-13:30, G33-14:30, G34-13:10, G35-11:35, G36-10:15, DUP-1-0000, Equipment Blank 1-1500

Client approval to run samples if discrepancies noted: Date:

SR #: J0900163 Date: 1.14.09 Initials: GB

Note that pH is checked and meets the required pH criterion listed in the column heading unless otherwise noted on cooler receipt form.

	Bottle Code																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	40mL	40mL	40mL	40mL	125mL	125mL	125mL	125mL	250mL	250mL	250mL	250mL	250mL	250mL	250mL	500mL	500mL	500mL	1L	1L	1L	1L	1L	2oz	4oz	8oz	16oz	5g	100mL	Misc.
Container	G	G	G	G	P	P	P	P	P	P	P	P	P	G	G	P	P	P	P	P	G	G	G	G	G	G	G	ENC	P	Misc.
Pres.		HCl	Sodium Thiosulfate	H2SO4		HCl	H2SO4	HNO3		H2SO4	HNO3	ZnAcetate NaOH	NaOH		HNO3		H2SO4	HNO3		HNO3		HCl	H2SO4						Sodium Thiosulfate	
Req. pH	N/A	<2	N/A	<2	N/A	<2	<2	<2	N/A	<2	<2	>9	>12	N/A	<2	N/A	<2	<2	N/A	<2	N/A	<2	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sample #	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-001																										2				
-002																										4				
-003																										2				
-004																										2				
-005																										2				
-006																										2				
-007																										2				
-008																										2				
-009								1													4									1 +$Na_2S_2O_3$
-010																														
-011																														
-012																														
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-014																														
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-039																														
-040																														

Columbia Analytical Services™

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

9143 Philips Highway, Ste 200 • Jacksonville, FL 32256 (904) 739-2277 • 800-695-7222 x06 • FAX (904) 739-2011 PAGE 1 OF 1

www.caslab.com

SR # J0900163

[redacted]

Project Name: Frog Pond	Project Number: 38617-355
Project Manager: Ed Leding	Email Address: Ed_Leding@urscorp.com
Company/Address: URS Corporation, 7800 Congress Ave, Suite 200, Boca Raton FL 33487	
Phone #: 561-994-6500	FAX#: 561-994-6524
Sampler's Signature: [signature]	Sampler's Printed Name: Jamie Sullivan

ANALYSIS REQUESTED (Include Method Number and [redacted]

CLIENT SAMPLE ID	LAB ID	SAMPLING DATE	SAMPLING TIME	MATRIX	NUMBER OF CONTAINERS	EPA 8081	EPA 8141	EPA 8151	Paraquat (549.2)	SPLP Metals	Copper	Zinc								REMARKS/ ALTERNATE DESCRIPTION
PRESERVATIVE						I	I	I	I/8	I/2	I/2	I/2								
G-30		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
G-31		1/13/09		S	4	✓	✓	✓	✓	✓	✓	✓								MS/MSD
G-32		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
G-33		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
G-34		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
G-35		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
G-36		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
DuP-1		1/13/09		S	2	✓	✓	✓	✓	✓	✓	✓								
Equipment Blank-1		1/13/09		W	6	✓	✓	✓	✓	✓	✓	✓								

Preservative Key: 0. NONE 1. HCL 2. HNO_3 3. H_2SO_4 4. NaOH 5. Zn. Acetate 6. MeOH 7. $NaHSO_4$ 8. Other $Na_2S_2O_3$ I = Ice

SPECIAL INSTRUCTIONS/COMMENTS

SFWMD Project
ADaPT Required

See QAPP ☐

TURNAROUND REQUIREMENTS
___ RUSH (SURCHARGES APPLY)
✓ STANDARD
REQUESTED FAX DATE
REQUESTED REPORT DATE

REPORT REQUIREMENTS
___ I. Results Only
___ II. Results + QC Summaries (LCS, DUP, MS/MSD as required)
___ III. Results + QC and Calibration Summaries
___ IV. Data Validation Report with Raw Data
___ V. Specialized Forms / Custom Report
Edata ___ Yes ___ No

INVOICE INFORMATION
PO#
BILL TO:

SAMPLE RECEIPT: CONDITION/COOLER TEMP: ____ CUSTODY SEALS: Y N

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature: [signature]	Signature: FedEx	Signature: FedEx	Signature: [signature]	Signature	Signature
Printed Name: Jamie Sullivan	Printed Name	Printed Name	Printed Name: G. Bauer	Printed Name	Printed Name
Firm: URS	Firm	Firm	Firm: CAS	Firm	Firm
Date/Time: 1/13/08 / 17:30	Date/Time	Date/Time	Date/Time: 1.14.09 925	Date/Time	Date/Time

Distribution: White - Return to Originator; Yellow - Lab Copy; Pink - Retained by Client

JSCOC-06/20/08

992

Columbia Analytical Services
9143 Philips Highway, Suite 200
Jacksonville, FL 32256
Tel 904-739-2277
Fax 904-739-2011

Appendix A

Subcontracted Analytical Results

SunLabs

January 27, 2009

Craig Myers
Columbia Analytical Services, Inc.
9143 Philips Hwy, Suite 200
Jacksonville, FL 32256

Re: SunLabs Project Number: **090115.04**
Client Project Description: **J0900163**

Dear Mr. Myers:

Enclosed is the report of laboratory analysis for the following samples:

Sample Number	Sample Description	Date Collected
78938	G-30	1/13/2009
78939	G-31	1/13/2009
78940	G-32	1/13/2009
78941	G-33	1/13/2009
78942	G-34	1/13/2009
78943	G-35	1/13/2009
78944	G-36	1/13/2009
78945	Dup-1	1/13/2009
78946	Equipment Blank-1	1/13/2009

Copies of the Chain(s)-of-Custody, if received, are attached to this report.

If you have any questions or comments concerning this report, please do not hesitate to contact us.

Michael W. Palmer
Vice President, Laboratory Operations

Enclosures

SunLabs, Inc.
5460 Beaumont Center Blvd., Suite 520
Tampa, FL 33634

Phone: (813) 881-9401
Email: Info@SunLabsInc.com
Website: www.SunLabsInc.com

Unless Otherwise Noted and Where Applicable:

These samples were received at the proper temperature and were analyzed as received. The results herein relate only to the items tested or to the samples as received by the laboratory • This report shall not be reproduced except in full, without the written approval of the laboratory • Results for all solid matrices are reported on a dry weight basis • All samples will be disposed of within 45 days of the date of receipt of the samples • All samples in the body of the report are environmental samples. All results in the Quality Control (QC) section are labeled appropriately • All results meet the requirements of the NELAC standards • Footnotes are given at the end of the report • Uncertainty values are available upon request.

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78938**
Sample Designation **G-30**

Matrix: Soil
Date Collected: 1/13/2009 12:15
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 15:56	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	83	1		1.5	DEP-SURR-	01/20/09 15:56	01/16/09 14:00
Dicamba	8321	ug/kg	59 U	1	59	240	1918-00-9	01/20/09 15:56	01/16/09 14:00
MCPP	8321	ug/kg	18 U	1	18	73	93-65-2	01/20/09 15:56	01/16/09 14:00
MCPA	8321	ug/kg	27 U	1	27	110	94-74-6	01/20/09 15:56	01/16/09 14:00
Dichlorprop	8321	ug/kg	39 U	1	39	160	120-36-5	01/20/09 15:56	01/16/09 14:00
2,4-D	8321	ug/kg	20 U	1	20	79	94-75-7	01/20/09 15:56	01/16/09 14:00
Silvex	8321	ug/kg	120 U	1	120	470	93-72-1	01/20/09 15:56	01/16/09 14:00
2,4,5-T	8321	ug/kg	82 U	1	82	330	93-76-5	01/20/09 15:56	01/16/09 14:00
2,4-DB	8321	ug/kg	55 U	1	55	220	94-82-6	01/20/09 15:56	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	34			0.15		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.061 U	1	0.061	1.5	85-00-7	01/22/09 14:33	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.076 U	1	0.076	1.5	1910-42-5	01/22/09 14:33	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	55	1		1.5	DEP-SURR-	01/21/09 19:38	01/16/09 15:00
Atrazine	8270SLI	ug/kg	21 U	1	21	150	1912-24-9	01/21/09 19:38	01/16/09 15:00
Aspon	8270SLI	ug/kg	9.1 U	1	9.1	150	3244-90-4	01/21/09 19:38	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	30 U	1	30	150	2642-71-9	01/21/09 19:38	01/16/09 15:00
Azinphos methyl	8270	ug/kg	20 U	1	20	150	86-50-0	01/21/09 19:38	01/16/09 15:00
Bolstar	8270SLI	ug/kg	18 U	1	18	150	35400-43-2	01/21/09 19:38	01/16/09 15:00
Carbophenothion	8270	ug/kg	9.1 U	1	9.1	150	786-19-6	01/21/09 19:38	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	17 U	1	17	150	470-90-6	01/21/09 19:38	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	27 U	1	27	150	2921-88-2	01/21/09 19:38	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	18 U	1	18	150	5598-13-0	01/21/09 19:38	01/16/09 15:00
Coumaphos	8270	ug/kg	26 U	1	26	150	56-72-4	01/21/09 19:38	01/16/09 15:00
Crotoxyphos	8270	ug/kg	26 U	1	26	150	7700-17-6	01/21/09 19:38	01/16/09 15:00
Demeton-O+S	8270	ug/kg	33 U	1	33	150	8065-48-3	01/21/09 19:38	01/16/09 15:00
Diazinon	8270SLI	ug/kg	21 U	1	21	150	333-41-5	01/21/09 19:38	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	3 U	1	3	150	97-17-6	01/21/09 19:38	01/16/09 15:00
Dichlorvos	8270	ug/kg	18 U	1	18	150	62-73-7	01/21/09 19:38	01/16/09 15:00
Dicrotophos	8270	ug/kg	20 U	1	20	150	141-66-2	01/21/09 19:38	01/16/09 15:00
Dimethoate	8270	ug/kg	14 U	1	14	150	60-51-5	01/21/09 19:38	01/16/09 15:00
Disulfoton	8270	ug/kg	32 U	1	32	150	298-04-4	01/21/09 19:38	01/16/09 15:00
EPN	8270	ug/kg	17 U	1	17	150	2104-64-5	01/21/09 19:38	01/16/09 15:00
Ethion	8270	ug/kg	20 U	1	20	150	563-12-2	01/21/09 19:38	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	15 U	1	15	150	13194-48-4	01/21/09 19:38	01/16/09 15:00
Famphur	8270	ug/kg	27 U	1	27	150	52-85-7	01/21/09 19:38	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	140 U	1	140	580	122-14-5	01/21/09 19:38	01/16/09 15:00

SunLabs, Inc.
5460 Beaumont Center Blvd., Suite 520
Tampa, FL 33634

Laboratory ID Number - E84809

Phone: (813) 881-9401
Email: Info@SunLabsInc.com
Website: www.SunLabsInc.com

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78938**
Sample Designation **G-30**

Matrix: Soil
Date Collected: 1/13/2009 12:15
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	18 U	1	18	150	115-90-2	01/21/09 19:38	01/16/09 15:00
Fenthion	8270	ug/kg	15 U	1	15	150	55-38-9	01/21/09 19:38	01/16/09 15:00
Fonophos	8270SLI	ug/kg	15 U	1	15	150	944-22-9	01/21/09 19:38	01/16/09 15:00
Leptophos	8270	ug/kg	18 U	1	18	150	21609-90-5	01/21/09 19:38	01/16/09 15:00
Malathion	8270	ug/kg	17 U	1	17	150	121-75-5	01/21/09 19:38	01/16/09 15:00
Merphos	8270SLI	ug/kg	24 U	1	24	150	150-50-5	01/21/09 19:38	01/16/09 15:00
Mevinphos	8270	ug/kg	15 U	1	15	150	7786-34-7	01/21/09 19:38	01/16/09 15:00
Monocrotophos	8270	ug/kg	17 U	1	17	150	6923-22-4	01/21/09 19:38	01/16/09 15:00
Naled	8270	ug/kg	18 U	1	18	150	300-76-5	01/21/09 19:38	01/16/09 15:00
Parathion	8270	ug/kg	12 U	1	12	150	56-38-2	01/21/09 19:38	01/16/09 15:00
Parathion methyl	8270	ug/kg	11 U	1	11	150	298-00-0	01/21/09 19:38	01/16/09 15:00
Phorate	8270	ug/kg	3 U	1	3	150	298-02-2	01/21/09 19:38	01/16/09 15:00
Phosmet	8270	ug/kg	11 U	1	11	150	732-11-6	01/21/09 19:38	01/16/09 15:00
Phosphamidon	8270	ug/kg	26 U	1	26	150	13171-21-6	01/21/09 19:38	01/16/09 15:00
Ronnel	8270SLI	ug/kg	18 U	1	18	150	299-84-3	01/21/09 19:38	01/16/09 15:00
Simazine	8270SLI	ug/kg	20 U	1	20	150	122-34-9	01/21/09 19:38	01/16/09 15:00
Sulfotepp	8270	ug/kg	18 U	1	18	150	3689-24-5	01/21/09 19:38	01/16/09 15:00
Stirofos	8270	ug/kg	18 U	1	18	150	961-11-5	01/21/09 19:38	01/16/09 15:00
TEPP	8270	ug/kg	38 U	1	38	150	107-49-3	01/21/09 19:38	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	18 U	1	18	150	327-98-0	01/21/09 19:38	01/16/09 15:00
Terbufos	8270	ug/kg	3 U	1	3	150	13071-79-9	01/21/09 19:38	01/16/09 15:00
Thionazin	8270	ug/kg	18 U	1	18	150	297-97-2	01/21/09 19:38	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	20 U	1	20	150	34643-46-4	01/21/09 19:38	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78939**
Sample Designation **G-31**

Matrix: Soil
Date Collected: 1/13/2009 10:40
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 16:37	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	65	1		1.4	DEP-SURR-	01/20/09 16:37	01/16/09 14:00
Dicamba	8321	ug/kg	56 U	1	56	220	1918-00-9	01/20/09 16:37	01/16/09 14:00
MCPP	8321	ug/kg	17 U	1	17	69	93-65-2	01/20/09 16:37	01/16/09 14:00
MCPA	8321	ug/kg	26 U	1	26	100	94-74-6	01/20/09 16:37	01/16/09 14:00
Dichlorprop	8321	ug/kg	37 U	1	37	150	120-36-5	01/20/09 16:37	01/16/09 14:00
2,4-D	8321	ug/kg	19 U	1	19	74	94-75-7	01/20/09 16:37	01/16/09 14:00
Silvex	8321	ug/kg	110 U	1	110	440	93-72-1	01/20/09 16:37	01/16/09 14:00
2,4,5-T	8321	ug/kg	77 U	1	77	310	93-76-5	01/20/09 16:37	01/16/09 14:00
2,4-DB	8321	ug/kg	51 U	1	51	210	94-82-6	01/20/09 16:37	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	30			0.14		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.057 U	1	0.057	1.4	85-00-7	01/22/09 14:44	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.071 U	1	0.071	1.4	1910-42-5	01/22/09 14:44	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	67	1		1.4	DEP-SURR-	01/21/09 19:57	01/16/09 15:00
Atrazine	8270SLI	ug/kg	20 U	1	20	140	1912-24-9	01/21/09 19:57	01/16/09 15:00
Aspon	8270SLI	ug/kg	8.6 U	1	8.6	140	3244-90-4	01/21/09 19:57	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	29 U	1	29	140	2642-71-9	01/21/09 19:57	01/16/09 15:00
Azinphos methyl	8270	ug/kg	19 U	1	19	140	86-50-0	01/21/09 19:57	01/16/09 15:00
Bolstar	8270SLI	ug/kg	17 U	1	17	140	35400-43-2	01/21/09 19:57	01/16/09 15:00
Carbophenothion	8270	ug/kg	8.6 U	1	8.6	140	786-19-6	01/21/09 19:57	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	16 U	1	16	140	470-90-6	01/21/09 19:57	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	26 U	1	26	140	2921-88-2	01/21/09 19:57	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	17 U	1	17	140	5598-13-0	01/21/09 19:57	01/16/09 15:00
Coumaphos	8270	ug/kg	24 U	1	24	140	56-72-4	01/21/09 19:57	01/16/09 15:00
Crotoxyphos	8270	ug/kg	24 U	1	24	140	7700-17-6	01/21/09 19:57	01/16/09 15:00
Demeton-O+S	8270	ug/kg	31 U	1	31	140	8065-48-3	01/21/09 19:57	01/16/09 15:00
Diazinon	8270SLI	ug/kg	20 U	1	20	140	333-41-5	01/21/09 19:57	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	2.9 U	1	2.9	140	97-17-6	01/21/09 19:57	01/16/09 15:00
Dichlorvos	8270	ug/kg	17 U	1	17	140	62-73-7	01/21/09 19:57	01/16/09 15:00
Dicrotophos	8270	ug/kg	19 U	1	19	140	141-66-2	01/21/09 19:57	01/16/09 15:00
Dimethoate	8270	ug/kg	13 U	1	13	140	60-51-5	01/21/09 19:57	01/16/09 15:00
Disulfoton	8270	ug/kg	30 U	1	30	140	298-04-4	01/21/09 19:57	01/16/09 15:00
EPN	8270	ug/kg	16 U	1	16	140	2104-64-5	01/21/09 19:57	01/16/09 15:00
Ethion	8270	ug/kg	19 U	1	19	140	563-12-2	01/21/09 19:57	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	14 U	1	14	140	13194-48-4	01/21/09 19:57	01/16/09 15:00
Famphur	8270	ug/kg	26 U	1	26	140	52-85-7	01/21/09 19:57	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	140 U	1	140	540	122-14-5	01/21/09 19:57	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78939**
Sample Designation **G-31**

Matrix Soil
Date Collected 1/13/2009 10:40
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	17 U	1	17	140	115-90-2	01/21/09 19:57	01/16/09 15:00
Fenthion	8270	ug/kg	14 U	1	14	140	55-38-9	01/21/09 19:57	01/16/09 15:00
Fonophos	8270SLI	ug/kg	14 U	1	14	140	944-22-9	01/21/09 19:57	01/16/09 15:00
Leptophos	8270	ug/kg	17 U	1	17	140	21609-90-5	01/21/09 19:57	01/16/09 15:00
Malathion	8270	ug/kg	16 U	1	16	140	121-75-5	01/21/09 19:57	01/16/09 15:00
Merphos	8270SLI	ug/kg	23 U	1	23	140	150-50-5	01/21/09 19:57	01/16/09 15:00
Mevinphos	8270	ug/kg	14 U	1	14	140	7786-34-7	01/21/09 19:57	01/16/09 15:00
Monocrotophos	8270	ug/kg	16 U	1	16	140	6923-22-4	01/21/09 19:57	01/16/09 15:00
Naled	8270	ug/kg	17 U	1	17	140	300-76-5	01/21/09 19:57	01/16/09 15:00
Parathion	8270	ug/kg	11 U	1	11	140	56-38-2	01/21/09 19:57	01/16/09 15:00
Parathion methyl	8270	ug/kg	10 U	1	10	140	298-00-0	01/21/09 19:57	01/16/09 15:00
Phorate	8270	ug/kg	2.9 U	1	2.9	140	298-02-2	01/21/09 19:57	01/16/09 15:00
Phosmet	8270	ug/kg	10 U	1	10	140	732-11-6	01/21/09 19:57	01/16/09 15:00
Phosphamidon	8270	ug/kg	24 U	1	24	140	13171-21-6	01/21/09 19:57	01/16/09 15:00
Ronnel	8270SLI	ug/kg	17 U	1	17	140	299-84-3	01/21/09 19:57	01/16/09 15:00
Simazine	8270SLI	ug/kg	19 U	1	19	140	122-34-9	01/21/09 19:57	01/16/09 15:00
Sulfotepp	8270	ug/kg	17 U	1	17	140	3689-24-5	01/21/09 19:57	01/16/09 15:00
Stirofos	8270	ug/kg	17 U	1	17	140	961-11-5	01/21/09 19:57	01/16/09 15:00
TEPP	8270	ug/kg	36 U	1	36	140	107-49-3	01/21/09 19:57	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	17 U	1	17	140	327-98-0	01/21/09 19:57	01/16/09 15:00
Terbufos	8270	ug/kg	2.9 U	1	2.9	140	13071-79-9	01/21/09 19:57	01/16/09 15:00
Thionazin	8270	ug/kg	17 U	1	17	140	297-97-2	01/21/09 19:57	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	19 U	1	19	140	34643-46-4	01/21/09 19:57	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78940**
Sample Designation **G-32**

Matrix: Soil
Date Collected: 1/13/2009 13:30
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 17:18	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	60	1		1.5	DEP-SURR-	01/20/09 17:18	01/16/09 14:00
Dicamba	8321	ug/kg	58 U	1	58	230	1918-00-9	01/20/09 17:18	01/16/09 14:00
MCPP	8321	ug/kg	18 U	1	18	72	93-65-2	01/20/09 17:18	01/16/09 14:00
MCPA	8321	ug/kg	27 U	1	27	110	94-74-6	01/20/09 17:18	01/16/09 14:00
Dichlorprop	8321	ug/kg	39 U	1	39	160	120-36-5	01/20/09 17:18	01/16/09 14:00
2,4-D	8321	ug/kg	19 U	1	19	78	94-75-7	01/20/09 17:18	01/16/09 14:00
Silvex	8321	ug/kg	110 U	1	110	460	93-72-1	01/20/09 17:18	01/16/09 14:00
2,4,5-T	8321	ug/kg	81 U	1	81	320	93-76-5	01/20/09 17:18	01/16/09 14:00
2,4-DB	8321	ug/kg	54 U	1	54	210	94-82-6	01/20/09 17:18	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	33			0.15		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.06 U	1	0.06	1.5	85-00-7	01/22/09 14:54	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.075 U	1	0.075	1.5	1910-42-5	01/22/09 14:54	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	68	1		1.5	DEP-SURR-	01/21/09 20:16	01/16/09 15:00
Atrazine	8270SLI	ug/kg	21 U	1	21	150	1912-24-9	01/21/09 20:16	01/16/09 15:00
Aspon	8270SLI	ug/kg	9 U	1	9	150	3244-90-4	01/21/09 20:16	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	30 U	1	30	150	2642-71-9	01/21/09 20:16	01/16/09 15:00
Azinphos methyl	8270	ug/kg	19 U	1	19	150	86-50-0	01/21/09 20:16	01/16/09 15:00
Bolstar	8270SLI	ug/kg	18 U	1	18	150	35400-43-2	01/21/09 20:16	01/16/09 15:00
Carbophenothion	8270	ug/kg	9 U	1	9	150	786-19-6	01/21/09 20:16	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	16 U	1	16	150	470-90-6	01/21/09 20:16	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	27 U	1	27	150	2921-88-2	01/21/09 20:16	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	18 U	1	18	150	5598-13-0	01/21/09 20:16	01/16/09 15:00
Coumaphos	8270	ug/kg	25 U	1	25	150	56-72-4	01/21/09 20:16	01/16/09 15:00
Crotoxyphos	8270	ug/kg	25 U	1	25	150	7700-17-6	01/21/09 20:16	01/16/09 15:00
Demeton-O+S	8270	ug/kg	33 U	1	33	150	8065-48-3	01/21/09 20:16	01/16/09 15:00
Diazinon	8270SLI	ug/kg	21 U	1	21	150	333-41-5	01/21/09 20:16	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	3 U	1	3	150	97-17-6	01/21/09 20:16	01/16/09 15:00
Dichlorvos	8270	ug/kg	18 U	1	18	150	62-73-7	01/21/09 20:16	01/16/09 15:00
Dicrotophos	8270	ug/kg	19 U	1	19	150	141-66-2	01/21/09 20:16	01/16/09 15:00
Dimethoate	8270	ug/kg	13 U	1	13	150	60-51-5	01/21/09 20:16	01/16/09 15:00
Disulfoton	8270	ug/kg	31 U	1	31	150	298-04-4	01/21/09 20:16	01/16/09 15:00
EPN	8270	ug/kg	16 U	1	16	150	2104-64-5	01/21/09 20:16	01/16/09 15:00
Ethion	8270	ug/kg	19 U	1	19	150	563-12-2	01/21/09 20:16	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	15 U	1	15	150	13194-48-4	01/21/09 20:16	01/16/09 15:00
Famphur	8270	ug/kg	27 U	1	27	150	52-85-7	01/21/09 20:16	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	140 U	1	140	570	122-14-5	01/21/09 20:16	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78940**
Sample Designation **G-32**

Matrix: Soil
Date Collected: 1/13/2009 13:30
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	18 U	1	18	150	115-90-2	01/21/09 20:16	01/16/09 15:00
Fenthion	8270	ug/kg	15 U	1	15	150	55-38-9	01/21/09 20:16	01/16/09 15:00
Fonophos	8270SLI	ug/kg	15 U	1	15	150	944-22-9	01/21/09 20:16	01/16/09 15:00
Leptophos	8270	ug/kg	18 U	1	18	150	21609-90-5	01/21/09 20:16	01/16/09 15:00
Malathion	8270	ug/kg	16 U	1	16	150	121-75-5	01/21/09 20:16	01/16/09 15:00
Merphos	8270SLI	ug/kg	24 U	1	24	150	150-50-5	01/21/09 20:16	01/16/09 15:00
Mevinphos	8270	ug/kg	15 U	1	15	150	7786-34-7	01/21/09 20:16	01/16/09 15:00
Monocrotophos	8270	ug/kg	16 U	1	16	150	6923-22-4	01/21/09 20:16	01/16/09 15:00
Naled	8270	ug/kg	18 U	1	18	150	300-76-5	01/21/09 20:16	01/16/09 15:00
Parathion	8270	ug/kg	12 U	1	12	150	56-38-2	01/21/09 20:16	01/16/09 15:00
Parathion methyl	8270	ug/kg	10 U	1	10	150	298-00-0	01/21/09 20:16	01/16/09 15:00
Phorate	8270	ug/kg	3 U	1	3	150	298-02-2	01/21/09 20:16	01/16/09 15:00
Phosmet	8270	ug/kg	10 U	1	10	150	732-11-6	01/21/09 20:16	01/16/09 15:00
Phosphamidon	8270	ug/kg	25 U	1	25	150	13171-21-6	01/21/09 20:16	01/16/09 15:00
Ronnel	8270SLI	ug/kg	18 U	1	18	150	299-84-3	01/21/09 20:16	01/16/09 15:00
Simazine	8270SLI	ug/kg	19 U	1	19	150	122-34-9	01/21/09 20:16	01/16/09 15:00
Sulfotepp	8270	ug/kg	18 U	1	18	150	3689-24-5	01/21/09 20:16	01/16/09 15:00
Stirofos	8270	ug/kg	18 U	1	18	150	961-11-5	01/21/09 20:16	01/16/09 15:00
TEPP	8270	ug/kg	37 U	1	37	150	107-49-3	01/21/09 20:16	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	18 U	1	18	150	327-98-0	01/21/09 20:16	01/16/09 15:00
Terbufos	8270	ug/kg	3 U	1	3	150	13071-79-9	01/21/09 20:16	01/16/09 15:00
Thionazin	8270	ug/kg	18 U	1	18	150	297-97-2	01/21/09 20:16	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	19 U	1	19	150	34643-46-4	01/21/09 20:16	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78941**
Sample Designation **G-33**

Matrix: Soil
Date Collected: 1/13/2009 14:30
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results		Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321										
Date Extracted	8321		01/16/09							01/16/09 14:00
Date Analyzed	8321		01/20/09		1				01/20/09 17:58	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	65		1		1.4	DEP-SURR-	01/20/09 17:58	01/16/09 14:00
Dicamba	8321	ug/kg	56	U	1	56	220	1918-00-9	01/20/09 17:58	01/16/09 14:00
MCPP	8321	ug/kg	17	U	1	17	69	93-65-2	01/20/09 17:58	01/16/09 14:00
MCPA	8321	ug/kg	26	U	1	26	100	94-74-6	01/20/09 17:58	01/16/09 14:00
Dichlorprop	8321	ug/kg	37	U	1	37	150	120-36-5	01/20/09 17:58	01/16/09 14:00
2,4-D	8321	ug/kg	19	U	1	19	74	94-75-7	01/20/09 17:58	01/16/09 14:00
Silvex	8321	ug/kg	110	U	1	110	440	93-72-1	01/20/09 17:58	01/16/09 14:00
2,4,5-T	8321	ug/kg	77	U	1	77	310	93-76-5	01/20/09 17:58	01/16/09 14:00
2,4-DB	8321	ug/kg	51	U	1	51	210	94-82-6	01/20/09 17:58	01/16/09 14:00
Percent Moisture										
% Moisture	160.3M	%	30				0.14		01/16/09	
Quarternary Ammonium Herbicides										
Date Extracted	549.2-Mod.		01/19/09							01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.057	U	1	0.057	1.4	85-00-7	01/22/09 15:05	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.071	U	1	0.071	1.4	1910-42-5	01/22/09 15:05	01/19/09 10:40
Organophosphorus Pesticides										
Date Extracted	3545a		01/16/09							01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	80		1		1.4	DEP-SURR-	01/21/09 20:35	01/16/09 15:00
Atrazine	8270SLI	ug/kg	20	U	1	20	140	1912-24-9	01/21/09 20:35	01/16/09 15:00
Aspon	8270SLI	ug/kg	8.6	U	1	8.6	140	3244-90-4	01/21/09 20:35	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	29	U	1	29	140	2642-71-9	01/21/09 20:35	01/16/09 15:00
Azinphos methyl	8270	ug/kg	19	U	1	19	140	86-50-0	01/21/09 20:35	01/16/09 15:00
Bolstar	8270SLI	ug/kg	17	U	1	17	140	35400-43-2	01/21/09 20:35	01/16/09 15:00
Carbophenothion	8270	ug/kg	8.6	U	1	8.6	140	786-19-6	01/21/09 20:35	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	16	U	1	16	140	470-90-6	01/21/09 20:35	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	26	U	1	26	140	2921-88-2	01/21/09 20:35	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	17	U	1	17	140	5598-13-0	01/21/09 20:35	01/16/09 15:00
Coumaphos	8270	ug/kg	24	U	1	24	140	56-72-4	01/21/09 20:35	01/16/09 15:00
Crotoxyphos	8270	ug/kg	24	U	1	24	140	7700-17-6	01/21/09 20:35	01/16/09 15:00
Demeton-O+S	8270	ug/kg	31	U	1	31	140	8065-48-3	01/21/09 20:35	01/16/09 15:00
Diazinon	8270SLI	ug/kg	20	U	1	20	140	333-41-5	01/21/09 20:35	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	2.9	U	1	2.9	140	97-17-6	01/21/09 20:35	01/16/09 15:00
Dichlorvos	8270	ug/kg	17	U	1	17	140	62-73-7	01/21/09 20:35	01/16/09 15:00
Dicrotophos	8270	ug/kg	19	U	1	19	140	141-66-2	01/21/09 20:35	01/16/09 15:00
Dimethoate	8270	ug/kg	13	U	1	13	140	60-51-5	01/21/09 20:35	01/16/09 15:00
Disulfoton	8270	ug/kg	30	U	1	30	140	298-04-4	01/21/09 20:35	01/16/09 15:00
EPN	8270	ug/kg	16	U	1	16	140	2104-64-5	01/21/09 20:35	01/16/09 15:00
Ethion	8270	ug/kg	19	U	1	19	140	563-12-2	01/21/09 20:35	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	14	U	1	14	140	13194-48-4	01/21/09 20:35	01/16/09 15:00
Famphur	8270	ug/kg	26	U	1	26	140	52-85-7	01/21/09 20:35	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	140	U	1	140	540	122-14-5	01/21/09 20:35	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78941**
Sample Designation **G-33**

Matrix Soil
Date Collected 1/13/2009 14:30
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	17 U	1	17	140	115-90-2	01/21/09 20:35	01/16/09 15:00
Fenthion	8270	ug/kg	14 U	1	14	140	55-38-9	01/21/09 20:35	01/16/09 15:00
Fonophos	8270SLI	ug/kg	14 U	1	14	140	944-22-9	01/21/09 20:35	01/16/09 15:00
Leptophos	8270	ug/kg	17 U	1	17	140	21609-90-5	01/21/09 20:35	01/16/09 15:00
Malathion	8270	ug/kg	16 U	1	16	140	121-75-5	01/21/09 20:35	01/16/09 15:00
Merphos	8270SLI	ug/kg	23 U	1	23	140	150-50-5	01/21/09 20:35	01/16/09 15:00
Mevinphos	8270	ug/kg	14 U	1	14	140	7786-34-7	01/21/09 20:35	01/16/09 15:00
Monocrotophos	8270	ug/kg	16 U	1	16	140	6923-22-4	01/21/09 20:35	01/16/09 15:00
Naled	8270	ug/kg	17 U	1	17	140	300-76-5	01/21/09 20:35	01/16/09 15:00
Parathion	8270	ug/kg	11 U	1	11	140	56-38-2	01/21/09 20:35	01/16/09 15:00
Parathion methyl	8270	ug/kg	10 U	1	10	140	298-00-0	01/21/09 20:35	01/16/09 15:00
Phorate	8270	ug/kg	2.9 U	1	2.9	140	298-02-2	01/21/09 20:35	01/16/09 15:00
Phosmet	8270	ug/kg	10 U	1	10	140	732-11-6	01/21/09 20:35	01/16/09 15:00
Phosphamidon	8270	ug/kg	24 U	1	24	140	13171-21-6	01/21/09 20:35	01/16/09 15:00
Ronnel	8270SLI	ug/kg	17 U	1	17	140	299-84-3	01/21/09 20:35	01/16/09 15:00
Simazine	8270SLI	ug/kg	19 U	1	19	140	122-34-9	01/21/09 20:35	01/16/09 15:00
Sulfotepp	8270	ug/kg	17 U	1	17	140	3689-24-5	01/21/09 20:35	01/16/09 15:00
Stirofos	8270	ug/kg	17 U	1	17	140	961-11-5	01/21/09 20:35	01/16/09 15:00
TEPP	8270	ug/kg	36 U	1	36	140	107-49-3	01/21/09 20:35	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	17 U	1	17	140	327-98-0	01/21/09 20:35	01/16/09 15:00
Terbufos	8270	ug/kg	2.9 U	1	2.9	140	13071-79-9	01/21/09 20:35	01/16/09 15:00
Thionazin	8270	ug/kg	17 U	1	17	140	297-97-2	01/21/09 20:35	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	19 U	1	19	140	34643-46-4	01/21/09 20:35	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78942**
Sample Designation **G-34**

Matrix: Soil
Date Collected: 1/13/2009 13:10
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 19:20	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	72	1		1.3	DEP-SURR-	01/20/09 19:20	01/16/09 14:00
Dicamba	8321	ug/kg	52 U	1	52	210	1918-00-9	01/20/09 19:20	01/16/09 14:00
MCPP	8321	ug/kg	16 U	1	16	64	93-65-2	01/20/09 19:20	01/16/09 14:00
MCPA	8321	ug/kg	24 U	1	24	96	94-74-6	01/20/09 19:20	01/16/09 14:00
Dichlorprop	8321	ug/kg	35 U	1	35	140	120-36-5	01/20/09 19:20	01/16/09 14:00
2,4-D	8321	ug/kg	17 U	1	17	69	94-75-7	01/20/09 19:20	01/16/09 14:00
Silvex	8321	ug/kg	100 U	1	100	410	93-72-1	01/20/09 19:20	01/16/09 14:00
2,4,5-T	8321	ug/kg	72 U	1	72	290	93-76-5	01/20/09 19:20	01/16/09 14:00
2,4-DB	8321	ug/kg	48 U	1	48	190	94-82-6	01/20/09 19:20	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	25			0.13		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.053 U	1	0.053	1.3	85-00-7	01/22/09 15:16	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.067 U	1	0.067	1.3	1910-42-5	01/22/09 15:16	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	69	1		1.3	DEP-SURR-	01/21/09 20:55	01/16/09 15:00
Atrazine	8270SLI	ug/kg	19 U	1	19	130	1912-24-9	01/21/09 20:55	01/16/09 15:00
Aspon	8270SLI	ug/kg	8 U	1	8	130	3244-90-4	01/21/09 20:55	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	27 U	1	27	130	2642-71-9	01/21/09 20:55	01/16/09 15:00
Azinphos methyl	8270	ug/kg	17 U	1	17	130	86-50-0	01/21/09 20:55	01/16/09 15:00
Bolstar	8270SLI	ug/kg	16 U	1	16	130	35400-43-2	01/21/09 20:55	01/16/09 15:00
Carbophenothion	8270	ug/kg	8 U	1	8	130	786-19-6	01/21/09 20:55	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	15 U	1	15	130	470-90-6	01/21/09 20:55	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	24 U	1	24	130	2921-88-2	01/21/09 20:55	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	16 U	1	16	130	5598-13-0	01/21/09 20:55	01/16/09 15:00
Coumaphos	8270	ug/kg	23 U	1	23	130	56-72-4	01/21/09 20:55	01/16/09 15:00
Crotoxyphos	8270	ug/kg	23 U	1	23	130	7700-17-6	01/21/09 20:55	01/16/09 15:00
Demeton-O+S	8270	ug/kg	29 U	1	29	130	8065-48-3	01/21/09 20:55	01/16/09 15:00
Diazinon	8270SLI	ug/kg	19 U	1	19	130	333-41-5	01/21/09 20:55	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	2.7 U	1	2.7	130	97-17-6	01/21/09 20:55	01/16/09 15:00
Dichlorvos	8270	ug/kg	16 U	1	16	130	62-73-7	01/21/09 20:55	01/16/09 15:00
Dicrotophos	8270	ug/kg	17 U	1	17	130	141-66-2	01/21/09 20:55	01/16/09 15:00
Dimethoate	8270	ug/kg	12 U	1	12	130	60-51-5	01/21/09 20:55	01/16/09 15:00
Disulfoton	8270	ug/kg	28 U	1	28	130	298-04-4	01/21/09 20:55	01/16/09 15:00
EPN	8270	ug/kg	15 U	1	15	130	2104-64-5	01/21/09 20:55	01/16/09 15:00
Ethion	8270	ug/kg	17 U	1	17	130	563-12-2	01/21/09 20:55	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	13 U	1	13	130	13194-48-4	01/21/09 20:55	01/16/09 15:00
Famphur	8270	ug/kg	24 U	1	24	130	52-85-7	01/21/09 20:55	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	130 U	1	130	510	122-14-5	01/21/09 20:55	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78942**
Sample Designation **G-34**

Matrix: Soil
Date Collected: 1/13/2009 13:10
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results		Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides										
Fensulfothion	8270	ug/kg	16	U	1	16	130	115-90-2	01/21/09 20:55	01/16/09 15:00
Fenthion	8270	ug/kg	13	U	1	13	130	55-38-9	01/21/09 20:55	01/16/09 15:00
Fonophos	8270SLI	ug/kg	13	U	1	13	130	944-22-9	01/21/09 20:55	01/16/09 15:00
Leptophos	8270	ug/kg	16	U	1	16	130	21609-90-5	01/21/09 20:55	01/16/09 15:00
Malathion	8270	ug/kg	15	U	1	15	130	121-75-5	01/21/09 20:55	01/16/09 15:00
Merphos	8270SLI	ug/kg	21	U	1	21	130	150-50-5	01/21/09 20:55	01/16/09 15:00
Mevinphos	8270	ug/kg	13	U	1	13	130	7786-34-7	01/21/09 20:55	01/16/09 15:00
Monocrotophos	8270	ug/kg	15	U	1	15	130	6923-22-4	01/21/09 20:55	01/16/09 15:00
Naled	8270	ug/kg	16	U	1	16	130	300-76-5	01/21/09 20:55	01/16/09 15:00
Parathion	8270	ug/kg	11	U	1	11	130	56-38-2	01/21/09 20:55	01/16/09 15:00
Parathion methyl	8270	ug/kg	9.3	U	1	9.3	130	298-00-0	01/21/09 20:55	01/16/09 15:00
Phorate	8270	ug/kg	2.7	U	1	2.7	130	298-02-2	01/21/09 20:55	01/16/09 15:00
Phosmet	8270	ug/kg	9.3	U	1	9.3	130	732-11-6	01/21/09 20:55	01/16/09 15:00
Phosphamidon	8270	ug/kg	23	U	1	23	130	13171-21-6	01/21/09 20:55	01/16/09 15:00
Ronnel	8270SLI	ug/kg	16	U	1	16	130	299-84-3	01/21/09 20:55	01/16/09 15:00
Simazine	8270SLI	ug/kg	17	U	1	17	130	122-34-9	01/21/09 20:55	01/16/09 15:00
Sulfotepp	8270	ug/kg	16	U	1	16	130	3689-24-5	01/21/09 20:55	01/16/09 15:00
Stirofos	8270	ug/kg	16	U	1	16	130	961-11-5	01/21/09 20:55	01/16/09 15:00
TEPP	8270	ug/kg	33	U	1	33	130	107-49-3	01/21/09 20:55	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	16	U	1	16	130	327-98-0	01/21/09 20:55	01/16/09 15:00
Terbufos	8270	ug/kg	2.7	U	1	2.7	130	13071-79-9	01/21/09 20:55	01/16/09 15:00
Thionazin	8270	ug/kg	16	U	1	16	130	297-97-2	01/21/09 20:55	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	17	U	1	17	130	34643-46-4	01/21/09 20:55	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78943**
Sample Designation **G-35**

Matrix: Soil
Date Collected: 1/13/2009 11:35
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 20:00	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	71	1		1.2	DEP-SURR-	01/20/09 20:00	01/16/09 14:00
Dicamba	8321	ug/kg	49 U	1	49	200	1918-00-9	01/20/09 20:00	01/16/09 14:00
MCPP	8321	ug/kg	15 U	1	15	60	93-65-2	01/20/09 20:00	01/16/09 14:00
MCPA	8321	ug/kg	22 U	1	22	90	94-74-6	01/20/09 20:00	01/16/09 14:00
Dichlorprop	8321	ug/kg	32 U	1	32	130	120-36-5	01/20/09 20:00	01/16/09 14:00
2,4-D	8321	ug/kg	16 U	1	16	65	94-75-7	01/20/09 20:00	01/16/09 14:00
Silvex	8321	ug/kg	96 U	1	96	380	93-72-1	01/20/09 20:00	01/16/09 14:00
2,4,5-T	8321	ug/kg	68 U	1	68	270	93-76-5	01/20/09 20:00	01/16/09 14:00
2,4-DB	8321	ug/kg	45 U	1	45	180	94-82-6	01/20/09 20:00	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	20			0.12		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.05 U	1	0.05	1.2	85-00-7	01/22/09 15:26	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.062 U	1	0.062	1.2	1910-42-5	01/22/09 15:26	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	72	1		1.2	DEP-SURR-	01/21/09 21:14	01/16/09 15:00
Atrazine	8270SLI	ug/kg	18 U	1	18	120	1912-24-9	01/21/09 21:14	01/16/09 15:00
Aspon	8270SLI	ug/kg	7.5 U	1	7.5	120	3244-90-4	01/21/09 21:14	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	25 U	1	25	120	2642-71-9	01/21/09 21:14	01/16/09 15:00
Azinphos methyl	8270	ug/kg	16 U	1	16	120	86-50-0	01/21/09 21:14	01/16/09 15:00
Bolstar	8270SLI	ug/kg	15 U	1	15	120	35400-43-2	01/21/09 21:14	01/16/09 15:00
Carbophenothion	8270	ug/kg	7.5 U	1	7.5	120	786-19-6	01/21/09 21:14	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	14 U	1	14	120	470-90-6	01/21/09 21:14	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	22 U	1	22	120	2921-88-2	01/21/09 21:14	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	15 U	1	15	120	5598-13-0	01/21/09 21:14	01/16/09 15:00
Coumaphos	8270	ug/kg	21 U	1	21	120	56-72-4	01/21/09 21:14	01/16/09 15:00
Crotoxyphos	8270	ug/kg	21 U	1	21	120	7700-17-6	01/21/09 21:14	01/16/09 15:00
Demeton-O+S	8270	ug/kg	28 U	1	28	120	8065-48-3	01/21/09 21:14	01/16/09 15:00
Diazinon	8270SLI	ug/kg	18 U	1	18	120	333-41-5	01/21/09 21:14	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	2.5 U	1	2.5	120	97-17-6	01/21/09 21:14	01/16/09 15:00
Dichlorvos	8270	ug/kg	15 U	1	15	120	62-73-7	01/21/09 21:14	01/16/09 15:00
Dicrotophos	8270	ug/kg	16 U	1	16	120	141-66-2	01/21/09 21:14	01/16/09 15:00
Dimethoate	8270	ug/kg	11 U	1	11	120	60-51-5	01/21/09 21:14	01/16/09 15:00
Disulfoton	8270	ug/kg	26 U	1	26	120	298-04-4	01/21/09 21:14	01/16/09 15:00
EPN	8270	ug/kg	14 U	1	14	120	2104-64-5	01/21/09 21:14	01/16/09 15:00
Ethion	8270	ug/kg	16 U	1	16	120	563-12-2	01/21/09 21:14	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	12 U	1	12	120	13194-48-4	01/21/09 21:14	01/16/09 15:00
Famphur	8270	ug/kg	22 U	1	22	120	52-85-7	01/21/09 21:14	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	120 U	1	120	480	122-14-5	01/21/09 21:14	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78943**
Sample Designation **G-35**

Matrix Soil
Date Collected 1/13/2009 11:35
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	15 U	1	15	120	115-90-2	01/21/09 21:14	01/16/09 15:00
Fenthion	8270	ug/kg	12 U	1	12	120	55-38-9	01/21/09 21:14	01/16/09 15:00
Fonophos	8270SLI	ug/kg	12 U	1	12	120	944-22-9	01/21/09 21:14	01/16/09 15:00
Leptophos	8270	ug/kg	15 U	1	15	120	21609-90-5	01/21/09 21:14	01/16/09 15:00
Malathion	8270	ug/kg	14 U	1	14	120	121-75-5	01/21/09 21:14	01/16/09 15:00
Merphos	8270SLI	ug/kg	20 U	1	20	120	150-50-5	01/21/09 21:14	01/16/09 15:00
Mevinphos	8270	ug/kg	12 U	1	12	120	7786-34-7	01/21/09 21:14	01/16/09 15:00
Monocrotophos	8270	ug/kg	14 U	1	14	120	6923-22-4	01/21/09 21:14	01/16/09 15:00
Naled	8270	ug/kg	15 U	1	15	120	300-76-5	01/21/09 21:14	01/16/09 15:00
Parathion	8270	ug/kg	10 U	1	10	120	56-38-2	01/21/09 21:14	01/16/09 15:00
Parathion methyl	8270	ug/kg	8.8 U	1	8.8	120	298-00-0	01/21/09 21:14	01/16/09 15:00
Phorate	8270	ug/kg	2.5 U	1	2.5	120	298-02-2	01/21/09 21:14	01/16/09 15:00
Phosmet	8270	ug/kg	8.8 U	1	8.8	120	732-11-6	01/21/09 21:14	01/16/09 15:00
Phosphamidon	8270	ug/kg	21 U	1	21	120	13171-21-6	01/21/09 21:14	01/16/09 15:00
Ronnel	8270SLI	ug/kg	15 U	1	15	120	299-84-3	01/21/09 21:14	01/16/09 15:00
Simazine	8270SLI	ug/kg	16 U	1	16	120	122-34-9	01/21/09 21:14	01/16/09 15:00
Sulfotepp	8270	ug/kg	15 U	1	15	120	3689-24-5	01/21/09 21:14	01/16/09 15:00
Stirofos	8270	ug/kg	15 U	1	15	120	961-11-5	01/21/09 21:14	01/16/09 15:00
TEPP	8270	ug/kg	31 U	1	31	120	107-49-3	01/21/09 21:14	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	15 U	1	15	120	327-98-0	01/21/09 21:14	01/16/09 15:00
Terbufos	8270	ug/kg	2.5 U	1	2.5	120	13071-79-9	01/21/09 21:14	01/16/09 15:00
Thionazin	8270	ug/kg	15 U	1	15	120	297-97-2	01/21/09 21:14	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	16 U	1	16	120	34643-46-4	01/21/09 21:14	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78944**
Sample Designation **G-36**

Matrix Soil
Date Collected 1/13/2009 10:15
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 20:41	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	64	1		1.2	DEP-SURR-	01/20/09 20:41	01/16/09 14:00
Dicamba	8321	ug/kg	47 U	1	47	190	1918-00-9	01/20/09 20:41	01/16/09 14:00
MCPP	8321	ug/kg	14 U	1	14	58	93-65-2	01/20/09 20:41	01/16/09 14:00
MCPA	8321	ug/kg	22 U	1	22	87	94-74-6	01/20/09 20:41	01/16/09 14:00
Dichlorprop	8321	ug/kg	31 U	1	31	130	120-36-5	01/20/09 20:41	01/16/09 14:00
2,4-D	8321	ug/kg	16 U	1	16	63	94-75-7	01/20/09 20:41	01/16/09 14:00
Silvex	8321	ug/kg	93 U	1	93	370	93-72-1	01/20/09 20:41	01/16/09 14:00
2,4,5-T	8321	ug/kg	65 U	1	65	260	93-76-5	01/20/09 20:41	01/16/09 14:00
2,4-DB	8321	ug/kg	43 U	1	43	170	94-82-6	01/20/09 20:41	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	17			0.12		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.048 U	1	0.048	1.2	85-00-7	01/22/09 15:37	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.06 U	1	0.06	1.2	1910-42-5	01/22/09 15:37	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	74	1		1.2	DEP-SURR-	01/21/09 21:33	01/16/09 15:00
Atrazine	8270SLI	ug/kg	17 U	1	17	120	1912-24-9	01/21/09 21:33	01/16/09 15:00
Aspon	8270SLI	ug/kg	7.2 U	1	7.2	120	3244-90-4	01/21/09 21:33	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	24 U	1	24	120	2642-71-9	01/21/09 21:33	01/16/09 15:00
Azinphos methyl	8270	ug/kg	16 U	1	16	120	86-50-0	01/21/09 21:33	01/16/09 15:00
Bolstar	8270SLI	ug/kg	14 U	1	14	120	35400-43-2	01/21/09 21:33	01/16/09 15:00
Carbophenothion	8270	ug/kg	7.2 U	1	7.2	120	786-19-6	01/21/09 21:33	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	13 U	1	13	120	470-90-6	01/21/09 21:33	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	22 U	1	22	120	2921-88-2	01/21/09 21:33	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	14 U	1	14	120	5598-13-0	01/21/09 21:33	01/16/09 15:00
Coumaphos	8270	ug/kg	20 U	1	20	120	56-72-4	01/21/09 21:33	01/16/09 15:00
Crotoxyphos	8270	ug/kg	20 U	1	20	120	7700-17-6	01/21/09 21:33	01/16/09 15:00
Demeton-O+S	8270	ug/kg	27 U	1	27	120	8065-48-3	01/21/09 21:33	01/16/09 15:00
Diazinon	8270SLI	ug/kg	17 U	1	17	120	333-41-5	01/21/09 21:33	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	2.4 U	1	2.4	120	97-17-6	01/21/09 21:33	01/16/09 15:00
Dichlorvos	8270	ug/kg	14 U	1	14	120	62-73-7	01/21/09 21:33	01/16/09 15:00
Dicrotophos	8270	ug/kg	16 U	1	16	120	141-66-2	01/21/09 21:33	01/16/09 15:00
Dimethoate	8270	ug/kg	11 U	1	11	120	60-51-5	01/21/09 21:33	01/16/09 15:00
Disulfoton	8270	ug/kg	25 U	1	25	120	298-04-4	01/21/09 21:33	01/16/09 15:00
EPN	8270	ug/kg	13 U	1	13	120	2104-64-5	01/21/09 21:33	01/16/09 15:00
Ethion	8270	ug/kg	16 U	1	16	120	563-12-2	01/21/09 21:33	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	12 U	1	12	120	13194-48-4	01/21/09 21:33	01/16/09 15:00
Famphur	8270	ug/kg	22 U	1	22	120	52-85-7	01/21/09 21:33	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	110 U	1	110	460	122-14-5	01/21/09 21:33	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78944**
Sample Designation **G-36**

Matrix Soil
Date Collected 1/13/2009 10:15
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	14 U	1	14	120	115-90-2	01/21/09 21:33	01/16/09 15:00
Fenthion	8270	ug/kg	12 U	1	12	120	55-38-9	01/21/09 21:33	01/16/09 15:00
Fonophos	8270SLI	ug/kg	12 U	1	12	120	944-22-9	01/21/09 21:33	01/16/09 15:00
Leptophos	8270	ug/kg	14 U	1	14	120	21609-90-5	01/21/09 21:33	01/16/09 15:00
Malathion	8270	ug/kg	13 U	1	13	120	121-75-5	01/21/09 21:33	01/16/09 15:00
Merphos	8270SLI	ug/kg	19 U	1	19	120	150-50-5	01/21/09 21:33	01/16/09 15:00
Mevinphos	8270	ug/kg	12 U	1	12	120	7786-34-7	01/21/09 21:33	01/16/09 15:00
Monocrotophos	8270	ug/kg	13 U	1	13	120	6923-22-4	01/21/09 21:33	01/16/09 15:00
Naled	8270	ug/kg	14 U	1	14	120	300-76-5	01/21/09 21:33	01/16/09 15:00
Parathion	8270	ug/kg	9.6 U	1	9.6	120	56-38-2	01/21/09 21:33	01/16/09 15:00
Parathion methyl	8270	ug/kg	8.4 U	1	8.4	120	298-00-0	01/21/09 21:33	01/16/09 15:00
Phorate	8270	ug/kg	2.4 U	1	2.4	120	298-02-2	01/21/09 21:33	01/16/09 15:00
Phosmet	8270	ug/kg	8.4 U	1	8.4	120	732-11-6	01/21/09 21:33	01/16/09 15:00
Phosphamidon	8270	ug/kg	20 U	1	20	120	13171-21-6	01/21/09 21:33	01/16/09 15:00
Ronnel	8270SLI	ug/kg	14 U	1	14	120	299-84-3	01/21/09 21:33	01/16/09 15:00
Simazine	8270SLI	ug/kg	16 U	1	16	120	122-34-9	01/21/09 21:33	01/16/09 15:00
Sulfotepp	8270	ug/kg	14 U	1	14	120	3689-24-5	01/21/09 21:33	01/16/09 15:00
Stirofos	8270	ug/kg	14 U	1	14	120	961-11-5	01/21/09 21:33	01/16/09 15:00
TEPP	8270	ug/kg	30 U	1	30	120	107-49-3	01/21/09 21:33	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	14 U	1	14	120	327-98-0	01/21/09 21:33	01/16/09 15:00
Terbufos	8270	ug/kg	2.4 U	1	2.4	120	13071-79-9	01/21/09 21:33	01/16/09 15:00
Thionazin	8270	ug/kg	14 U	1	14	120	297-97-2	01/21/09 21:33	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	16 U	1	16	120	34643-46-4	01/21/09 21:33	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78945**
Sample Designation **Dup-1**

Matrix Soil
Date Collected 1/13/2009
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/16/09						01/16/09 14:00
Date Analyzed	8321		01/20/09	1				01/20/09 21:21	
2,4-Dichlorophenylacetic acid (5-111)	8321	%	61	1		1.4	DEP-SURR-	01/20/09 21:21	01/16/09 14:00
Dicamba	8321	ug/kg	54 U	1	54	220	1918-00-9	01/20/09 21:21	01/16/09 14:00
MCPP	8321	ug/kg	17 U	1	17	67	93-65-2	01/20/09 21:21	01/16/09 14:00
MCPA	8321	ug/kg	25 U	1	25	100	94-74-6	01/20/09 21:21	01/16/09 14:00
Dichlorprop	8321	ug/kg	36 U	1	36	140	120-36-5	01/20/09 21:21	01/16/09 14:00
2,4-D	8321	ug/kg	18 U	1	18	72	94-75-7	01/20/09 21:21	01/16/09 14:00
Silvex	8321	ug/kg	110 U	1	110	430	93-72-1	01/20/09 21:21	01/16/09 14:00
2,4,5-T	8321	ug/kg	75 U	1	75	300	93-76-5	01/20/09 21:21	01/16/09 14:00
2,4-DB	8321	ug/kg	50 U	1	50	200	94-82-6	01/20/09 21:21	01/16/09 14:00
Percent Moisture									
% Moisture	160.3M	%	28			0.14		01/16/09	
Quarternary Ammonium Herbicides									
Date Extracted	549.2-Mod.		01/19/09						01/19/09 10:40
Diquat	549.2-Mod.	mg/kg	0.056 U	1	0.056	1.4	85-00-7	01/22/09 15:48	01/19/09 10:40
Paraquat	549.2-Mod.	mg/kg	0.069 U	1	0.069	1.4	1910-42-5	01/22/09 15:48	01/19/09 10:40
Organophosphorus Pesticides									
Date Extracted	3545a		01/16/09						01/16/09 15:00
p-terphenyl-d14 (5-130)	8270	%	58	1		1.4	DEP-SURR-	01/21/09 21:52	01/16/09 15:00
Atrazine	8270SLI	ug/kg	19 U	1	19	140	1912-24-9	01/21/09 21:52	01/16/09 15:00
Aspon	8270SLI	ug/kg	8.3 U	1	8.3	140	3244-90-4	01/21/09 21:52	01/16/09 15:00
Azinphos ethyl	8270SLI	ug/kg	28 U	1	28	140	2642-71-9	01/21/09 21:52	01/16/09 15:00
Azinphos methyl	8270	ug/kg	18 U	1	18	140	86-50-0	01/21/09 21:52	01/16/09 15:00
Bolstar	8270SLI	ug/kg	17 U	1	17	140	35400-43-2	01/21/09 21:52	01/16/09 15:00
Carbophenothion	8270	ug/kg	8.3 U	1	8.3	140	786-19-6	01/21/09 21:52	01/16/09 15:00
Chlorfenvinphos	8270	ug/kg	15 U	1	15	140	470-90-6	01/21/09 21:52	01/16/09 15:00
Chlorpyrifos	8270SLI	ug/kg	25 U	1	25	140	2921-88-2	01/21/09 21:52	01/16/09 15:00
Chlorpyrifos methyl	8270SLI	ug/kg	17 U	1	17	140	5598-13-0	01/21/09 21:52	01/16/09 15:00
Coumaphos	8270	ug/kg	24 U	1	24	140	56-72-4	01/21/09 21:52	01/16/09 15:00
Crotoxyphos	8270	ug/kg	24 U	1	24	140	7700-17-6	01/21/09 21:52	01/16/09 15:00
Demeton-O+S	8270	ug/kg	31 U	1	31	140	8065-48-3	01/21/09 21:52	01/16/09 15:00
Diazinon	8270SLI	ug/kg	19 U	1	19	140	333-41-5	01/21/09 21:52	01/16/09 15:00
Dichlofenthion	8270SLI	ug/kg	2.8 U	1	2.8	140	97-17-6	01/21/09 21:52	01/16/09 15:00
Dichlorvos	8270	ug/kg	17 U	1	17	140	62-73-7	01/21/09 21:52	01/16/09 15:00
Dicrotophos	8270	ug/kg	18 U	1	18	140	141-66-2	01/21/09 21:52	01/16/09 15:00
Dimethoate	8270	ug/kg	12 U	1	12	140	60-51-5	01/21/09 21:52	01/16/09 15:00
Disulfoton	8270	ug/kg	29 U	1	29	140	298-04-4	01/21/09 21:52	01/16/09 15:00
EPN	8270	ug/kg	15 U	1	15	140	2104-64-5	01/21/09 21:52	01/16/09 15:00
Ethion	8270	ug/kg	18 U	1	18	140	563-12-2	01/21/09 21:52	01/16/09 15:00
Ethoprop	8270SLI	ug/kg	14 U	1	14	140	13194-48-4	01/21/09 21:52	01/16/09 15:00
Famphur	8270	ug/kg	25 U	1	25	140	52-85-7	01/21/09 21:52	01/16/09 15:00
Fenitrothion	8270SLI	ug/kg	130 U	1	130	530	122-14-5	01/21/09 21:52	01/16/09 15:00

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

SunLabs Sample Number **78945**
Sample Designation **Dup-1**

Matrix: Soil
Date Collected: 1/13/2009
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fensulfothion	8270	ug/kg	17 U	1	17	140	115-90-2	01/21/09 21:52	01/16/09 15:00
Fenthion	8270	ug/kg	14 U	1	14	140	55-38-9	01/21/09 21:52	01/16/09 15:00
Fonophos	8270SLI	ug/kg	14 U	1	14	140	944-22-9	01/21/09 21:52	01/16/09 15:00
Leptophos	8270	ug/kg	17 U	1	17	140	21609-90-5	01/21/09 21:52	01/16/09 15:00
Malathion	8270	ug/kg	15 U	1	15	140	121-75-5	01/21/09 21:52	01/16/09 15:00
Merphos	8270SLI	ug/kg	22 U	1	22	140	150-50-5	01/21/09 21:52	01/16/09 15:00
Mevinphos	8270	ug/kg	14 U	1	14	140	7786-34-7	01/21/09 21:52	01/16/09 15:00
Monocrotophos	8270	ug/kg	15 U	1	15	140	6923-22-4	01/21/09 21:52	01/16/09 15:00
Naled	8270	ug/kg	17 U	1	17	140	300-76-5	01/21/09 21:52	01/16/09 15:00
Parathion	8270	ug/kg	11 U	1	11	140	56-38-2	01/21/09 21:52	01/16/09 15:00
Parathion methyl	8270	ug/kg	9.7 U	1	9.7	140	298-00-0	01/21/09 21:52	01/16/09 15:00
Phorate	8270	ug/kg	2.8 U	1	2.8	140	298-02-2	01/21/09 21:52	01/16/09 15:00
Phosmet	8270	ug/kg	9.7 U	1	9.7	140	732-11-6	01/21/09 21:52	01/16/09 15:00
Phosphamidon	8270	ug/kg	24 U	1	24	140	13171-21-6	01/21/09 21:52	01/16/09 15:00
Ronnel	8270SLI	ug/kg	17 U	1	17	140	299-84-3	01/21/09 21:52	01/16/09 15:00
Simazine	8270SLI	ug/kg	18 U	1	18	140	122-34-9	01/21/09 21:52	01/16/09 15:00
Sulfotepp	8270	ug/kg	17 U	1	17	140	3689-24-5	01/21/09 21:52	01/16/09 15:00
Stirofos	8270	ug/kg	17 U	1	17	140	961-11-5	01/21/09 21:52	01/16/09 15:00
TEPP	8270	ug/kg	35 U	1	35	140	107-49-3	01/21/09 21:52	01/16/09 15:00
Trichloronate	8270SLI	ug/kg	17 U	1	17	140	327-98-0	01/21/09 21:52	01/16/09 15:00
Terbufos	8270	ug/kg	2.8 U	1	2.8	140	13071-79-9	01/21/09 21:52	01/16/09 15:00
Thionazin	8270	ug/kg	17 U	1	17	140	297-97-2	01/21/09 21:52	01/16/09 15:00
Tokuthion	8270SLI	ug/kg	18 U	1	18	140	34643-46-4	01/21/09 21:52	01/16/09 15:00

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78946**
Sample Designation **Equipment Blank-1**

Matrix: Water
Date Collected: 1/13/2009 15:00
Date Received: 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Chlorinated Herbicides by EPA Method 8321									
Date Extracted	8321		01/19/09						01/19/09 16:45
Date Analyzed	8321		01/21/09	1				01/21/09 00:45	
2,4-Dichlorophenylacetic acid (D-131)	8321	%	73	1		1	DEP-SURR-	01/21/09 00:45	01/19/09 16:45
Dicamba	8321	ug/L	0.35 U	1	0.35	1.4	1918-00-9	01/21/09 00:45	01/19/09 16:45
MCPP	8321	ug/L	0.15 U	1	0.15	0.6	93-65-2	01/21/09 00:45	01/19/09 16:45
MCPA	8321	ug/L	0.21 U	1	0.21	0.84	94-74-6	01/21/09 00:45	01/19/09 16:45
Dichlorprop	8321	ug/L	0.32 U	1	0.32	1.3	120-36-5	01/21/09 00:45	01/19/09 16:45
2,4-D	8321	ug/L	0.31 U	1	0.31	1.3	94-75-7	01/21/09 00:45	01/19/09 16:45
2,4,5-TP	8321	ug/L	0.28 U	1	0.28	1.1	93-72-1	01/21/09 00:45	01/19/09 16:45
2,4,5-T	8321	ug/L	0.23 U	1	0.23	0.92	93-76-5	01/21/09 00:45	01/19/09 16:45
2,4-DB	8321	ug/L	1.1 U	1	1.1	4.4	94-82-6	01/21/09 00:45	01/19/09 16:45
Quarternary Ammonium Herbicides									
Date Extracted	549.2		01/20/09						01/20/09 15:00
Diquat	549.2	mg/L	0.0003 U	1	0.0003	0.0012	85-00-7	01/22/09 11:21	01/20/09 15:00
Paraquat	549.2	mg/L	0.0004 U	1	0.0004	0.0016	1910-42-5	01/22/09 11:21	01/20/09 15:00
Organophosphorus Pesticides									
Date Extracted	3510c		01/19/09						01/19/09 15:30
p-terphenyl-d14 (11-122)	8270	%	85	1		1	DEP-SURR-	01/21/09 17:24	01/19/09 15:30
Atrazine	8270SLI	ug/L	0.06 U	1	0.06	1	1912-24-9	01/21/09 17:24	01/19/09 15:30
Aspon	8270SLI	ug/L	0.06 U	1	0.06	1	3244-90-4	01/21/09 17:24	01/19/09 15:30
Azinphos ethyl	8270SLI	ug/L	0.07 U	1	0.07	1	2642-71-9	01/21/09 17:24	01/19/09 15:30
Azinphos methyl	8270	ug/L	0.53 U	1	0.53	2.1	86-50-0	01/21/09 17:24	01/19/09 15:30
Bolstar	8270SLI	ug/L	0.09 U	1	0.09	1	35400-43-2	01/21/09 17:24	01/19/09 15:30
Carbophenothion	8270	ug/L	0.06 U	1	0.06	1	786-19-6	01/21/09 17:24	01/19/09 15:30
Chlorfenvinphos	8270	ug/L	0.2 U	1	0.2	5	470-90-6	01/21/09 17:24	01/19/09 15:30
Chlorpyrifos	8270SLI	ug/L	0.08 U	1	0.08	1	2921-88-2	01/21/09 17:24	01/19/09 15:30
Chlorpyrifos methyl	8270SLI	ug/L	0.08 U	1	0.08	1	5598-13-0	01/21/09 17:24	01/19/09 15:30
Coumaphos	8270	ug/L	0.5 U	1	0.5	2	56-72-4	01/21/09 17:24	01/19/09 15:30
Crotoxyphos	8270	ug/L	0.02 U	1	0.02	5	7700-17-6	01/21/09 17:24	01/19/09 15:30
Demeton-O+S	8270	ug/L	0.02 U	1	0.02	1	8065-48-3	01/21/09 17:24	01/19/09 15:30
Diazinon	8270SLI	ug/L	0.05 U	1	0.05	1	333-41-5	01/21/09 17:24	01/19/09 15:30
Dichlofenthion	8270SLI	ug/L	0.07 U	1	0.07	1	97-17-6	01/21/09 17:24	01/19/09 15:30
Dichlorvos	8270	ug/L	0.06 U	1	0.06	1	62-73-7	01/21/09 17:24	01/19/09 15:30
Dicrotophos	8270	ug/L	0.16 U	1	0.16	1	141-66-2	01/21/09 17:24	01/19/09 15:30
Dimethoate	8270	ug/L	0.07 U	1	0.07	1	60-51-5	01/21/09 17:24	01/19/09 15:30
Disulfoton	8270	ug/L	0.04 U	1	0.04	1	298-04-4	01/21/09 17:24	01/19/09 15:30
EPN	8270	ug/L	0.21 U	1	0.21	1	2104-64-5	01/21/09 17:24	01/19/09 15:30
Ethion	8270	ug/L	0.11 U	1	0.11	1	563-12-2	01/21/09 17:24	01/19/09 15:30
Ethoprop	8270SLI	ug/L	0.05 U	1	0.05	1	13194-48-4	01/21/09 17:24	01/19/09 15:30
Famphur	8270	ug/L	0.12 U	1	0.12	1	52-85-7	01/21/09 17:24	01/19/09 15:30
Fenitrothion	8270SLI	ug/L	0.05 U	1	0.05	1	122-14-5	01/21/09 17:24	01/19/09 15:30
Fensulfothion	8270	ug/L	0.08 U	1	0.08	1	115-90-2	01/21/09 17:24	01/19/09 15:30
Fenthion	8270	ug/L	0.06 U	1	0.06	1	55-38-9	01/21/09 17:24	01/19/09 15:30

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Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

SunLabs Sample Number **78946**
Sample Designation **Equipment Blank-1**

Matrix Water
Date Collected 1/13/2009 15:00
Date Received 1/15/2009 10:05

Parameters	Method	Units	Results	Dil Factor	MDL	RL	CAS Number	Date/Time Analyzed	Date/Time Prep
Organophosphorus Pesticides									
Fonophos	8270SLI	ug/L	0.08 U	1	0.08	1	944-22-9	01/21/09 17:24	01/19/09 15:30
Leptophos	8270	ug/L	0.26 U	1	0.26	1	21609-90-5	01/21/09 17:24	01/19/09 15:30
Malathion	8270	ug/L	0.07 U	1	0.07	1	121-75-5	01/21/09 17:24	01/19/09 15:30
Merphos	8270	ug/L	0.02 U	1	0.02	1	150-50-5	01/21/09 17:24	01/19/09 15:30
Mevinphos	8270	ug/L	0.05 U	1	0.05	1	7786-34-7	01/21/09 17:24	01/19/09 15:30
Monocrotophos	8270	ug/L	0.05 U	1	0.05	1	6923-22-4	01/21/09 17:24	01/19/09 15:30
Naled	8270	ug/L	0.21 U	1	0.21	1	300-76-5	01/21/09 17:24	01/19/09 15:30
Parathion	8270	ug/L	0.07 U	1	0.07	1	56-38-2	01/21/09 17:24	01/19/09 15:30
Parathion methyl	8270	ug/L	0.05 U	1	0.05	1	298-00-0	01/21/09 17:24	01/19/09 15:30
Phorate	8270	ug/L	0.04 U	1	0.04	1	298-02-2	01/21/09 17:24	01/19/09 15:30
Phosmet	8270	ug/L	0.14 U	1	0.14	1	732-11-6	01/21/09 17:24	01/19/09 15:30
Phosphamidon	8270	ug/L	0.18 U	1	0.18	1	13171-21-6	01/21/09 17:24	01/19/09 15:30
Ronnel	8270SLI	ug/L	0.05 U	1	0.05	1	299-84-3	01/21/09 17:24	01/19/09 15:30
Simazine	8270SLI	ug/L	0.07 U	1	0.07	1	122-34-9	01/21/09 17:24	01/19/09 15:30
Sulfotepp	8270	ug/L	0.08 U	1	0.08	1	3689-24-5	01/21/09 17:24	01/19/09 15:30
Stirofos	8270	ug/L	0.08 U	1	0.08	1	961-11-5	01/21/09 17:24	01/19/09 15:30
TEPP	8270	ug/L	0.02 U	1	0.02	1	107-49-3	01/21/09 17:24	01/19/09 15:30
Trichloronate	8270SLI	ug/L	0.08 U	1	0.08	1	327-98-0	01/21/09 17:24	01/19/09 15:30
Terbufos	8270	ug/L	0.09 U	1	0.09	1	13071-79-9	01/21/09 17:24	01/19/09 15:30
Thionazin	8270	ug/L	0.05 U	1	0.05	1	297-97-2	01/21/09 17:24	01/19/09 15:30
Tokuthion	8270SLI	ug/L	0.06 U	1	0.06	1	34643-46-4	01/21/09 17:24	01/19/09 15:30

Report of Laboratory Analysis

SunLabs Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

Footnotes	
*	SunLabs is not currently NELAC certified for this analyte.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MB	Method Blank
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Sample not analyzed at client's request.
RL	RL(reporting limit) = PQL(practical quantitation limit).
RPD	Relative Percent Difference
U	Compound was analyzed for but not detected.
V	Indicates that the analyte was detected in both the sample and the associated method blank.

Quality Control Data

Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

Batch No: C7897

Test: Chlorinated Herbicides by EPA Method 8321

TestCode: 8321-s

Associated Samples: 78938, 78939, 78940, 78941, 78942, 78943, 78944, 78945

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number									*78939*	*78939*					
2,4-Dichlorophenylacetic acid (5-111)	79														
Dicamba	39 U	5	80	71	12	44	53-107	5	64	75	16	48	0-94		
MCPP	12 U	5	81	74	9	44	44-107	5	69	69	0	56	0-90		
MCPA	18 U	5	79	72	9	36	45-102	5	67	62	8	45	0-92		
Dichlorprop	26 U	5	79	72	9	44	46-103	5	66	65	2	53	0-85		
2,4-D	13 U	5	93	83	11	55	32-129	5	69	64	8	50	0-89		
Silvex	77 U	5	88	78	12	46	46-112	5	69	72	4	48	14-133		
2,4,5-T	54 U	5	80	72	11	43	45-103	5	62	60	3	52	0-90		
2,4-DB	36 U	5	85	78	9	38	48-111	5	78	77	1	61	0-90		

Batch No: C7899

Test: Organophosphorus Pesticides

TestCode: 8270-OGP-S-CAS

Associated Samples: 78938, 78939, 78940, 78941, 78942, 78943, 78944, 78945

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number									*78939*	*78939*					
p-terphenyl-d14 (5-130)	63														
Atrazine	14 U														
Aspon	6.0 U														
Azinphos ethyl	20 U														
Azinphos methyl	13 U	5000	71	85	18 *	16	0-152	5000	115	136 *	17	26	0-124		
Bolstar	12 U	5000	76	81	6	18	36-103	5000	95	103 *	8	39	37-99		
Carbophenothion	6.0 U														
Chlorfenvinphos	11 U														
Chlorpyrifos	18 U	5000	88	86	2	5	47-94	5000	104 *	110 *	6	44	40-89		
Chlorpyrifos methyl	12 U														
Coumaphos	17 U	5000	77	82	6	15	37-114	5000	118 *	141 *	18	20	33-110		
Crotoxyphos	17 U														
Demeton-O+S	22 U	5000	77	87	12	13	56-129	5000	107	120	11	31	4-129		
Diazinon	14 U	5000	91	89	2	10	18-109	5000	111 *	117 *	5	25	16-108		
Dichlofenthion	2.0 U														
Dichlorvos	12 U	5000	40	46	14	40	5-110	5000	101	107	6	41	10-166		
Dicrotophos	13 U														
Dimethoate	9.0 U	5000	70	79	12	28	43-107	5000	96	100	4	19	30-115		
Disulfoton	21 U	5000	83	81	2	10	38-108	5000	95 *	100 *	5	25	16-90		
EPN	11 U	5000	63	64	2	10	21-151	5000	101	112	10	16	1-176		
Ethion	13 U														
Ethoprop	10 U	5000	69	79	14 *	7	50-100	5000	100	105	5	30	40-108		
Famphur	18 U														
Fenitrothion	95 U														
Fensulfothion	12 U														
Fenthion	10 U	5000	98	98	0	5	63-112	5000	116 *	124 *	7	35	47-105		
Fonophos	10 U														
Leptophos	12 U														
Malathion	11 U	5000	75	76	1	11	44-97	5000	108 *	113 *	5	39	44-101		
Merphos	16 U														
Mevinphos	10 U	5000	59	65	10	25	40-83	5000	103	110 *	7	42	40-106		
Monocrotophos	11 U														
Naled	12 U														
Parathion	8.0 U	5000	69	74	7	7	35-135	5000	95	101	6	35	22-139		
Parathion methyl	7.0 U	5000	65	73	12	17	41-104	5000	89	96	8	32	28-118		

Quality Control Data

Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

Batch No: C7899

Test: Organophosphorus Pesticides

TestCode: 8270-OGP-S-CAS

Associated Samples: 78938, 78939, 78940, 78941, 78942, 78943, 78944, 78945

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number									*78939*	*78939*					
Phorate	2.0 U	5000	75	77	3	11	41-108	5000	95	101	6	13	32-106		
Phosmet	7.0 U														
Phosphamidon	17 U														
Ronnel	12 U	5000	78	81	4	10	47-96	5000	91 *	98 *	7	36	40-88		
Simazine	13 U														
Sulfotepp	12 U														
Stirofos	12 U														
TEPP	25 U														
Trichloronate	12 U	5000	90	88	2	4	47-119	5000	105	109	4	41	45-118		
Terbufos	2.0 U														
Thionazin	12 U														
Tokuthion	13 U	5000	78	80	3	10	15-137	5000	93	100	7	40	33-109		

Batch No: C7909

Test: Quarternary Ammonium Herbicides

TestCode: 549.2-S

Associated Samples: 78938, 78939, 78940, 78941, 78942, 78943, 78944, 78945

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number									*78939*	*78939*					
Date Extracted	01/19/09		19/09	19/09	0				19/09	19/09	0				
Diquat	0.04 U	1000	50	43	15	15	37-97	1000	17	15	12	21	0-159		
Paraquat	0.05 U	1000	67	71	6	10	33-88	1000	22	24	9	169	0-130		

Batch No: C7917

Test: Organophosphorus Pesticides

TestCode: 8270-OGP-W

Associated Samples: 78946

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number															
p-terphenyl-d14 (11-122)	72														
Atrazine	0.06 U														
Aspon	0.06 U														
Azinphos ethyl	0.07 U														
Azinphos methyl	0.53 U	5000	84	84	0	16	0-152								
Bolstar	0.09 U	5000	100	96	4	18	36-103								
Carbophenothion	0.06 U														
Chlorfenvinphos	0.2 U														
Chlorpyrifos	0.08 U	5000	116 *	110 *	5	5	47-94								
Chlorpyrifos methyl	0.08 U														
Coumaphos	0.5 U	5000	90	92	2	15	37-114								
Crotoxyphos	0.02 U														
Demeton-O+S	0.02 U	5000	91	96	5	13	56-129								
Diazinon	0.05 U	5000	121 *	118 *	3	10	18-109								
Dichlofenthion	0.07 U														
Dichlorvos	0.06 U	5000	111 *	104	7	40	5-110								
Dicrotophos	0.16 U														
Dimethoate	0.07 U	5000	73	72	1	28	43-107								
Disulfoton	0.04 U	5000	113 *	109 *	4	10	38-108								
EPN	0.21 U	5000	85	85	0	10	21-151								
Ethion	0.11 U														

Quality Control Data

Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description: J0900163

January 27, 2009

Batch No: C7917

Test: Organophosphorus Pesticides

TestCode: 8270-OGP-W

Associated Samples: 78946

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number															
Ethoprop	0.05 U	5000	99	98	1	7	50-100								
Famphur	0.12 U														
Fenitrothion	0.05 U														
Fensulfothion	0.08 U	5000	93 *	97 *	4 *	0	85-90								
Fenthion	0.06 U	5000	125 *	119 *	5	5	63-112								
Fonophos	0.08 U														
Leptophos	0.26 U														
Malathion	0.07 U	5000	100 *	97	3	11	44-97								
Merphos	0.02 U														
Mevinphos	0.05 U	5000	94 *	95 *	1	25	40-83								
Monocrotophos	0.05 U														
Naled	0.21 U														
Parathion	0.07 U	5000	93	92	1	7	35-135								
Parathion methyl	0.05 U	5000	88	86	2	17	41-104								
Phorate	0.04 U	5000	99	95	4	11	41-108								
Phosmet	0.14 U														
Phosphamidon	0.18 U														
Ronnel	0.05 U	5000	98 *	95	3	10	47-96								
Simazine	0.07 U														
Sulfotepp	0.08 U														
Stirofos	0.08 U	5000	89	86	3	20	45-92								
TEPP	0.02 U														
Trichloronate	0.08 U														
Terbufos	0.09 U														
Thionazin	0.05 U														
Tokuthion	0.06 U	5000	97	96	1	10	15-137								

Batch No: C7919

Test: Chlorinated Herbicides by EPA Method 8321

TestCode: 8321-w

Associated Samples: 78946

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number															
2,4-Dichlorophenylacetic acid (D-131)	67														
Dicamba	0.35 U	5	72	72	0	44	53-107								
MCPP	0.15 U	5	75	71	5	44	44-107								
MCPA	0.21 U	5	73	69	6	36	45-102								
Dichlorprop	0.32 U	5	73	68	7	44	46-103								
2,4-D	0.31 U	5	81	76	6	55	32-129								
2,4,5-TP	0.28 U	5	78	73	7	22	55-110								
2,4,5-T	0.23 U	5	72	68	6	43	45-103								
2,4-DB	1.1 U	5	76	72	5	38	48-111								

Batch No: C7930

Test: Quarternary Ammonium Herbicides

TestCode: 549.2

Associated Samples: 78946

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number									*78946*						
Date Extracted	01/20/09														

Quality Control Data

Project Number	Columbia Analytical Services, Inc.
090115.04	Project Description
	J0900163

January 27, 2009

Batch No: **C7930**

Test: Quarternary Ammonium Herbicides

TestCode: 549.2

Associated Samples
78946

Compound	Blank	LCS Spike	LCS %Rec	LCSD %Rec	RPD %	---QC Limits--- RPD	LCS	MS Spike	MS %Rec	MSD %Rec	RPD %	---QC Limits--- RPD	MS	Dup RPD	Qualifiers
Parent Sample Number									*78946*						
Diquat	0.0003 U	1000	79	80	1	15	37-97	1000	86				0-159		
Paraquat	0.0004 U	1000	85	84	1	10	33-88	1000	91				0-130		

* indicates value is outside control limits for %Recovery or greater than acceptance criteria for RP

Footnotes

I	*The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.*
U	*Compound was analyzed for but not detected.*

Columbia Analytical Services, Inc. Chain of Custody

9143 Philips Highway • Jacksonville, FL 32256 • 904-739-2277 • FAX 904-739-2011

CAS Contact: Craig Myers

Project Number: J0900163
Project Manager: Craig Myers

090115.04

Lab Code	Sample ID	# of Cont.	Matrix	Sample Date	Sample Time	Lab ID	HERB 8151A	MISC_OUT_1 None (549.2)	PEST_OP 8141A	PEST_OP 8141B	
J0900163-001	G-30	1	Soil	1/13/09	1215	SunLabs	X	X	X		78938
J0900163-002	G-31	2	Soil	1/13/09	1040	SunLabs					MS/MSD 78939
J0900163-003	G-32		Soil	1/13/09	1330	SunLabs					78940
J0900163-004	G-33		Soil	1/13/09	1430	SunLabs					78941
J0900163-005	G-34		Soil	1/13/09	1310	SunLabs					78942
J0900163-006	G-35		Soil	1/13/09	1135	SunLabs					78943
J0900163-007	G-36		Soil	1/13/09	1015	SunLabs					78944
J0900163-008	DUP-1		Soil	1/13/09	0000	SunLabs					78945
J0900163-009	Equipment Blank-1	3	Water	1/13/09	1500	SunLabs				X	78946

Test Comments

PEST_OP - 8141A	J0900163-001,3,4,5,6,7,8	Report Standard SFWMD Reporting List
PEST_OP - 8141A	J0900163-002	Report Standard SFWMD Reporting List USE FOR MS/MSD
PEST_OP - 8141B	J0900163-009	Report Standard SFWMD Reporting List
HERB - 8151A	J0900163-001,3,4,5,6,7,8,9	Report Standard SFWMD Reporting List

2.8°C

Special Instructions/Comments	Turnaround Requirements	Report Requirements	Invoice Information
PLEASE SEND RESULTS TO MANDY SULLIVAN	____RUSH (Surcharges Apply) PLEASE CIRCLE WORK DAYS 1 2 3 4 5 ✓ STANDARD Requested FAX Date: ____ Requested Report Date: 01/28/09	____I. Results Only ✓ II. Results + QC Summaries ____III. Results + QC and Calibration Summaries ____IV. Data Validation Report with Raw Data PQL/MDL/J Y EDD Y ADaPT EDD Required	PO# J0900163 Bill to

Relinquished By: Shawn Lightsey 1-14-09 Received By: J. Walkin 1/15/09 1005 Airbill Number:

1018

Columbia Analytical Services, Inc. Chain of Custody

9143 Philips Highway • Jacksonville, FL 32256 • 904-739-2277 • FAX 904-739-2011

CAS Contact: Craig Myers

Test Comments

HERB - 8151A	J0900163-002	Report Standard SFWMD Reporting List USE FOR MS/MSD
MISC_OUT_1 - None	J0900163-009	Analyze and report Paraquat by EPA Method 549.2
MISC_OUT_1 - None	J0900163-001,3,4,5,6,7,8	Analyze and report Paraquat by EPA Method 549.2M
MISC_OUT_1 - None	J0900163-002	Analyze and report Paraquat by EPA Method 549.2M USE FOR MS/MSD

Special Instructions/Comments	Turnaround Requirements	Report Requirements	Invoice Information
	____RUSH (Surcharges Apply) PLEASE CIRCLE WORK DAYS 1 2 3 4 5 ____STANDARD Requested FAX Date: _____ Requested Report Date: 01/28/09	____I. Results Only ____II. Results + QC Summaries ____III. Results + QC and Calibration Summaries ____IV. Data Validation Report with Raw Data PQL/MDL/I Y EDD Y	PO# J0900163 Bill to

Relinquished By: _____ Received By: _____ Airbill Number: _____

Page 2

67

1019

February 10, 2009

Mr. Ed Leding
URS Corporation
7800 Congress Ave.
Suite 200
Boca Raton, FL 33487

RE: 38617-355/FROG POND HYDROLOGIC Order No.: F09010483

Dear Mr. Ed Leding:

PAS, Inc. received 8 samples on 1/14/2009 10:50:00 AM for the analyses presented in the following report.
Analyses are performed with method-required calibration and QA/QC samples whenever applicable. Method performance, which is based on the calibration and QA/QC samples, establishes the validity and certainty of the reported sample results. This data is provided along with the sample results when requested.

Thank you for this opportunity to be of service. If you have any questions regarding this data, please feel free to call me at (386) 672-5668, extension 308.

Sincerely,
Martha Montero

Martha Montero
Project Manager
ELAB, Inc.
P.O. Box 468
Ormond Beach, FL 32175-0468

THIS DOCUMENT MEETS NELAC STANDARDS
NELAC Certification #E83079

The following acronyms may be utilized within this report:

%REC	Percent Recovery
A	Absent
ABLK	Analytical Method Blank
CG	Confluent Growth
CGB	Confluent Growth Without Coliforms
CGC	Confluent Growth With Coliforms
DUP	Sample Duplicate
LCS	Laboratory Control Spike (may also be appended with an abbreviation indicating spiking level)
MBLK	Preparation Method Blank
MDL	Laboratory Method Detection Limit
MS	Matrix Spike (may also be appended with an abbreviation indicating spiking level)
MSD	Matrix Spike Duplicate (may also be appended with an abbreviation indicating spiking level)
P	Present
PQL	Practical Quantitation Limit
QCS	Alternate source Calibration Verification Standard (may also be reported as analytical LCS in some
RL	Reporting Limit
RPD	Relative Percent Difference
SPK	Spike
TIC	Tentatively Identified Compound
TNTC	Too Numerous To Count

The following notes may apply to analytical results within this report:

Residue (solids) analysis may employ a single, heated drying process of at least 12 hours duration in lieu of employing short, repeated drying cycles, which represents a deviation from the methodology.

Because the EPA-recommended holding time for pH, residual chlorine, chloramines and chlorine dioxide is 15 minutes from time of collection, these analyses are routinely performed outside of their EPA-recommended holding time when performed in the laboratory.

Analytical results for ammonia analysis, or calculated analytical results depending on ammonia analysis, do not include a sample distillation procedure. A study comparing distilled versus non-distilled analytical results has been performed to document the validity of the analysis without prior distillation, and represents equivalent results for the represented project matrices.

Since N-nitrosodiphenylamine decomposes in the GC inlet and cannot be chromatographically resolved from diphenylamine, these compounds are reported as a single analyte in the report.

Since m-cresol and p-cresol cannot be chromatographically resolved, these compounds are reported as a single analyte in the report.

The following certifications may apply to analytical results within this report:

Alabama	DEM	41320
Arizona	DHS	AZ0640
Colorado	DPHE	FL NELAC Reciprocity
Connecticut	DPH	PH-0216
Florida	DOH	E83079
Georgia	DNR	955
Kentucky	DEP	90050
Maine	LCP	2006032
Massachusetts	DEP	M-FL020
Michigan	DEQ	9911
Mississippi	DOH	FL NELAC Reciprocity
Nevada	EP	ELAB FL-00020
New Hampshire	DES	295805
New Jersey	DEP	FL765
New York	DOH	11608
Pennsylvania	DEP	68-00547
Puerto Rico	DOH	FL 00020
South Carolina	DHEC	96027001
Tennessee	DOH	02974
Texas	CEQ	T104704184-05-TX

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

WorkOrder Sample Summary

CLIENT: URS Corporation
Project: 38617-355/FROG POND HYDROLOGIC
Lab Order: F09010483

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
F09010483-001	G-31 (SPLIT)		1/13/2009 10:40:00 AM	1/14/2009
F09010483-002	G-30		1/13/2009 12:15:00 PM	1/14/2009
F09010483-003	G-31		1/13/2009 10:40:00 AM	1/14/2009
F09010483-004	G-32		1/13/2009 1:30:00 PM	1/14/2009
F09010483-005	G-33		1/13/2009 2:30:00 PM	1/14/2009
F09010483-006	G-34		1/13/2009 1:10:00 PM	1/14/2009
F09010483-007	G-35		1/13/2009 11:35:00 AM	1/14/2009
F09010483-008	G-36		1/13/2009 10:15:00 AM	1/14/2009

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87

Case Narrative

CLIENT: URS Corporation
Project: 38617-355/FROG POND HYDROLOGIC
Lab Order: F09010483

I. SAMPLE RECEIVING/ CUSTODY

The samples were received and processed by the Sample Custody section of the laboratory. There were no significant logistics or quality problems unless noted below.

The work order had containers which were sent to Pace Analytical (E87948; 1241 Belleviue Street, Suite 9, Green Bay, WI. 54302; (920) 469-2496) for SW9060 soil matrix.

II. ANALYTICAL DATA

The samples were analyzed according to the laboratory's Standard Operating Procedures for the methodologies requested. There were no significant logistics or quality problems unless noted below or in the text of the report.

III. QUALITY CONTROL

There were no significant quality control problems unless noted below or in the text of the report.

EPA 549.2. At client request a recorded sample weigth was leachated and the leachate was extracted by method 549.2. The laboratory does not hold certification for Paraquat in soil matrix, it has certification in liquid matrix.

EPA 8081 Because the Continuing Calibration Verification standard (CCV) recovery for target compound DDT and methoxychlor exceeded method guidance criteria (low bias), affecting sample G-31 (SPLIT), a Reporting Limit (RL) standard was analyzed at the end of the analytical sequence. All affected target compounds were detected in this RL standard, which demonstrates appropriate instrument sensitivity; consequently, all samples in the affected batches not exhibiting the presence of this target compound are reported.

EPA 8081 For samples G-31 (SPLIT) MS and G-31 (SPLIT) MSD, the Internal Standard failed method guidance criteria (high bias).

SW6010 Sample G-31 (SPLIT) required a dilution due to matrix interference, which resulted in elevated reporting limits for the target compounds.

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation **Client Sample ID:** G-31 (SPLIT)
Lab Order: F09010483 **Collection Date:** 1/13/2009 10:40:00 AM
Project: 38617-355/FROG POND HYDROLOGIC **Sample Description:**
Lab ID: F09010483-001 **Matrix:** Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
ICP METALS		**SW6010**	PrepDate:	**1/15/2009 8:25:00 A**		Analyst: **TPI**		
Arsenic	1.1		0.26	0.52	mg/Kg-dry	1	01/23/09 00:27	58622
Barium	14		0.13	2.6	mg/Kg-dry	5	01/24/09 07:58	58622
Cadmium	0.18	I	0.13	0.26	mg/Kg-dry	5	01/24/09 07:58	58622
Chromium	20		0.64	1.3	mg/Kg-dry	5	01/24/09 07:58	58622
Copper	77		0.64	1.3	mg/Kg-dry	5	01/24/09 07:58	58622
Lead	6.0		1.3	2.6	mg/Kg-dry	5	01/24/09 07:58	58622
Selenium	1.9	U	1.9	3.9	mg/Kg-dry	5	01/24/09 07:58	58622
Silver	0.64	U	0.64	1.3	mg/Kg-dry	5	01/24/09 07:58	58622
Zinc	62		2.6	5.2	mg/Kg-dry	5	01/24/09 07:58	58622
MERCURY		**SW7471**	PrepDate:	**1/16/2009 11:36:00 A**		Analyst: **SKA**		
Mercury	0.020	I	0.011	0.021	mg/Kg-dry	1	01/19/09 15:34	58661
549: DIQUAT/PARAQUAT BY HPLC		**E549.2**	PrepDate:	**1/15/2009 10:30:00 A**		Analyst: **BC**		
Paraquat	29	U	29	50	µg/kg-dry	1	01/15/08 20:21	58609
8081: PESTICIDES, ORGANOCHLORINE		**SW8081**	PrepDate:	**1/16/2009 9:45:00 A**		Analyst: **CL**		
Aldrin	0.072	U	0.072	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
alpha-BHC	0.085	U	0.085	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
beta-BHC	0.095	U	0.095	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
delta-BHC	0.11	U	0.11	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
gamma-BHC	0.18	U	0.18	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
alpha-Chlordane	0.046	U	0.046	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
gamma-Chlordane	0.084	U	0.084	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Chlordane	20	U	20	21	µg/Kg-dry	1	01/17/09 02:34	58654
4,4'-DDD	0.16	U	0.16	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
4,4'-DDE	0.075	U	0.075	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
4,4'-DDT	0.12	U	0.12	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Dieldrin	0.049	U	0.049	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Endosulfan I	0.26	I	0.031	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Endosulfan II	0.070	U	0.070	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Endosulfan sulfate	0.053	U	0.053	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Endrin	0.064	U	0.064	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Endrin aldehyde	0.082	U	0.082	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Endrin ketone	0.099	U	0.099	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Heptachlor	0.048	U	0.048	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Heptachlor epoxide	0.14	U	0.14	2.1	µg/Kg-dry	1	01/17/09 02:34	58654

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation **Client Sample ID:** G-31 (SPLIT)
Lab Order: F09010483 **Collection Date:** 1/13/2009 10:40:00 AM
Project: 38617-355/FROG POND HYDROLOGIC **Sample Description:**
Lab ID: F09010483-001 **Matrix:** Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
8081: PESTICIDES, ORGANOCHLORINE		**SW8081**	PrepDate:	**1/16/2009 9:45:00 A**			Analyst: **CL**	
Methoxychlor	1.3	U	1.3	2.1	µg/Kg-dry	1	01/17/09 02:34	58654
Toxaphene	9.1	U	9.1	21	µg/Kg-dry	1	01/17/09 02:34	58654
Surr: Decachlorobiphenyl	93.5		0	15-160	%REC	1	01/17/09 02:34	58654
Surr: Tetrachloro-m-xylene	94.7		0	15-160	%REC	1	01/17/09 02:34	58654
8141: PESTICIDES, ORGANOPHOSPHORUS		**SW8141**	PrepDate:	**1/15/2009 4:00:00 PM**			Analyst: **JKR**	
Atrazine	21	U	21	120	µg/Kg-dry	1	01/16/09 22:24	58634
Azinphos methyl	3.9	U	3.9	41	µg/Kg-dry	1	01/16/09 22:24	58634
Carbophenothion	11	U	11	41	µg/Kg-dry	1	01/16/09 22:24	58634
Chlorpyrifos	4.5	U	4.5	41	µg/Kg-dry	1	01/16/09 22:24	58634
Coumaphos	7.2	U	7.2	41	µg/Kg-dry	1	01/16/09 22:24	58634
Demeton-O	9.0	U	9.0	41	µg/Kg-dry	1	01/16/09 22:24	58634
Demeton-S	5.1	U	5.1	41	µg/Kg-dry	1	01/16/09 22:24	58634
Diazinon	6.3	U	6.3	41	µg/Kg-dry	1	01/16/09 22:24	58634
Dichlorvos	6.4	U	6.4	41	µg/Kg-dry	1	01/16/09 22:24	58634
Dimethoate	2.8	U	2.8	41	µg/Kg-dry	1	01/16/09 22:24	58634
Disulfoton	12	U	12	41	µg/Kg-dry	1	01/16/09 22:24	58634
Ethion	5.8	U	5.8	41	µg/Kg-dry	1	01/16/09 22:24	58634
Ethoprop	5.6	U	5.6	41	µg/Kg-dry	1	01/16/09 22:24	58634
Famphur	3.7	U	3.7	41	µg/Kg-dry	1	01/16/09 22:24	58634
Fensulfothion	11	U	11	41	µg/Kg-dry	1	01/16/09 22:24	58634
Malathion	5.0	U	5.0	41	µg/Kg-dry	1	01/16/09 22:24	58634
Mevinphos	5.5	U	5.5	41	µg/Kg-dry	1	01/16/09 22:24	58634
Monocrotophos	21	U	21	83	µg/Kg-dry	1	01/16/09 22:24	58634
Parathion, Ethyl	11	U	11	83	µg/Kg-dry	1	01/16/09 22:24	58634
Parathion, Methyl	5.7	U	5.7	41	µg/Kg-dry	1	01/16/09 22:24	58634
Phorate	17	U	17	83	µg/Kg-dry	1	01/16/09 22:24	58634
Phosmet	10	U	10	41	µg/Kg-dry	1	01/16/09 22:24	58634
Simazine	16	U	16	66	µg/Kg-dry	1	01/16/09 22:24	58634
Surr: 4-Chloro-3-nitrobenzotrifluoric	78.1		0	15-133	%REC	1	01/16/09 22:24	58634
8151: HERBICIDES, CHLORINATED BY GC		**SW8151**	PrepDate:	**1/15/2009 9:30:00 A**			Analyst: **PC**	
2,4-D	7.8	U	7.8	39	µg/Kg-dry	1	01/21/09 23:08	58607
2,4-DB	15	U	15	78	µg/Kg-dry	1	01/21/09 23:08	58607
Dalapon	11	U	11	38	µg/Kg-dry	1	01/21/09 23:08	58607
Dicamba	0.80	U	0.80	3.9	µg/Kg-dry	1	01/21/09 23:08	58607
Dinoseb	1.8	U	1.8	7.8	µg/Kg-dry	1	01/21/09 23:08	58607

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation
Lab Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC
Lab ID: F09010483-001

Client Sample ID: G-31 (SPLIT)
Collection Date: 1/13/2009 10:40:00 AM
Sample Description:
Matrix: Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
8151: HERBICIDES, CHLORINATED BY GC		**SW8151**	PrepDate:	**1/15/2009 9:30:00 A**			Analyst: **PC**	
Pentachlorophenol	0.42	U	0.42	1.2	µg/Kg-dry	1	01/21/09 23:08	58607
Picloram	0.30	U	0.30	3.9	µg/Kg-dry	1	01/21/09 23:08	58607
2,4,5-T	1.3	U	1.3	7.9	µg/Kg-dry	1	01/21/09 23:08	58607
2,4,5-TP (Silvex)	1.4	U	1.4	7.9	µg/Kg-dry	1	01/21/09 23:08	58607
Surr: DCAA	71.8		0	28-132	%REC	1	01/21/09 23:08	58607
SOLIDS, PERCENT		**SM2540G**	PrepDate:				Analyst: **MDE**	
Percent Solid	80.2		0.100	0.100	%	1	01/19/09	R75410

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT:	URS Corporation	**Client Sample ID:**	G-30
Lab Order:	F09010483	**Collection Date:**	1/13/2009 12:15:00 PM
Project:	38617-355/FROG POND HYDROLOGIC	**Sample Description:**	
Lab ID:	F09010483-002	**Matrix:**	Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	120000		5600	20000	mg/Kg-dry	1	01/22/09 11:42	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT:	URS Corporation	**Client Sample ID:**	G-31
Lab Order:	F09010483	**Collection Date:**	1/13/2009 10:40:00 AM
Project:	38617-355/FROG POND HYDROLOGIC	**Sample Description:**	
Lab ID:	F09010483-003	**Matrix:**	Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	94000		5600	20000	mg/Kg-dry	1	01/22/09 12:53	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation
Lab Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC
Lab ID: F09010483-004

Client Sample ID: G-32
Collection Date: 1/13/2009 1:30:00 PM
Sample Description:
Matrix: Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	96000		4700	17000	mg/Kg-dry	1	01/22/09 13:06	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation
Lab Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC
Lab ID: F09010483-005

Client Sample ID: G-33
Collection Date: 1/13/2009 2:30:00 PM
Sample Description:
Matrix: Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	63000		3300	12000	mg/Kg-dry	1	01/22/09 13:19	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation
Lab Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC
Lab ID: F09010483-006

Client Sample ID: G-34
Collection Date: 1/13/2009 1:10:00 PM
Sample Description:
Matrix: Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	77000		3300	12000	mg/Kg-dry	1	01/22/09 13:33	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation
Lab Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC
Lab ID: F09010483-007

Client Sample ID: G-35
Collection Date: 1/13/2009 11:35:00 AM
Sample Description:
Matrix: Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	62000		3100	11000	mg/Kg-dry	1	01/22/09 13:48	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

PAS, Inc. 8 East Tower Cr., Ormond Beach, FL 32174-87 **Date:** *10-Feb-09*

Analytical Report

CLIENT: URS Corporation
Lab Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC
Lab ID: F09010483-008

Client Sample ID: G-36
Collection Date: 1/13/2009 10:15:00 AM
Sample Description:
Matrix: Soil

Analyses	Result	Qual	MDL	PQL	Units	DF	Date Analyzed	Batch ID
CARBON, TOTAL ORGANIC		**SW9060**	PrepDate:				Analyst: **SUB**	
Total Organic Carbon	100000		4300	15000	mg/Kg-dry	1	01/22/09 14:28	NA

Data Qualifier Code Key: I Analyte detected below quantitation limits U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 549_W

Sample ID: **MB-58609** SampType: **MBLK** TestCode: **549_W** Units: **µg/L** Prep Date: **1/15/2009** RunNo: **75342**
Client ID: **MB-58609** Batch ID: **58609** TestNo: **E549.2** **E549.2** Analysis Date: **1/15/2009** SeqNo: **2278190**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Paraquat	0.23	U	0.23								

Sample ID: **LCS-58609** SampType: **LCS** TestCode: **549_W** Units: **µg/L** Prep Date: **1/15/2009** RunNo: **75342**
Client ID: **LCS-58609** Batch ID: **58609** TestNo: **E549.2** **E549.2** Analysis Date: **1/15/2009** SeqNo: **2278191**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Paraquat	1.4		0.23	2.0	0	70.0	70	130			

Sample ID: **F09010408-001HMS** SampType: **MS** TestCode: **549_W** Units: **µg/L** Prep Date: **1/15/2009** RunNo: **75342**
Batch ID: **58609** TestNo: **E549.2** **E549.2** Analysis Date: **1/15/2009** SeqNo: **2278194**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Paraquat	1.6		0.23	2.0	0	80.0	70	130			

Sample ID: **F09010409-001IMS** SampType: **MS** TestCode: **549_W** Units: **µg/L** Prep Date: **1/15/2009** RunNo: **75342**
Batch ID: **58609** TestNo: **E549.2** **E549.2** Analysis Date: **1/15/2009** SeqNo: **2278197**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Paraquat	1.6		0.23	2.0	0	80.2	70	130			

Sample ID: **F09010408-001HMSD** SampType: **MSD** TestCode: **549_W** Units: **µg/L** Prep Date: **1/15/2009** RunNo: **75342**
Batch ID: **58609** TestNo: **E549.2** **E549.2** Analysis Date: **1/15/2009** SeqNo: **2278195**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Paraquat	1.6		0.23	2.0	0	80.2	70	130	1.6	0.355	40

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 549_W

Sample ID: **F09010409-001IMSD** SampType: **MSD** TestCode: **549_W** Units: **µg/L** Prep Date: **1/15/2009** RunNo: **75342**
Batch ID: **58609** TestNo: **E549.2** **E549.2** Analysis Date: **1/15/2009** SeqNo: **2278198**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Paraquat	1.6		0.23	2.0	0	77.9	70	130	1.6	2.97	40

1036

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-58654**	SampType: **MBLK**	TestCode: **8081_S**	Units: **µg/Kg**	Prep Date: **1/16/2009**	RunNo: **75414**
Client ID: **MB-58654**	Batch ID: **58654**	TestNo: **SW8081**	**SW3550**	Analysis Date: **1/16/2009**	SeqNo: **2281761**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	0.058	U	0.058								
alpha-BHC	0.069	U	0.069								
beta-BHC	0.077	U	0.077								
delta-BHC	0.087	U	0.087								
gamma-BHC	0.15	U	0.15								
alpha-Chlordane	0.037	U	0.037								
gamma-Chlordane	0.068	U	0.068								
Chlordane	16	U	16								
4,4'-DDD	0.13	U	0.13								
4,4'-DDE	0.061	U	0.061								
4,4'-DDT	0.096	U	0.096								
Dieldrin	0.040	U	0.040								
Endosulfan I	0.025	U	0.025								
Endosulfan II	0.057	U	0.057								
Endosulfan sulfate	0.043	U	0.043								
Endrin	0.052	U	0.052								
Endrin aldehyde	0.066	U	0.066								
Endrin ketone	0.080	U	0.080								
Heptachlor	0.039	U	0.039								
Heptachlor epoxide	0.11	U	0.11								
Methoxychlor	1.0	U	1.0								
Toxaphene	7.3	U	7.3								
Surr: Decachlorobiphenyl	16		0	17	0	97.2	15	160			
Surr: Tetrachloro-m-xylene	15		0	17	0	92.3	15	160			

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-58654** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **1/16/2009** RunNo: **75414**
Client ID: **LCS-58654** Batch ID: **58654** TestNo: **SW8081** **SW3550** Analysis Date: **1/16/2009** SeqNo: **2281762**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	8.0		0.058	8.3	0	95.6	30	131			
gamma-BHC	8.2		0.15	8.3	0	98.3	45	133			
4,4'-DDT	17		0.096	17	0	102	41	162			
Dieldrin	15		0.040	17	0	91.2	50	145			
Endrin	16		0.052	17	0	95.4	50	201			
Heptachlor	8.1		0.039	8.3	0	97.3	35	182			
Surr: Decachlorobiphenyl	16		0	17	0	97.9	15	160			
Surr: Tetrachloro-m-xylene	15		0	17	0	91.9	15	160			

Sample ID: **F09010483-001AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg-dry** Prep Date: **1/16/2009** RunNo: **75414**
Client ID: **G-31 (SPLIT) MS** Batch ID: **58654** TestNo: **SW8081** **SW3550** Analysis Date: **1/17/2009** SeqNo: **2281793**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	9.0		0.071	10	0	88.2	30	131			
gamma-BHC	9.3		0.18	10	0	91.4	45	133			
4,4'-DDT	16		0.12	20	0	79.4	41	162			
Dieldrin	19		0.049	20	0	95.3	50	145			
Endrin	16		0.064	20	0	78.1	50	201			
Heptachlor	9.8		0.048	10	0	95.9	35	182			
Surr: Decachlorobiphenyl	19		0	20	0	91.2	15	160			
Surr: Tetrachloro-m-xylene	18		0	20	0	87.5	15	160			

Sample ID: **F09010483-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg-dry** Prep Date: **1/16/2009** RunNo: **75414**
Client ID: **G-31 (SPLIT) MSD** Batch ID: **58654** TestNo: **SW8081** **SW3550** Analysis Date: **1/17/2009** SeqNo: **2281794**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Aldrin	9.2		0.071	10	0	90.5	30	131	9.0	2.52	40

Data Qualifier Code Key:
I Analyte detected below quantitation limits
S Spike Recovery outside accepted recovery limits
R RPD outside accepted recovery limits
U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **F09010483-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg-dry** Prep Date: **1/16/2009** RunNo: **75414**
Client ID: **G-31 (SPLIT) MSD** Batch ID: **58654** TestNo: **SW8081** **SW3550** Analysis Date: **1/17/2009** SeqNo: **2281794**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
gamma-BHC	9.5		0.18	10	0	93.3	45	133	9.3	2.06	40
4,4'-DDT	14		0.12	20	0	70.2	41	162	16	12.4	40
Dieldrin	19		0.049	20	0	93.3	50	145	19	2.07	40
Endrin	16		0.064	20	0	80.4	50	201	16	2.88	40
Heptachlor	9.3		0.048	10	0	91.4	35	182	9.8	4.76	40
Surr: Decachlorobiphenyl	18		0	20	0	87.0	15	160	19	0	0
Surr: Tetrachloro-m-xylene	17		0	20	0	85.6	15	160	18	0	0

1039

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8141_S_(EXT)

Sample ID: **MB-58634** SampType: **MBLK** TestCode: **8141_S_(EXT)** Units: **µg/Kg** Prep Date: **1/15/2009** RunNo: **75387**
Client ID: **MB-58634** Batch ID: **58634** TestNo: **SW8141** **SW3540** Analysis Date: **1/16/2009** SeqNo: **2280599**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Atrazine	25	U	25								
Azinphos methyl	4.7	U	4.7								
Carbophenothion	13	U	13								
Chlorpyrifos	5.4	U	5.4								
Coumaphos	8.7	U	8.7								
Demeton-O	11	U	11								
Demeton-S	6.2	U	6.2								
Diazinon	7.6	U	7.6								
Dichlorvos	7.8	U	7.8								
Dimethoate	3.4	U	3.4								
Disulfoton	14	U	14								
Ethion	7.0	U	7.0								
Ethoprop	6.8	U	6.8								
Famphur	4.5	U	4.5								
Fensulfothion	13	U	13								
Malathion	6.0	U	6.0								
Mevinphos	6.6	U	6.6								
Monocrotophos	26	U	26								
Parathion, Ethyl	13	U	13								
Parathion, Methyl	6.9	U	6.9								
Phorate	20	U	20								
Phosmet	12	U	12								
Surr: 4-Chloro-3-nitrobenzotrifluoride	810		0	1000	0	80.7	15	133			

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8141_S_(EXT)

Sample ID: **LCS-58634** SampType: **LCS** TestCode: **8141_S_(EXT)** Units: **µg/Kg** Prep Date: **1/15/2009** RunNo: **75387**
Client ID: **LCS-58634** Batch ID: **58634** TestNo: **SW8141** **SW3540** Analysis Date: **1/16/2009** SeqNo: **2280600**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Azinphos methyl	240		4.7	250	0	95.6	50	150			
Chlorpyrifos	220		5.4	250	0	89.6	50	150			
Coumaphos	220		8.7	250	0	89.6	50	150			
Diazinon	210		7.6	250	0	84.0	50	150			
Dichlorvos	260		7.8	250	0	103	50	150			
Ethoprop	210		6.8	250	0	85.2	50	150			
Fensulfothion	220		13	250	0	86.4	50	150			
Mevinphos	200		6.6	250	0	81.2	50	150			
Parathion, Methyl	200		6.9	250	0	81.6	50	150			
Surr: 4-Chloro-3-nitrobenzotrifluoride	810		0	1000	0	80.6	15	133			

Sample ID: **F09010483-001AMS** SampType: **MS** TestCode: **8141_S_(EXT)** Units: **µg/Kg-dry** Prep Date: **1/15/2009** RunNo: **75387**
Client ID: **G-31 (SPLIT) MS** Batch ID: **58634** TestNo: **SW8141** **SW3540** Analysis Date: **1/16/2009** SeqNo: **2280602**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Azinphos methyl	210		3.9	210	0	100	50	150			
Chlorpyrifos	180		4.5	210	0	87.2	50	150			
Coumaphos	190		7.2	210	0	91.2	50	150			
Diazinon	170		6.3	210	0	83.6	50	150			
Dichlorvos	210		6.4	210	0	102	50	150			
Ethoprop	170		5.6	210	0	84.0	50	150			
Fensulfothion	180		11	210	0	85.6	50	150			
Mevinphos	170		5.5	210	0	80.8	50	150			
Parathion, Methyl	170		5.7	210	0	81.6	50	150			
Surr: 4-Chloro-3-nitrobenzotrifluoride	650		0	830	0	78.7	15	133			

Data Qualifier Code Key:

I Analyte detected below quantitation limits
S Spike Recovery outside accepted recovery limits
R RPD outside accepted recovery limits
U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8141_S_(EXT)

Sample ID: **F09010483-001AMSD** SampType: **MSD** TestCode: **8141_S_(EXT)** Units: **µg/Kg-dry** Prep Date: **1/15/2009** RunNo: **75387**
Client ID: **G-31 (SPLIT) MSD** Batch ID: **58634** TestNo: **SW8141** **SW3540** Analysis Date: **1/16/2009** SeqNo: **2280603**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Azinphos methyl	200		3.8	200	0	98.8	50	150	3.8 U	4.22	40
Chlorpyrifos	180		4.3	200	0	87.6	50	150	4.3 U	2.16	40
Coumaphos	180		7.0	200	0	90.0	50	150	7.0 U	3.94	40
Diazinon	170		6.1	200	0	83.6	50	150	6.1 U	2.61	40
Dichlorvos	200		6.3	200	0	98.4	50	150	6.3 U	6.60	40
Ethoprop	170		5.5	200	0	84.0	50	150	5.5 U	2.61	40
Fensulfothion	170		11	200	0	84.8	50	150	180	3.55	40
Mevinphos	170		5.3	200	0	82.4	50	150	5.3 U	0.654	40
Parathion, Methyl	170		5.6	200	0	82.4	50	150	5.6 U	1.64	40
Surr: 4-Chloro-3-nitrobenzotrifluoride	640		0	800	0	79.3	15	133	650	0	40

1042

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8151_S

Sample ID: **MB-58607** SampType: **MBLK** TestCode: **8151_S** Units: **µg/Kg** Prep Date: **1/15/2009** RunNo: **75542**
Client ID: **MB-58607** Batch ID: **58607** TestNo: **SW8151** **SW8151** Analysis Date: **1/21/2009** SeqNo: **2286333**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
2,4-D	6.3	U	6.3								
2,4-DB	12	U	12								
Dalapon	9.0	U	9.0								
Dicamba	0.64	U	0.64								
Dinoseb	1.4	U	1.4								
Pentachlorophenol	0.34	U	0.34								
Picloram	0.24	U	0.24								
2,4,5-T	1.0	U	1.0								
2,4,5-TP (Silvex)	1.1	U	1.1								
Surr: DCAA	170		0	270	0	65.2	28	132			

Sample ID: **LCS-58607** SampType: **LCS** TestCode: **8151_S** Units: **µg/Kg** Prep Date: **1/15/2009** RunNo: **75542**
Client ID: **LCS-58607** Batch ID: **58607** TestNo: **SW8151** **SW8151** Analysis Date: **1/21/2009** SeqNo: **2286335**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
2,4-D	230		6.3	270	0	86.2	16	118			
2,4,5-TP (Silvex)	50		1.1	53	0	93.7	25.2	151			
Surr: DCAA	210		0	270	0	77.3	28	132			

Sample ID: **F09010483-001AMS** SampType: **MS** TestCode: **8151_S** Units: **µg/Kg-dry** Prep Date: **1/15/2009** RunNo: **75542**
Client ID: **G-31 (SPLIT) MS** Batch ID: **58607** TestNo: **SW8151** **SW8151** Analysis Date: **1/21/2009** SeqNo: **2286339**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
2,4-D	210		7.9	330	0	64.0	16	118			
2,4,5-TP (Silvex)	49		1.4	67	0	72.8	12	147			
Surr: DCAA	230		0	330	0	67.2	28	132			

Data Qualifier Code Key:

I Analyte detected below quantitation limits
S Spike Recovery outside accepted recovery limits
R RPD outside accepted recovery limits
U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: 8151_S

Sample ID: **F09010483-001AMSD** SampType: **MSD** TestCode: **8151_S** Units: **µg/Kg-dry** Prep Date: **1/15/2009** RunNo: **75542**
Client ID: **G-31 (SPLIT) MSD** Batch ID: **58607** TestNo: **SW8151** **SW8151** Analysis Date: **1/22/2009** SeqNo: **2286361**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
2,4-D	200		7.9	340	0	58.7	16	118	7.9 U	8.27	40
2,4,5-TP (Silvex)	50		1.4	67	0	74.2	12	147	49	2.21	40
Surr: DCAA	240		0	340	0	71.5	28	132	230	0	0

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: AA-HG7471_S

Sample ID: **MB-58661** SampType: **MBLK** TestCode: **AA-HG7471_S** Units: **mg/Kg** Prep Date: **1/16/2009** RunNo: **75388**
Client ID: **MB-58661** Batch ID: **58661** TestNo: **SW7471** **SW7471** Analysis Date: **1/19/2009** SeqNo: **2282255**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Mercury	0.0020	U	0.0020								

Sample ID: **LCS-58661** SampType: **LCS** TestCode: **AA-HG7471_S** Units: **mg/Kg** Prep Date: **1/16/2009** RunNo: **75388**
Client ID: **LCS-58661** Batch ID: **58661** TestNo: **SW7471** **SW7471** Analysis Date: **1/19/2009** SeqNo: **2282257**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Mercury	0.042		0.0020	0.040	0	105	80	120			

Sample ID: **F09010505-001BMS** SampType: **MS** TestCode: **AA-HG7471_S** Units: **mg/Kg-dry** Prep Date: **1/16/2009** RunNo: **75388**
Batch ID: **58661** TestNo: **SW7471** **SW7471** Analysis Date: **1/19/2009** SeqNo: **2282266**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Mercury	1.7		0.049	0.98	0.58	113	85	115			

Sample ID: **F09010505-001BMSD** SampType: **MSD** TestCode: **AA-HG7471_S** Units: **mg/Kg-dry** Prep Date: **1/16/2009** RunNo: **75388**
Batch ID: **58661** TestNo: **SW7471** **SW7471** Analysis Date: **1/19/2009** SeqNo: **2282269**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Mercury	1.2	RS	0.049	0.98	0.58	**62.3**	85	115	1.7	**34.0**	20

1045

Data Qualifier Code Key:

I	Analyte detected below quantitation limits	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits	U	Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: ICP-6010_S

Sample ID: **MB-58622** SampType: **MBLK** TestCode: **ICP-6010_S** Units: **mg/Kg** Prep Date: **1/15/2009** RunNo: **75292**
Client ID: **MB-58622** Batch ID: **58622** TestNo: **SW6010** **SW3050B** Analysis Date: **1/16/2009** SeqNo: **2280859**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Arsenic	0.20	U	0.20								
Barium	0.020	U	0.020								
Cadmium	0.020	U	0.020								
Chromium	0.10	U	0.10								
Copper	0.10	U	0.10								
Lead	0.20	U	0.20								
Selenium	0.30	U	0.30								
Silver	0.10	U	0.10								
Zinc	0.40	U	0.40								

Sample ID: **LCS-58622** SampType: **LCS** TestCode: **ICP-6010_S** Units: **mg/Kg** Prep Date: **1/15/2009** RunNo: **75292**
Client ID: **LCS-58622** Batch ID: **58622** TestNo: **SW6010** **SW3050B** Analysis Date: **1/16/2009** SeqNo: **2280860**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Arsenic	10		0.20	10	0	101	80	120			
Barium	10		0.020	10	0	102	80	120			
Cadmium	1.0		0.020	1.0	0	102	80	120			
Chromium	10		0.10	10	0	104	80	120			
Copper	10		0.10	10	0	102	80	120			
Lead	10		0.20	10	0	102	80	120			
Selenium	10		0.30	10	0	102	80	120			
Silver	1.1		0.10	1.0	0	106	80	120			
Zinc	50		0.40	50	0	101	80	120			

Data Qualifier Code Key:

I Analyte detected below quantitation limits
S Spike Recovery outside accepted recovery limits
R RPD outside accepted recovery limits
U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: ICP-6010_S

Sample ID: **F09010526-006BMS** SampType: **MS** TestCode: **ICP-6010_S** Units: **mg/Kg-dry** Prep Date: **1/15/2009** RunNo: **75292**
Batch ID: **58622** TestNo: **SW6010** **SW3050B** Analysis Date: **1/16/2009** SeqNo: **2280865**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Arsenic	120		2.2	110	2.9	102	75	125			
Barium	180		0.22	110	63	105	75	125			
Cadmium	12		0.22	11	0.66	102	75	125			
Chromium	120		1.1	110	8.0	103	75	125			
Copper	260		1.1	110	130	109	75	125			
Lead	120		2.2	110	9.8	104	75	125			
Selenium	110		3.3	110	0	98.4	75	125			
Silver	14		1.1	11	1.9	109	75	125			
Zinc	990		4.4	560	420	102	75	125			

Sample ID: **F09010526-006BMSD** SampType: **MSD** TestCode: **ICP-6010_S** Units: **mg/Kg-dry** Prep Date: **1/15/2009** RunNo: **75292**
Batch ID: **58622** TestNo: **SW6010** **SW3050B** Analysis Date: **1/16/2009** SeqNo: **2280866**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Arsenic	120		2.2	110	2.9	103	75	125	2.2 U	1.14	20
Barium	180		0.22	110	63	104	75	125	180	0.248	20
Cadmium	12		0.22	11	0.66	102	75	125	12	0	20
Chromium	120		1.1	110	8.0	103	75	125	120	0.363	20
Copper	260		1.1	110	130	114	75	125	260	2.07	20
Lead	130		2.2	110	9.8	104	75	125	2.2 U	0.355	20
Selenium	110		3.3	110	0	98.8	75	125	3.3 U	0.406	20
Silver	14		1.1	11	1.9	109	75	125	14	0	20
Zinc	990		4.4	560	420	102	75	125	990	0	20

Data Qualifier Code Key:

I Analyte detected below quantitation limits
S Spike Recovery outside accepted recovery limits
R RPD outside accepted recovery limits
U Not Detected Above the MDL

CLIENT: URS Corporation
Work Order: F09010483
Project: 38617-355/FROG POND HYDROLOGIC

ANALYTICAL QC SUMMARY REPORT

TestCode: PSOLID

Sample ID: **F09010483-001ADUP** SampType: **DUP** TestCode: **PSOLID** Units: **%** Prep Date: RunNo: **75410**
Client ID: **G-31 (SPLIT) DUP** Batch ID: **R75410** TestNo: **SM2540G** Analysis Date: **1/19/2009** SeqNo: **2282973**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Percent Solid	82.1		0.100						80.2	2.34	10

Sample ID: **F09010589-001ADUP** SampType: **DUP** TestCode: **PSOLID** Units: **%** Prep Date: RunNo: **75410**
Batch ID: **R75410** TestNo: **SM2540G** Analysis Date: **1/19/2009** SeqNo: **2283020**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Percent Solid	0.909		0.100						0.906	0.337	10

Sample ID: **F09010661-001ADUP** SampType: **DUP** TestCode: **PSOLID** Units: **%** Prep Date: RunNo: **75410**
Batch ID: **R75410** TestNo: **SM2540G** Analysis Date: **1/19/2009** SeqNo: **2283040**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Percent Solid	13.1		0.100						13.2	0.435	10

Sample ID: **F09010681-008ADUP** SampType: **DUP** TestCode: **PSOLID** Units: **%** Prep Date: RunNo: **75410**
Batch ID: **R75410** TestNo: **SM2540G** Analysis Date: **1/19/2009** SeqNo: **2283060**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Percent Solid	89.6		0.100						88.8	0.872	10

Sample ID: **F09010681-017ADUP** SampType: **DUP** TestCode: **PSOLID** Units: **%** Prep Date: RunNo: **75410**
Batch ID: **R75410** TestNo: **SM2540G** Analysis Date: **1/19/2009** SeqNo: **2283107**

Analyte	Result	Qual	MDL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit
Percent Solid	87.8		0.100						87.7	0.0284	10

Data Qualifier Code Key:

I Analyte detected below quantitation limits
S Spike Recovery outside accepted recovery limits
R RPD outside accepted recovery limits
U Not Detected Above the MDL

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

URSBOC F09010483

Page: of

1224126

Section A Required Client Information:
Company: URS Corporation
Address: 7800 Congress Ave., Suite 200 Boca Raton FL
Email To: Ed_Leding@urscorp.com
Phone: 561-994-6500 Fax: 561-994-6524
Requested Due Date/TAT:

Section B Required Project Information:
Report To: Ed Leding
Copy To:
Purchase Order No.:
Project Name: Frog Pond
Project Number: 38617-355

Section C Invoice Information:
Attention: Ed Leding
Company Name: URS Corporation
Address: 7800 Congress Ave, Suite 200 Boca
Pace Quote Reference:
Pace Project Manager: Martha Monforo
Pace Profile #:

REGULATORY AGENCY
☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☑ OTHER SPWMD
Site Location STATE: FL

Section D Required Client Information

Matrix Codes MATRIX / CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED Composite Start Date	Composite Start Time	Composite End/Grab Date	Composite End/Grab Time	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other (i.e.)	Analysis Test (Y/N) EPA 8081	EPA 8141	EPA 8151	Pesticide (5142)	SKCLCA Metals	Copper	Zinc	Total Organic Carbon	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	G-31(SPLIT)	SL	C	1/13/09	10:40				6								✓	✓	✓	✓	✓	✓	✓	✓			
2	G-30	SL	C	1/13/09	12:15				1								✓							✓			
3	G-31	SL	C	1/13/09	10:40				1								✓							✓			
4	G-32	SL	C	1/13/09	13:30				1								✓							✓			
5	G-33	SL	C	1/13/09	14:30				1								✓							✓			
6	G-34	SL	C	1/13/09	13:10				1								✓							✓			
7	G-35	SL	C	1/13/09	11:35				1								✓							✓			
8	G-36	SL	C	1/13/09	10:15				1								✓							✓			
9																											
10																											
11																											
12																											

SPWMD Project ADaPT Required.

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	SAMPLING KIT-EMPTY	12-29-8			12/30/08	14:00	
		1/13/09	1620		1/14/09	10:50	4.7

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Jamie Sullivan
SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY): 01/13/09

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

ORIGINAL

*Important! Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

APPENDIX D

SITE SPECIFIC (EQUILIBRIUM PARTITIONING) BASED SEDIMENT QUALITY GUIDELINE CALCULATIONS

BENTHIC COMMUNITY RISK ANALYSIS OF CHEMICALS WITHOUT SEDIMENT QUALITY ASSESSMENT GUIDELINES FOR THE FROG POND PROPERTY, MIAMI-DADE COUNTY, FLORIDA

Numerical sediment quality assessment guidelines (SQAGs) have not been developed for several chemicals detected in Frog Pond soils (Table 1). These chemicals are:

- Aldrin
- alpha-, beta-, and delta-BHC
- Endosulfan (alpha, beta, and sulfate)
- Paraquat
- Pentachlorophenol

SQAGs have been developed for gamma-BHC (Lindane) (MacDonald et al. 2003). Although gamma-BHC is more toxic than the other isomers of BHC (ATSDR 2005), its SQAGs were considered to be conservative screening surrogates for alpha-, beta-, and delta-BHC.

Derivation of Sediment Quality Guidelines

Equilibrium partitioning methodology (USEPA 2000) was used to derive sediment quality guidelines from water quality standards for aldrin, endosulfan, endosulfan sulfate, paraquat and pentachlorophenol. The derivation is based on the chemical-specific organic carbon-to-water partitioning coefficient (K_{oc}), the fraction of organic carbon (f_{oc}) and the toxicity of the chemical to aquatic organisms. The relationship is described as follows:

$$ESG = foc \times Koc \times WQC$$

Where:

ESG	=	Equilibrium partitioning based sediment quality guideline
$f$oc	=	Fraction organic carbon
K_{oc}	=	Organic carbon-to-water partitioning coefficient
WQC	=	Chronic water quality criterion

The ESG derived from this methodology is equivalent to a lower-bound SQAG (i.e., TEC).

Selection of Water Quality Criteria

Water quality criteria were obtained from the Florida Water Quality Standards for Class III fresh waters (recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife). Values are presented in the following table:

Analyte	Florida Class III Fresh Water Criterion (µg/L)
Aldrin	0.00014
Endosulfan	0.056
Pentachlorophenol	8.2*

* maximum at average annual flow conditions

A Florida chronic WQC was available for each of the chemicals, with the exception of paraquat. Therefore, a water quality criterion was derived for paraquat.

Derivation of Aquatic Life Criteria for Paraquat

Water quality criteria are not available for paraquat. Great Lakes Water Quality Initiative methodologies (USEPA 2002) were used to derive water quality criteria for paraquat. Aquatic and chronic toxicity data were compiled from the Aquatic Information Retrieval (AQUIRE) database, which is now accessible through USEPA's ECOTOX database. Only data on freshwater species having breeding populations in North America were accessed (USEPA 2002). In order to derive aquatic life criteria, acute toxicity values are required from the following eight families:

1. *Salmonidae*
2. Warmwater family (e.g., sunfish/catfish)
3. Third family from fish or amphibian
4. Planktonic crustacean family (cladoceran/copepod)
5. Benthic crustacean family (ostracod, isopod, amphipod, crayfish)
6. Insect family
7. One from either *Rotifera, Annelida,* or *Mollusca*
8. One other family not represented in the preceding 7 families

If all of these requirements are met, it is possible to calculate a Criterion Continuous Concentration (CCC) (chronic) and a Criterion Maximum Concentration (CMC) (acute). If all eight requirements are not met, a Secondary Continuous Concentration (SCC) and a Secondary Maximum Concentration (SMC) can be calculated using the Tier II methodology for deriving aquatic life values (USEPA 2002). Data were insufficient to calculate a CCC for paraquat; therefore, an SCC was calculated (Tables A-1 and A-2). Therefore, the WQC selected for calculating an ESG for paraquat is 8.9 µg/L.

Selection of Koc

The K_{oc}s used in calculating the ESG were selected from, in order of priority, (1) the Agency for Toxic Substances and Disease Registry (ATSDR); (2) the Hazardous Substances Data Bank (HSDB); or (3) USEPA's ecotoxicology database (ECOTOX). The K_{oc}s selected and their sources are:

Analyte	K_{oc}	Source
Aldrin	46,773,514	ATSDR 2002
Endosulfan	3,981	HSDB 2003
Endosulfan sulfate	32,000	HSDB 2003
Paraquat	15,473	ECOTOX
Pentachlorophenol	31,622	ATSDR 2001

Fraction of Organic Carbon

Organic carbon content was measured for 31 soil samples from the Frog Pond grids (Table 2). The average fraction of organic carbon was calculated to be 0.0409 mg/kg.

Equilibrium Partitioning Based Sediment Quality Guidelines

Using the information from the previous sections, ESGs were derived for each of the chemicals as shown in the following table:

ESGs

Analyte	Chronic WQC	K_{oc}	f_{oc}	ESG (µg/kg)*
Aldrin	0.00014	5E+07	0.041	268
Endosulfan	0.056	3,981	0.041	9.14
Endosulfan sulfate	0.056[1]	32,000	0.041	73.5
Paraquat	8.9	15,473	0.041	5,646
Pentachlorophenol	8.2	31,622	0.041	10,631

* TEC equivalent [1] WQC for endosulfan used as surrogate

SCREENING EVALUATION FOR BENTHIC ORGANISMS

Chemicals of Potential Ecological Concern

As a screening evaluation to determine contaminants of potential ecological concern (COPECs) to the benthic community, maximum detected concentrations were compared with ESGs.

COPEC Screening

Analyte	Maximum (µg/kg)	ESG* (µg/kg)
Aldrin	1.3	268
Alpha-BHC	0.75	2.4[1]
Beta-BHC	0.98	2.4[1]
Delta-BHC	7.4	2.4[1]
Endosulfan (α, β + sulfate)	260.7	9.14[2]
Paraquat	3.1	5,646
Pentachlorophenol	<0.09	10,631

* TEC equivalent

Comment [cxc1]: This is the only value presented in Table 1 – Soil Analytical Results. Was there actually a hit?

[1] SQAG TEC for gamma-BHC used as surrogate
[2] Endosulfan ESG (endosulfan sulfate ESG is 73.5µg/kg)

Only the maximum detected concentration for delta-BHC and combined endosulfans (alpha-endosulfan, beta-endosulfan and endosulfan sulfate) exceeded their respective screening values. Thus, aldrin, alpha-BHC, beta-BHC, paraquat and pentachlorophenol are not COPECs for potential benthic receptors at the Frog Pond property.

COPEC Refinement

COPECs were refined by comparing a site-wide exposure concentration, expressed as the upper 95th percentile confidence limit of the mean (95% UCL), with the conservative ESG. EPA's software ProUCL Version 3.00.02 was used to calculate the exposure concentration. ProUCL computes multiple statistics and presents a recommendation for the appropriate exposure concentration. However, there are limitations to the application of ProUCL. Specifically, (1) ProUCL does not consider nondetects in distribution testing and subsequent derivation of an exposure concentration; and (2) depending on the characteristics of the dataset, ProUCL will at times recommend a statistic other than the 95% UCL to represent a conservative estimate of the mean. Therefore, the following manual modifications were made:

- A surrogate value (in this case, one-half the reporting limit) was used to represent nondetects.
- When a statistic other than the 95% UCL was recommended by ProUCL, the 95% UCL was selected as the preferred statistic to represent a conservative exposure concentration.

In calculating the 95% UCL, the higher value of the split and parent sample was entered as one data point. Attachment 1 contains the ProUCL outputs.

Comparisons between the 95% UCL and the ESG for delta-BHC and total endosulfans are shown below. To determine a relative potential for risk, the 95% UCL was divided by the ESG.

Relative Risk Comparison

Analyte	95% UCL (µg/kg)	ESG (µg/kg)	UCL/ESG
Delta-BHC	2.14	2.4[1]	0.9
Endosulfans (α, β + sulfate)	73	9.14[2]	8

[1] SQAG TEC for gamma-BHC used as surrogate
[2] Endosulfan ESG (endosulfan sulfate ESG is 73.5µg/kg)

By this analysis, delta-BHC does not appear to pose a potential risk to the benthic community at the Frog Pond property. The analysis of potential risk from the combined endosulfans is slightly more problematic. According to HSDB (2003), endosulfan sulfate has a K_{oc} approximately an order of magnitude greater than endosulfan or alpha-

endosulfan (a K_{oc} was not available for beta-endosulfan). The ESG calculated for endosulfan sulfate was 73.5 µg/mg (see Table A-4). If endosulfan sulfate was the primary component in the mixture, the UCL/ESG would be less than one. This would suggest a relatively low level of potential risk. A more accurate estimate of the potential for risk to the benthic community would require distinguishing the relative proportion of endosulfan sulfate in the mixture.

References

ATSDR. 2001. Toxicological Profile for Pentachlorophenol. Agency for Toxic Substances and Disease Registry.

ATSDR. 2002. Toxicological Profile for Aldrin/Dieldrin. Agency for Toxic Substances and Disease Registry.

ATSDR. 2005. Toxicological Profile for Hexachlorocyclohexane. Agency for Toxic Substances and Disease Registry. August.

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MacDonald, D.D., C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, G. Sloane and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Technical Report. Prepared for Florida Department of Environmental Protection. January.

USEPA. 2000. Technical Basis for the Derivation of Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Nonionic Organics. U.S. EPA Office of Science and Technology. Washington, D.C.

USEPA. 2002. Great Lakes Water Quality Initiative Methodologies for Development of Aquatic Life Criteria and Values. 40 CFR-Chapter I-Part 132, Appendix A.

TABLES

APPENDIX E

EVALUATION OF ADDITIONAL DATA COLLECTED BY URS IN JANUARY 2009 FOR ECOLOGICAL RISK ASSESSMENT OF FROG POND SITE SOILS

NEWFIELDS

February 20, 2009
Via electronic mail

Ed Leding
Project Manager
URS Corporation
7800 Congress Avenue, Suite 200
Boca Raton, FL 33487

Subject: Evaluation of additional data collected by URS in January 2009 for ecological risk assessment of Frog Pond site soils

Dear Mr. Leding:

NewFields has reviewed the data collected by URS in January 2009 at the Frog Pond site in Miami-Dade County, Florida. This dataset included composite samples collected from seven 50-acre grid cells on the Western boundary of the Frog Pond property adjacent to the C-111 canal (Figure 1) in areas not previously sampled.

The samples were collected under the Phase I/II Environmental Site Assessment (ESA) soil sampling protocol for agricultural areas (USFWS and SFWMD 2008) and were intended to complete the characterization of the Frog Pond site soils. These data supplement the 2006 ESA (URS 2006) of the 1,380 acres of the Frog Pond in which the District originally planned to construct a 'leaky reservoir'. Design changes to the project necessitated a shift of the planned construction area west, outside of the area investigated for the original ESA.

The data were evaluated based on the conclusions reached in the recently completed and expanded Ecological Risk Assessment (ERA) for the Frog Pond (NewFields 2009). The ERA was completed using the 2006 ESA and on data collected from the 5-acre Pilot Study area located within the newly established Grid 30 (Figure 1). The Pilot Study (URS 2008) was conducted to demonstrate the effectiveness of reducing bulk soil copper concentrations and mass by scraping the thin layer of soil present at the Frog Pond from the surface of the limestone cap rock. The ERA concluded that soil scraping was expected to be an adequate means of reducing soil contaminant concentrations to levels below those expected to cause unacceptable risks to United Stated Fish and Wildlife (USFWS) trust species and to a future aquatic community.

If the chemical of potential concern (COPC) concentrations in the revised footprint prior to soil scraping are similar or less than those observed in the Pilot Study area prior to scraping, the conclusions reached in the ERA can be assumed to be valid for the revised footprint. Table 1 indicates all chemicals detected in 50-acre grid composite samples that exceeded a Sediment Quality Assessment Guidelines (SQAGs) published by the Florida Department of Environmental Protection (FDEP) (MacDonald et al. 2003). Review of the data collected from the seven additional 50-acre grid cells indicates that soil copper and other chemical concentrations are

similar to or less than pre-scraping soil concentrations within the Pilot Study area. URS (2006) reported copper concentrations ranging from 145 to 271 mg/kg and zinc concentrations ranging from 68 to 201 mg/kg in Grid 30 prior to scraping.

Additionally, by combining the newly collected data with composite data from the 50-acre grid cells within the revised project footprint collected during the initial ESA, upper bound estimates of the mean soil concentrations, 95% Upper Confidence Limits (95% UCLs) for the project footprint are similar to those observed for the primary COPCs in the Pilot Study area (Table 1) with several minor exceptions.

The 95% UCL concentrations of chromium and 4,4'-DDE within the revised footprint were greater than those observed in Grid 30 where the Pilot Study was performed. No pre- or post-scraping data were available in the Pilot Study area for either chemical because chromium and 4,4'-DDE were not detected in that area of the Frog Pond site. This represents an uncertainty since chromium and 4,4'-DDE concentrations greater than the TEC were not observed in the samples tested for toxicity in the Pilot Study area (Table 2). Neither of these samples was toxic to the test species, and no unacceptable risk was predicted for the Everglades snail kite due to bioaccumulation of copper in apple snails.

Chromium and 4,4'-DDE concentrations were elevated in the Grid 6 ERA sample which showed significant toxicity in the ERA, however chromium, copper, zinc and 4,4'-DDE concentrations were more elevated relative to benchmarks (i.e., > PEC) in that sample than in any collected within the revised footprint (Table 2). It is likely that the observed toxicity within that sample was due to elevated pesticide, copper and zinc concentrations rather than the chromium and 4,4'-DDE concentrations, for which the 95% UCL concentrations were only slightly greater than the TEC. No unacceptable risks are expected due to exceedance of the TEC by chromium or 4,4'-DDE 95% UCL concentrations.

Ed Leding
URS Corporation
February 20, 2009

Table 1. 50-Acre Grid Composite Samples for the Revised Frog Pond Project Footprint

Grid	4,4-DDE (ug/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)
January 2009 Samples						
G-30	0.105	6.1	19	37	167	97
G-31	0.1	6.3	17	34	83	66
G-32	0.105	6.9	25	39	37	64
G-33	0.1	8	19	56	65	70
G-34	0.095	6.4	19	56	136	102
G-35	0.09	7.2	17	47	206	124
G-36	0.62	12	17	58	224	138
October 2006 Samples						
G-3	1.6	4.1	12	38	93	60
G-8	11	4	20	48	200	140
G-9	2.2	7.3	20	65	220	140
G-14	0.1	1.9	17	60	200	140
G-15	0.085	2.8	17	51	200	130
G-20	0.095	3.7	18	35	100	80
G-21	0.12	2.8	13	33	120	90
G-26	0.095	3	18	37	120	74
G-27	0.095	3	14	25	27	29
Min	0.085	1.9	12	25	27	29
Max	11	12	25	65	224	140
Average	1.0	5.3	17.6	44.9	137	96.5
Median	0.1	5.1	17.5	43	128	93.5
95% UCL	7.83	6.5	19	50	166.5	112
SQAG-TEC	3.2	9.8	20	43	32	120
SQAG-PEC	31	33	60	110	150	460

NOTE: Shaded cells represent non-detect samples at 1/2 of the detection limit
RBCs for 4,4'-DDE and zinc calculated using ERA bioaccumulation tests

Table 2. Concentrations Tested in the Pilot Study

Sample	4,4-DDE (ug/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)
Post-Scraping Pilot Study Area						
CS-8	N/A	N/A	N/A	N/A	140	95.7
CS-10	N/A	N/A	N/A	N/A	97	60.3
Non-Scraped Sample						
Grid-6	82.3	N/A	32	109.3	365	189.7

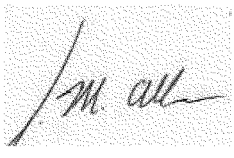
NOTE: N/A indicates that the chemical was not analyzed in that sample.

2500 55TH STREET, Suite 200
Boulder, CO 80301
303-442-0267 *tel.* • 303-442-3679 *fax*

The 95% UCL concentrations of copper and zinc in the revised footprint are similar to those observed in post-scraping soils within the Pilot Study area and tested for toxicity and bioaccumulation. No unacceptable risk was predicted for either the Everglades snail kite or the future aquatic community at the Frog Pond at those concentrations. If soil scraping is conducted within the revised footprint, project-wide average concentrations of copper and zinc are likely to be reduced further. Soils within Grids 31, 32, and 33 do not exceed the copper snail kite benchmark (85 mg/kg) and only the TECs for barium (Grid 32), copper (Grids 31, 32, and 33) and chromium (Grid 33). Soil scraping may not be necessary within these three grids to meet risk management goals for the project since copper concentrations do not exceed the snail kite benchmark and Pilot Study samples indicated no toxicity to benthic invertebrates at higher concentrations. Scraping is recommended to reduce risks primarily from copper within the remaining areas of the revised project footprint in order to lower the potential for risk to the aquatic and semi-aquatic receptors that may inhabit the project footprint in the future.

Please review the memo at your earliest convenience. As always, we appreciate the opportunity to work with URS on District projects. Please do not hesitate to call me if you have any questions. Thank you.

Sincerely,
NEWFIELDS BOULDER, LLC



Joe Allen
Project Manager

cc:

Robert Taylor (SFWMD)

Yudex Hasbun (WRScompass)

2500 55TH STREET, Suite 200
Boulder, CO 80301
303-442-0267 *tel.* • 303-442-3679 *fax*

References:

NewFields. 2009. Ecological Risk Assessment of Frog Pond Soils. Prepared for WRScompass and URS Corporation on Behalf of South Florida Water Management District. January.

South Florida Water Management District (SFWMD) and United States Fish and Wildlife Service (USFWS). 2008. Protocol for Assessment, Remediation and Post-Remediation Monitoring for Environmental Contaminants on Everglades Restoration. March.

URS. 2006. Limited Phase II Environmental Site Assessment Report, Frog Pond. October.

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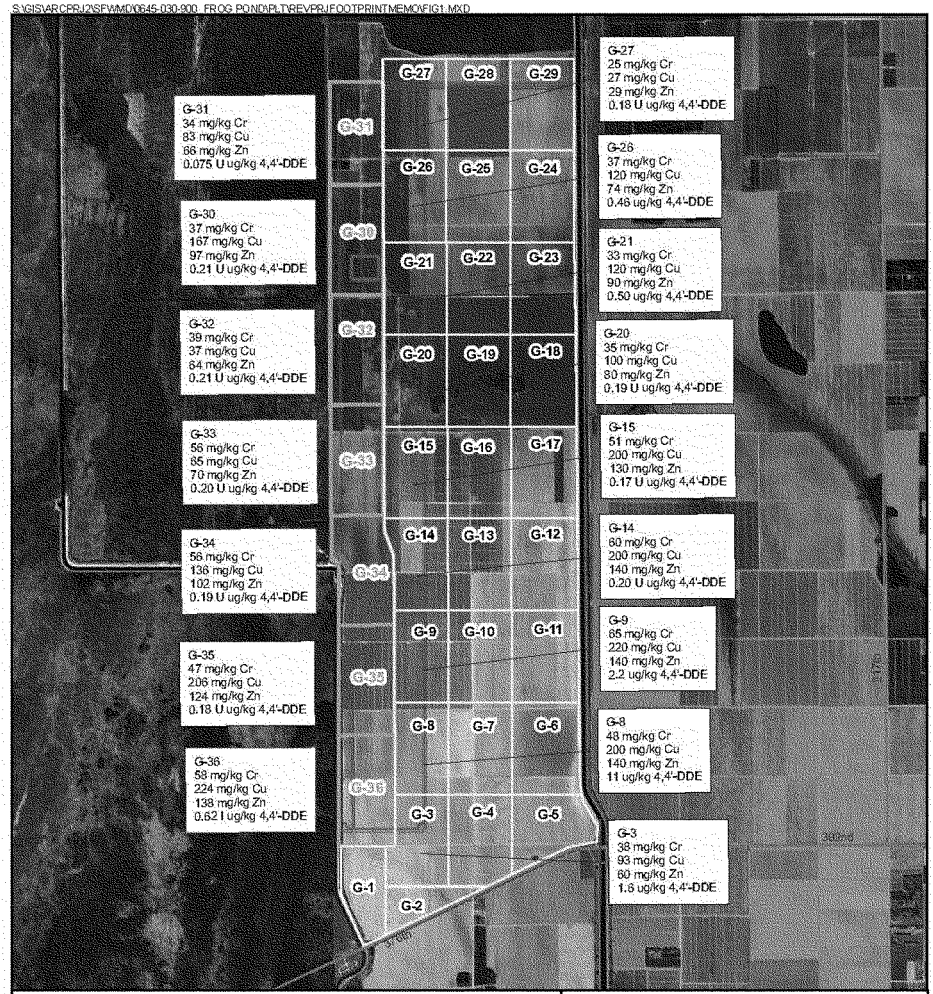
S:\GIS\ARCPRJ2\SFWMD\0645-030-900_FROG POND\PLTREVPRJFOOTPRINT\MEMO\FIG1.MXD



South Florida Water Management District
Ecological Risk Assessment
of Frog Pond Soils

FIGURE 1

50-Acre Composite Samples in the Revised Frog Pond Project Footprint

PRJ: 0645-030-900	DATE: FEB 20, 2009	
REV: 0	BY: RLW	CHK: JMA

NEWFIELDS

A.4 SOIL MANAGEMENT

URS

SOIL MANAGEMENT PLAN
Detention Area – Frog Pond
C-111 Spreader Canal Northern Storage Reservoir
Frog Pond
Florida City, Miami-Dade County, Florida

Prepared for:
SOUTH FLORIDA WATER
MANAGEMENT DISTRICT
3301 Gun Club Road
West Palm Beach, Florida 33406

Prepared by:
URS CORPORATION
7800 Congress Avenue
Boca Raton, FL 33487

JOB #: 38617-408

November 17, 2010

URS

November 17, 2010

Mr. Robert J. Taylor
Lead Environmental Engineer
Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

RE: Soil Management Plan
Detention Area - Frog Pond
Florida City, Miami-Dade County, Florida
Job # 38617-408

Dear Mr. Taylor:

Herewith transmitted is URS Corporation's (URS') report of the Soil Management Plan for the copper impacted soils at the Detention Area within the Frog Pond.

URS appreciates the opportunity to support the District on this important project. If you have any questions with the information contained in this report or this project, please contact URS at your convenience.

Respectfully Submitted,

URS Corporation

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Projects Director

TABLE OF CONTENTS

1.0 INTRODUCTION / BACKGROUND 1
- 1.1 PROPERTY DESCRIPTION 1
- 1.2 SITE ASSESSMENTS/INVESTIGATIONS 2
  - 1.2.1 Phase I/II ESA (1995) 2
  - 1.2.2 Limited Phase II ESA (2006) 3
  - 1.2.3 Screening Level ERA (2006) 3
  - 1.2.4 Pilot Study (2007) 4
  - 1.2.5 Expanded ERA (2008) 5
  - 1.2.6 Hydrologic Evaluation (2008) 6
  - 1.2.7 Additional Soil Investigation (2008) 6

2.0 WATER QUALITY 7
- 2.1 GROUNDWATER 7
- 2.2 SURFACE WATER 8

3.0 OBJECTIVE 9

4.0 EXTENT OF IMPACTED SOILS 9
- 4.1 CONSTITUENTS OF CONCERN 9
- 4.2 LATERAL AND VERTICAL EXTENT 10
- 4.3 SOIL REMEDIATION 10

5.0 SOIL REMEDIATION METHODOLOGY 10
- 5.1 HEALTH AND SAFETY PLAN 11
- 5.2 PRE-SOIL EXCAVATION SURVEY 11
- 5.3 UTILITIES PROTECTION 11
- 5.4 STORMWATER 11
- 5.5 PERMITS 12
  - 5.5.1 Environmental Permits 12
  - 5.5.2 Construction Permit 12
- 5.6 PROJECT CONTROLS AND MANAGEMENT MEASURES 12
  - 5.6.1 Dust Control 12
  - 5.6.2 Watering 12
  - 5.6.3 Roadway Dust Control 12

5.7 SOIL EXCAVATION PROCEDURE AND EQUIPMENT 12
5.7.1 Soil Profile 12
5.7.2 Soil Excavation Activities 13
5.7.3 Excavation Survey 13
5.7.4 Soil Confirmation Sampling 14
5.7.5 Soil Confirmation Sampling Procedure 15
5.7.6 Quality Assurance / Quality Control (QA/QC) 16
5.8 LEVEE CONSTRUCTION 16
5.9 SOIL RELOCATION AND STAGING 17
5.10 GROUNDWATER MONITORING 18
6.0 SUMMARY REPORT 18

LIST OF FIGURES

Figure 1 General Site Vicinity Map
Figure 2 Detention Area Site Map
Figure 3 Copper and Zinc TEC/PEC Exceedance Map
Figure 4 Areas of Proposed Impacted Soil Relocation Map
Figure 5 Perimeter and Inlet Levee Construction & Excavated Soil Placement
Figure 6 Location of Proposed Groundwater Monitor Wells

LIST OF TABLES

Table 1 Summary of Historical Pesticide, Herbicide, Paraquat, and Metal Soil Analytical Results
Table 2 50-Acre Grid Composite Samples for the Revised Frog Pond Project Footprint – Potential Risk Issues
Table 3 Sample Size Calculations (Post Scraping Confirmation)

APPENDICES

Appendix A Florida Department of Environmental Protection Response to Comments

Appendix B U.S. Fish and Wildlife Service's and Florida Department of Environmental Protection Approval Letters

1.0 INTRODUCTION / BACKGROUND

The C-111 Spreader Canal, Phase I project is comprised of the Frog Pond Detention Area improvements and the Aerojet, C-110, and L-31E canal modifications all of which are located west of Florida City in Miami-Dade County, Florida. The Detention Area is a 570-acre water detention area which will be constructed as part of the northern component of the C-111 Spreader Canal project.

The Detention Area involves the construction of containment levees which will form three cells, an inlet channel, a pump station (S-200), and a series of weirs. The cells will be separated by two intermediate levees and utilized to store water.

As indicated in the "Final Geotechnical Report" dated May 14, 2009, the existing surficial soils within the footprint of the proposed Detention Area (e.g. levees, canal lining, and pump station) have poor geotechnical properties and are required to be removed in order to provide adequate foundation support or seepage control.

Environmental investigations in the area of the proposed Detention Area revealed the presence of copper impacted soils in concentrations that pose a potential ecological risk. Because the surficial soils to be removed have elevated concentrations of copper, a soil management plan must be developed. This Soil Management Plan (SMP) provides procedures for the handling and management of copper impacted soil, during construction, within the proposed Detention Area.

The C-111 Spreader Canal Phase I Aerojet, C-110, and L-31E Canal Modifications are located in an area primarily used as a wildlife and environmental protection area by the Florida Fish and Wildlife Conservation Commission. One aspect of the C-111 Spreader Canal Project consists of constructing a Detention Area with a total capacity of approximately 293.7 acre-feet. The C-111 canal to the east of the subject property disrupts the natural groundwater flow away from the Everglades National Park and Taylor Slough, located to the south and west of the property. The groundwater flow is currently to the southeast on the property. The construction of the Detention Area will re-establish the natural groundwater flow patterns to flow towards Taylor Slough and ultimately into Florida Bay. The design for the Detention Area involves water infiltrating through the bottom of the reservoir to the groundwater in order to create a groundwater mound that will force groundwater on the property to flow towards the south and west. The anticipated high water mark in the Detention Area is three feet above the cap-rock floor surface. Restoration efforts may include the filling of ditches and removal of site roads.

1.1 PROPERTY DESCRIPTION

The Frog Pond and other agricultural properties in the region were developed by draining the surface waters from the southeastern portion of the Everglades. Soils within the Frog Pond and the surrounding area are relatively thin, at only 8 to 12 inches of soil, and are underlain by limestone cap-rock. Although the soils in the region are considered poor in nutrient value, the water available from the Everglades has led to the region being highly productive as agricultural. The Frog Pond property consists of 5,216 acres, of which 1,380 acres are currently used for agricultural production. Originally, the Detention Area, (referred to as a "Leaky Reservoir" in previous reports) was to be constructed on the 1,380 acres of agriculture production. The original design was recently revised to shift the Detention Area to the west and construct the reservoir on

approximately 600 acres in the western portion of the 1,380 acres of the property. The project site vicinity map is included as **Figure 1**. The Frog Pond property is located in Sections 30 and 31, Township 57 South, Range 38 East and Sections 6 and 7, Township 58 East, Range 38 East. A site location map illustrating the subject property is included as **Figure 2**.

1.2 SITE ASSESSMENTS/INVESTIGATIONS

Environmental Site Assessments (ESA's), Ecological Risk Assessments (ERAs), a pilot study, additional soil investigations, and a hydrologic evaluation have been conducted on the Frog Pond. The ESA's were conducted to evaluate whether historical activities on or near the subject property may have resulted in contamination by hazardous substances or wastes. The ERAs were conducted to evaluate the potential ecological risk issues associated with the contamination identified during the ESAs. Given below is a brief overview of the results of each assessment/study.

1.2.1 Phase I/II ESA (1995)

A Phase I/II ESA was conducted on the 5,216 acres of the Frog Pond in 1995. The Phase I ESA identified 26 areas of potential concern, of which 10 were located inside the footprint of the original 1,380 acre Detention Area design. Following the Phase I ESA, a Phase II ESA was recommended in order to evaluate the soil and groundwater quality in the areas of potential concern. The Phase II ESA involved installing and sampling 25 temporary monitoring wells, along with sampling five on-site irrigation wells, and collecting composite soil grab samples from visually impacted areas. The groundwater samples were analyzed for Volatile Aromatics (EPA Method 602), Organochlorine Pesticides (EPA Method 608), Organophosphorus Pesticides (EPA Method 614), Chlorinated Herbicides (EPA Method 615), Triazine Herbicides (EPA Method 619), Total Recoverable Petroleum Hydrocarbons (TRPH) (EPA Method 418.1/9073), Ethylene Dibromide (EPA Method 504), and the 8 Resource Conservation and Recovery Act (RCRA) metals. Soil samples were analyzed for TRPH (EPA Method 9073), Organochlorine Pesticides (EPA Method 8080), Organophosphorus Pesticides (EPA Method 8140), Chlorinated Herbicides (EPA Method 8150), and the 8 RCRA metals.

Groundwater analytical results indicated four groundwater samples with atrazine concentrations above the Florida Administrative Code (F.A.C.) Primary Drinking Water Standards of 0.003 milligrams per liter (mg/L). All other parameters analyzed were below their respective Primary Drinking Water Standards.

Soil analytical results exhibited Total Recoverable Petroleum Hydrocarbon levels in petroleum stained areas above the Chapter 62-770, F.A.C. Soil Cleanup Target Level – Residential Direct Exposure of 460 milligrams per kilogram (mg/kg). Soil analytical results for the burn areas exhibited elevated arsenic, chromium, and lead concentrations above their respective Sediment Quality Assessment Guideline (SQAG) – Probable Effects Concentration (PEC).

In 1995 and 1996, following the Phase II ESA, the burn areas and petroleum impacted areas were excavated and properly disposed of off-site. Approximately 30 tons of petroleum impacted soils and 5,500 cubic yards (yd^3) of solid wastes were removed from the Frog Pond.

1.2.2 Limited Phase II ESA (2006)

A Limited Phase II ESA was conducted on the 1,380 acres of the Frog Pond in 2006. The Limited Phase II ESA involved following the District's and Service's composite random design sampling protocol for agricultural areas by collecting one 10 point composite soil sample from each of the 50 acre grids in order to further evaluate the soil quality of the Frog Pond. The 10 point composite soil samples were collected from 0 to 6 inches below land surface (bls). A total of 29, 50 acre grids were sampled. The soil samples were analyzed for Organochlorine Pesticides (EPA Method 8081), Chlorinated Herbicides (EPA Method 8151), Organophosphorus Pesticides and Triazine Herbicides (EPA Method 8141), Paraquat (EPA Method 549), the 8 RCRA metals, plus copper, and Total Organic Carbon (TOC).

Soil analytical results for two of the 29 grids exhibited organochlorine pesticide 4,4-DDE concentrations above the SQAG–PEC of 31 micrograms per kilogram (µg/kg). Five grids also exhibited 4,4-DDE concentrations above the SQAG – Threshold Effects Concentration (TEC) of 3.2 µg/kg. Two grids exhibited 4,4-DDT concentrations above the SQAG–TEC of 4.2 µg/kg. Six grids exhibited total chlordane concentrations above the SQAG–TEC of 3.2 µg/kg.

Composite soil samples collected in 23 of the 29 grids exhibited elevated copper concentrations above the Service's Interim Value of 85 mg/kg. Concentrations of copper above the SQAG–TEC of 32 mg/kg were detected in four of the 29 grids. Twelve grids exhibited barium concentrations above the SQAG–TEC of 20 mg/kg, with one grid exhibiting a barium concentration above the SQAG–PEC of 60 mg/kg. Cadmium concentrations exceeded the SQAG–TEC of 1.0 mg/kg in six grids. Twenty-one grids exhibited chromium concentrations above the SQAG–TEC of 43 mg/kg. Seventeen grids exhibited zinc concentrations above the SQAG–TEC of 120 mg/kg. Two grids exhibited lead concentrations above the SQAG–TEC of 36 mg/kg. Arsenic was detected in one grid above the SQAG–TEC of 9.8 mg/kg.

1.2.3 Screening Level ERA (2006)

Due to elevated concentrations of agrochemicals detected during the Limited Phase II ESA in 2006 above the SQAGs, a Screening Level Ecological Risk Assessment (SLERA) was conducted on the 1,380 acres of the Frog Pond. The SLERA involved a three step process in order to assess potential impacts to wetland habitat and inhabitants once the area is inundated with water. The SLERA evaluated the potential ecological impacts due to the 10 chemicals of potential ecological concern (COPEC) identified during the Limited Phase II ESA. The 10 COPEC identified were 4,4-DDE, 4,4-DDT, total chlordane, barium, cadmium, chromium, lead, mercury, copper, and zinc. The COPECs were selected if the maximum concentration of the chemical exceeded the SQAG-TEC; mercury was evaluated due to the high potential to bio-accumulate.

Using 95% upper confidence limit (UCL) statistical analysis, per FDEP guidelines, it was determined that copper is the primary COPEC posing a potential risk to the benthic macroinvertebrate community. The SLERA indicated that for the Service Trustee species, copper poses a potential risk to the snail kite and 4,4-DDE poses a potential risk to the osprey. According to the SLERA, rehydration of the Frog Pond may result in unacceptable risks to the fish and water column community from exposure to copper at a water hardness of 50 micrograms per liter (µg/L). The SLERA did not indicate that barium, cadmium, chromium,

lead, total chlordane, 4,4-DDT, nor 4,4-DDD would pose any undo risk to the Service's trustee species.

1.2.4 Pilot Study (2007)

Based on the results from the Limited Phase II ESA and the SLERA, approximately 1,936,000 yd^3 of copper impacted soils are present in the 1,380 acres of the Frog Pond. Zinc and 4,4-DDE impacted soils are co-located with the copper impacted soil. Due to the large volume of impacted soils, corrective action options were evaluated. Excavation and offsite disposal of the impacted soils would not be feasible due to the large volume. However, excavation and re-location of the impacted soils outside of the Detention Area footprint is an option. Based on this, a Pilot Study was performed in 2007 in order to evaluate the effectiveness of scraping the impacted soils from the underlying limestone bedrock and relocating the soils outside of the Detention Area footprint.

The Pilot Study was performed on a western 50 acre plot adjacent to the 1,380 acre "Leaky Reservoir" footprint due to agricultural activities preventing the performance of the study inside the reservoir footprint. The area was identified as Grid 30. Twenty-seven discrete soil samples, from 20 soil boring locations, were collected in June 2007 and analyzed from Grid 30 for copper in order to determine the presence of these constituents. The soil samples were collected from 0 to 6 inches bls and from six inches to auger refusal, which typically occurred at eight inches bls. The soil analytical results of sampling Grid 30 exhibited copper concentrations above the Service's Interim Value and zinc concentrations above the SQAG–TEC. Based on the soil analytical results, Grid 30 was deemed acceptable to conduct the Pilot Study. A five acre plot within Grid 30 was selected for the Pilot Study based on this area having the highest copper concentrations.

The pre-scraping activities involved collecting 10 evenly spaced discrete soil samples from 0 to 6 inches bls, prior to scraping in the five acre Pilot Study area, and analyzing these samples for copper, zinc, and organochlorine pesticides. Following review of the soil analytical data the soil scraping was performed by utilizing a front-end loader. The soils were then stockpiled northwest of the five acre Pilot Study area, by utilizing dump trucks to transport the soils.

Following the soil scraping and relocating activities, in order to evaluate the effectiveness of the corrective actions, 18 confirmation discrete soil samples were collected from the residual soils remaining on top of the limestone bedrock and in the depressions of the limestone. The soil samples were analyzed for copper. Discrete and composite soil samples were also collected from the excavated soil stockpiles in order to evaluate if the excavated soils will be suitable for construction of the berms associated with the Detention Area.

A statistical analysis using the 95% UCL was conducted on the pre and post scraping soil analytical results. Statistically, the corrective actions reduced the copper concentrations from 239.3 mg/kg to 173.1 mg/kg and from 164.8 mg/kg to 145.6 mg/kg, respectively. Based on the samples collected from the stockpiled soils, copper concentrations slightly decreased due to mixing of the soils that occurs during the relocation activities.

In order to further examine the corrective actions performed during the Pilot Study, depressions in the vugs and solution cavities within the limestone bedrock were measured in order to

estimate the amount of residual soil present in the depressions. The total area of the depressions measured 4,676 square feet (ft^2) with the average depths of the depressions being 3.9 inches below grade. On average, the depth of the soils in the depressions was less than one inch. It was determined that the amount of residual soil remaining on the limestone surface, above the depression areas, was 0.5 inches or less. Based on these findings, the total volume of residual soil remaining on the five acre Pilot Study area was 385.5 yd^3, or 7.2% of the soil.

1.2.5 Expanded ERA (2008)

Based on the Pilot Study results that 7.2% of the copper impacted soil remains after scraping, further evaluation with respect to the potential risk to the Service's trustee species was conducted by laboratory simulations on pesticides and metals leaching into the sediment and surface water and an ERA was completed for the Frog Pond area. The Expanded ERA, as defined by the District and Service's 2008 ERA Protocol, was conducted to determine the potential for an ecological risk due to residual soils at the Frog Pond if a Detention Area were to be constructed at the site following routine scraping.

For the expanded ERA, three bulk soil samples (20 gallons of soil each) were collected from the Frog Pond and submitted for laboratory analysis of toxicity, bioaccumulation, and chemical desorption under simulated field conditions. Two of the soil samples were collected from the Pilot Study area (post-scrape) at locations identified to have copper concentrations above 85 mg/kg and zinc concentrations greater than 100 mg/kg. An additional soil sample was collected from an area on the Frog Pond that had not been scraped and considered a "worse-case" location due to elevated copper and organochlorine pesticide concentrations.

Based on the findings from the expanded ERA, soil scraping was recommended to reduce the mass and concentration of copper and other chemicals in the soil. The ERA concluded that the removal of the impacted soils from the top of the limestone bedrock will be adequate to reduce soil impacts to the extent that would not pose a significant risk to the Everglades snail kite, benthic macroinvertebrates, and other aquatic-feeding birds that may inhabit any habitat created by the construction of a reservoir at the site. A recommendation was also made to collect post-scraping confirmation soil samples from within the Detention Area footprint to evaluate the effectiveness of soil removal.

In conjunction with the expanded ERA, additional soil samples were collected from within the five acre Pilot Study area in order to evaluate the depth and aerial extent of residual soil remaining on the limestone bedrock and within the limestone bedrock depressions following soil scraping. To accomplish this, the Pilot Study area was divided into five, one acre grid cells. From each grid cell, one shallow (< 1 inch) sample was collected from the thin layer of soil on top of the limestone bedrock and one deep sample from the surface to approximately six inches in the bedrock depressions. The samples were analyzed for copper.

Soil analytical results for the samples indicated that concentrations of copper decrease with depth. The copper concentrations were higher in the shallow samples (top one inch of soil) than in the deeper samples in all five grid cells. Based on the delineation of soil depth and aerial extent, area-weighted surface soil concentrations (0 to 1 inch) were calculated. The area-

weighted copper concentration for the Pilot Study area was 64.7 mg/kg, below the Service's Interim Value for copper of 85 mg/kg following soil scraping.

1.2.6 Hydrologic Evaluation (2008)

In response to the COPECs identified in the Limited Phase II ESA, a hydrologic study was conducted to evaluate the contaminated soil's potential impact on the groundwater quality surrounding the Detention Area footprint as well as the groundwater recharge and flow direction within the footprint of the Detention Area.

The hydrologic study involved installing eight temporary monitoring wells around the perimeter of the Detention Area footprint and sampling on a quarterly basis. The groundwater samples were analyzed for organochlorine pesticides by EPA Method 8081 and barium, chromium, copper, and zinc by EPA Method 6010B. In addition to the groundwater sampling, In-Situ Level Troll 500 pressure transducers were installed in five of the eight monitoring wells to monitor the groundwater level and the flow direction in the vicinity of the Detention Area footprint.

The groundwater analytical results for each of the quarterly sampling events conducted in June 2008, October 2008, January 2009, and April 2009, indicated organochlorine pesticide concentrations were below laboratory detection limits (BDL). Groundwater samples exhibited concentrations of barium, chromium, copper, and/or zinc below Groundwater Cleanup Target Levels (GCTLs) per Chapter 62-777, F.A.C. or BDL.

Level Troll data indicate a rise in groundwater elevations corresponds to rainfall events or irrigation in the vicinity of the Level Troll (s) and followed by a decrease in groundwater elevations until the subsequent rainfall/irrigation event. The site specific groundwater flow direction over the past year has been to the southeast, towards the C-111 Canal.

Evaluating the groundwater analytical data with the Level Troll data indicates that the organochlorine pesticides and metals that were detected in the soil samples within the Frog Pond and the Detention Area are not leaching into the groundwater above applicable GCTLs.

1.2.7 Additional Soil Investigation (2008)

Following the Phase II ESA and Pilot Study, the initial 1,380 acre footprint of the Detention Area had been modified. Recent design changes have shifted the Detention Area to the west, resulting in an area of 350 acres, which had not been evaluated with respect to residual agrochemicals and soil addendums. an Additional Soil Investigation was conducted on December 17, 2008, to evaluate the potential presence of soil impacts within the western 350 acre footprint of the proposed Detention Area at the Frog Pond.

With farming practices on the 350 acres similar to the surrounding 1,380 acres previously sampled during the Limited Phase II ESA and in order to evaluate residual agrochemicals and soil addendums, distribution and concentrations in the agricultural area, the District and Service's sampling protocol was followed as given in the document entitled *Protocol for Assessment, Remediation and Post-Remediation Monitoring for Environmental Contaminants on Everglades Restoration Projects.* Soil sampling activities involved collecting one composite soil sample from each of the 50 acre grids in order to further evaluate the soil quality of the Frog

Pond. A total of seven, 50 acre grids were sampled. Each 50 acre grid was then subdivided into 10, five acre sub-grids. Within each of the five acre sub-grids, a five aliquot subset, close proximity discrete soil sample was collected. The discrete soil samples were collected from 0 to 6 inches bls. The 10 discrete soil samples were then thoroughly mixed to comprise the composite soil sample for each grid. The soil samples were analyzed for Organochlorine Pesticides (EPA Method 8081), Chlorinated Herbicides (EPA Method 8151), Organophosphorus Pesticides and Triazine Herbicides (EPA Method 8141), Paraquat (EPA Method 549.2-Mod), the 8 RCRA metals, plus copper, and Total Organic Carbon (EPA Method 9060).

The soil analytical results for the Additional Soil Investigation indicated elevated copper concentrations above the Service's Interim Value of 85 mg/kg in four of the seven grids. The highest copper concentration was 224 mg/kg. Concentrations of copper, above the SQAG–TEC, were detected in the remaining three grids.

Barium was detected above the SQAG–TEC in one of the seven grids. Concentrations of chromium above the SQAG–TEC were detected in four grids. Concentrations of zinc above the SQAG–TEC were detected in two grids. Arsenic concentrations exceeded the SQAG–TEC in one grid and exceeded the SCTL Residential Direct Exposure of 2.1 mg/kg in all seven grids.

The additional soil data was summarized in the report entitled *Additional Soil Investigations*, dated March 30, 2009. This report was submitted to and approved by both the FDEP and the Service. Copies of the approval letters are included in **Appendix B.**

Following the collection of the additional seven, 50 acre grids, an Expanded ERA was completed. The results of the additional grids were similar to the results observed in post-scraping soils in the Pilot Study area, in which no significant risk was observed for the Everglades snail kite, benthic macroinvertebrates, or other aquatic-feeding birds if soil scraping is conducted. The Expanded ERA concluded that soil scraping may not be necessary to meet risk management goals within three grids (Grids 31, 32, and 33) in the additional 350 acres sampled since copper concentrations do not exceed the snail kite benchmark and Pilot Study samples. However, scraping is recommended for the remaining areas of the revised Detention Area footprint. The Expanded ERA was submitted to the Service for review. The Service approved the recommendation to scrape the soils as a means of reducing the potential risks associated with the copper impacted soils. A copy of the Service approval letter is included in **Appendix B**.

Soil analytical results from the ESA's and additional soil sampling activities are summarized in **Table 1.**

2.0 WATER QUALITY

2.1 GROUNDWATER

From June 2008 to May 2009, a hydrologic study was conducted to evaluate the impacted soil's potential impact on the groundwater quality surrounding the Detention Area. Groundwater samples were collected from eight monitoring wells from a period of one year; with one sample collected per well every three months. The groundwater samples were analyzed for organochlorine pesticides by EPA Method 8081 and barium, chromium, copper, and zinc by EPA Method 6010B. The groundwater analytical results did not detect organochlorine pesticide

concentrations above laboratory reporting limits. Groundwater samples exhibited concentrations of barium, chromium, copper, and/or zinc below Chapter 62-777, F.A.C. GCTLs or were BDL. The groundwater analytical data indicates that the organochlorine pesticides and metals that were detected in the soil samples within the Frog Pond Detention Area are not leaching into the groundwater above applicable GCTLs.

To further evaluate if the impacted soils have the potential for metals to leach into the groundwater, on June 11, 2009, composite soil samples were collected from five, 50-acre grids within the Detention Area. The soil samples were submitted to a State certified laboratory for analysis of five metals for total metal concentrations followed by Synthetic Precipitation Leaching Procedure (SPLP). The SPLP was performed on the samples to evaluate the potential leachability of the impacted soils that are present within the 600-acre water detention area. The five metals analyzed were arsenic, barium, chromium, copper, and zinc.

The total metal analytical results of the soil samples collected on June 11, 2009 were similar to the initial sampling results collected on January 13, 2009 during the Additional Soil Investigations. The SPLP results were compared to the Primary and Secondary Drinking Water Standards per the Chapter 62-777, F.A.C. and Criteria for Surface Water Quality Classifications (SWQCs) to determine if the metals had the potential to leach from the soils at the site above regulatory standards.

The site-specific SPLP results for arsenic, barium, chromium, copper, and zinc did not have concentrations above the Primary or Secondary Drinking Water Standards indicating that the metal concentrations in excavated soils and residual soils in the 600-acre water Detention Area will not leach into the groundwater above applicable regulatory standards. These results are consistent with the groundwater data collected over the past year at the Frog Pond.

2.2 SURFACE WATER

The aforementioned SPLP results were compared to the Surface Water criteria to evaluate if the residual soils remaining in the Detention Area, after scraping, had the potential to desorb the metal (s) into the surface water above SWQCs. The site-specific SPLP results for copper ranged between 0.0058 mg/L to 0.044 mg/L of which three samples exceeded the calculated SWQC of 0.019 mg/L. The SPLP result for arsenic was below the SWQC of 50 mg/L, and for chromium and zinc the SPLP results were below the calculated SWQCs of 0.0167 mg/L and 0.238 mg/L, respectively.

Based on review of the SPLP test results, the potential environmental risk posed by copper desorbing from the residual soils into the surface water in the Detention Area is anticipated to be low. Only a thin veneer of impacted soil and isolated vugs of impacted soils, with limited aerial and vertical extent will be present in the Detention Area after scraping. The majority of the scrapped soil will be located outside of the reservoir. However, a sample percentage of impacted soils (15%) may be mixed with clean fill and used in the construction of the Detention Area berms. This mixed material will make up no more than 25 % of the inner core of the berms.

The estimated infiltration rate of the Frog Pond soil/sediment will likely exceed the diffusion rate of copper out of the sediment into the overlying water column. Also, the more acidic conditions

that soil samples are exposed to as part of the SPLP tests will not expected to be present in the Detention Area or the waters flowing into the Detention Area. The Detention Area is underlain by limestone cap rock, which will cause the surface water and groundwater to be slightly basic, as opposed to acidic. Therefore this basic condition should decrease the potential for leaching of the absorbed metals into the groundwater and surface waters. Additionally, water is not anticipated to pond within the Detention Area for an extended period of time, creating an environment that would be conducive for copper to desorb from the soils/sediment. Any copper that leaches out of the berms is estimated to be at concentrations below the 0.019 mg/L SWQC. In addition, the copper concentrations in the water column are expected to decrease with subsequent flooding.

Based on the additional soil sampling conducted on June 11, 2009, the "*Soil Leachability Study for the Frog Pond section of the C-111 Spreader Canal*" report was submitted for review by the FDEP on July 22, 2009. Comments on the leachability study from the FDEP were issued on September 2, 2009. The FDEP commented on the soil concentration of copper at which an SPLP exceedance would occur, specifically from the utilization of copper impacted soil in the construction of the levees and berms. A response to the FDEP comments on the Frog Pond leachability study was submitted on September 17, 2009. The Response to the leachability studies SPLP results estimated soil copper concentrations greater than 91 mg/kg have the potential to desorb into the Detention Area surface water. Based on this estimation, The SMP sampling and analysis of the clean fill material and mixed soils was incorporated to ensure the soils utilized in the construction of Detention Area levees and berms do not pose a potential risk to surface water or ecological receptors. Following the response to comments, the Frog Pond leachability study was approved by the FDEP in an approval letter dated November 9, 2009. A copy of the FDEP comments on the Frog Pond leachability study and responses to comments are included in **Appendix A**. A copy of the FDEP approval letter is included as **Appendix B**.

3.0 OBJECTIVE

The purpose of the SMP is to provide the procedures required for the permitting, excavation, and relocation of the copper impacted soils, and how the soils are associated with the design of the Frog Pond Detention Area for the C-111 Spreader Canal Project. The SMP will be presented for review and concurrence from applicable regulatory agencies. A Health and Safety Plan (HASP) will also be developed prior to initiation of field activities.

4.0 EXTENT OF IMPACTED SOILS

Copper concentrations detected in composite soil samples within the Detention Area footprint are illustrated in **Figure 3**.

4.1 CONSTITUENTS OF CONCERN

Results of the ESAs and ERAs conducted at the Frog Pond identified agricultural areas impacted with copper at concentrations that would potentially pose an unacceptable ecological risk to the Snail Kite and Osprey, Service trustee species. Residual organochlorine pesticides, including 4,4-DDE, as well as arsenic, chromium, and barium were not identified in the soil samples collected within the Detention Area footprint at concentrations that would cause undo-risk to the Service's trustee species.

4.2 LATERAL AND VERTICAL EXTENT

Results from the Limited Phase II ESA, SLERA, and additional sampling efforts at the Frog Pond identified agricultural areas impacted with copper concentrations above the Service's Interim Value. These concentrations may pose a risk to the snail kite.

The following range of copper impacts was observed in the impacted areas at different depths:

- 0-6" bls – from 27 mg/kg to 230 mg/kg
- 6"-8'' bls – from 11 mg/kg to 187 mg/kg

Zinc concentrations above the SQAG-TEC, but below the SQAG-PEC, were also identified. These concentrations may pose a risk to the snail kite.

The following range of zinc impacts were observed in the impacted area at different depths:

- 0-6" bls – from 29 mg/kg to 160 mg/kg
- 6"-8'' bls – from 4.3 mg/kg to 143 mg/kg

The 6"-8" range for both copper impacted soil is from Grid-30 that was sampled to determine the pilot study area. No other areas were sampled below six inches bls.

Approximately 600 acres, located in the western portion of the Frog Pond, exhibit copper concentrations above the Service's Interim Value for copper. The area of zinc impacted soil, approximately 300 acres, is co-located with the copper impacted soil. Based on extensive soil sampling conducted on the 600 acres, copper impacts extend to an approximate depth of six inches bls. The Service has approved excavation and relocation of impacted soils from the 600 acre area on the Frog Pond. A copy of the Service's approval letter is included in **Appendix B**.

The approximate volume of soil on the Frog Pond requiring excavation and relocation, based on an approximate six inch thickness of soils, is 473,780 yd^3.

4.3 SOIL REMEDIATION

Based on results from the Limited Phase II ESA and Pilot Study, a corrective action method was identified to eliminate and/or minimize the potential risks of the copper impacted soils to the Service's trustee species. The corrective action method involves excavating the six to eight inches of soil down to the limestone cap-rock and relocating the impacted soils outside of the Detention Area footprint. The Pilot Study performed in 2007 and the Expanded ERA in 2009 determined that scraping the impacted soils from the underlying limestone bedrock and relocating the soils outside of the Detention Area footprint is an effective corrective action method and poses no significant risk to the Service's trustee species.

5.0 SOIL REMEDIATION METHODOLOGY

Based on site-specific conditions, 600 acres of impacted soils from Grids 30 through 36 and portions of Grids 3, 8, 9, 14, 15, 20, 21, 26, 27, 28, and 29 will be scraped from the Detention Area footprint. Based on site-specific conditions, the copper impacted surficial soils will be excavated and relocated east of the Detention Area construction. The District's selected contractor can use any one of the three designated stockpiles for storage of impacted surficial

soils. The following sections detail the soil excavation, relocation, and verification sampling methodology.

Of the 600 acres of copper impacted soils to be excavated and relocated, approximately 13 acres of tree islands are located on the eastern edge of the Detention Area footprint. The construction design of the Detention Area is to leave the 13 acres of tree islands undisturbed.

5.1 HEALTH AND SAFETY PLAN

Prior to implementing any field work, the District's selected contractor should develop a HASP for worker exposure to impacted dust/soil during the relocation process. Soil analytical data collected at the Frog Pond have exhibited arsenic and copper concentrations above the Direct Exposure Residential SCTLs of 2.1 mg/kg and 150 mg/kg, respectively. Exceedances above the Direct Exposure Commercial/Industrial SCTLs were not exhibited in any of the soil analytical data. The arsenic and copper exceedances at the Frog Pond do not represent a significant human health risk. The site specific HASP should provide the details for the health and safety component of this project. Details on excavation safety and worker safety should be included in the site specific HASP.

5.2 PRE-SOIL EXCAVATION SURVEY

The District Engineer or project manager (PM) will work with the excavation contractor to identify the area to be scraped. The final engineering plans indicate that all of the soil, both within and below the proposed levees and berms, will be scraped to the top of the limestone cap-rock. Site visits will be conducted to confirm that the area to be scraped is properly marked. In the event that there is a discrepancy in the area to be scraped, then coordination with the District onsite PM to resolve these issues.

This work order does not address the need for the following items. It is our understanding that these issues will be completed by the District PM or the selected contractor under a separate work order

5.3 UTILITIES PROTECTION

The District's selected contractor will be required to obtain the necessary utility clearance prior to beginning any excavation work, in addition to notifying the Miami-Dade County Public Works Department (PWD). If necessary, a site surveying crew will assist in the location of identified utilities and verify the depths of existing piping or utilities. Utilities within or near the site will be flagged prior to commencement of work.

5.4 STORMWATER

The District's selected contractor will be required to obtain the necessary Storm Water Management Plan. The District's selected contractor will ensure that the site work associated with soil excavation and soil stockpiling is consistent with the issued storm water permit.

5.5 PERMITS

5.5.1 Environmental Permits

The District has, as part of the project permitting, already obtained the necessary Federal, State, and Local permits for the construction and operation of this project. The soil excavation and relocation of the soil will be conducted in conjunction with the permits.

5.5.2 Construction Permit

The District's selected contractor for the soil excavation will obtain all necessary State and Local permits

5.6 PROJECT CONTROLS AND MANAGEMENT MEASURES

The District's selected contractor will implement engineering controls to limit the impact of the excavation/construction on the site and surrounding areas. These measures will also preclude cross-contamination by controlling dust emissions, surface erosion, and stormwater run-on and run-off.

5.6.1 Dust Control

Engineering controls and work practices, which will be used to control emissions, are outlined below.

5.6.2 Watering

Water will be applied to site and work area surfaces where other engineering controls (such as temporary liners) are not employed and when airborne dust emissions are present.

5.6.3 Roadway Dust Control

The District's selected contractor will ensure that haul and access roads and pathways are properly maintained to enhance dust control. Material transport vehicles will be loaded in a manner to avoid spillage during transport. Any spillage of impacted soils or waste materials during transport will be cleaned up immediately. Water may also be used for dust control on roadways, if necessary.

5.7 SOIL EXCAVATION PROCEDURE AND EQUIPMENT

5.7.1 Soil Profile

Soils within the Frog Pond area are relatively thin, approximately six to eight inches thick, and are underlain by solution-riddled limestone cap-rock. Historically, the soils in the Frog Pond area have been either rock-plowed or mechanically scarified and cultivated. These activities have resulted in the thin layer of soil with fragments of the underlying cap-rock.

During the Pilot Study (2007) and the Expanded ERA (2008) depressions were observed in the limestone cap-rock that contained residual soils beyond six to eight inches bls. After conducting

the pilot test, on average, the depth of the residual soils in the depressions was less than one inch, however in some areas the thicknesses of soils in the solution-riddled cap-rock measured one to two feet in thickness.

The soil analytical data collected during the site assessments and investigations indicates that copper concentrations were present in the soils above the Service's Interim Value of 85 mg/kg. The thin veneer of residual soils remaining on the cap-rock after scraping also had elevated copper above 85 mg/kg. However, the copper in the soils located in the solution riddled cap-rock attenuated with depth to concentrations below 85 mg/kg.

5.7.2 Soil Excavation Activities

The inlet channel levee will intersect the C-111 Canal in the northeast portion of the property and extend west 2,955 feet before intersecting the northern portion of the east perimeter levee. The inlet channel levee will then extend 1,869 feet west from the inlet channel levee and east perimeter levee intersection to the existing west perimeter levee. The east perimeter levee extends south 14,327 feet from the inlet channel levee and east perimeter levee intersection before turning 90 degrees to the west to connect with the south perimeter levee. **Figure 4** illustrates the Detention Area footprint and the areas proposed for the impacted soil relocation.

The final construction plans indicate that impacted soil within the Frog Pond Detention Area will be excavated from the soil surface down to the limestone cap-rock and relocated to one of the three stockpile areas on-site. The proposed areas for relocation of the impacted soils is along the outer edge of the east perimeter containment levee and south of the inlet channel levee of the Detention Area. The locations of the stockpile areas are illustrated on **Figure 4**. The estimated amount of soils that will be relocated to the stockpile areas, excluding the excavated soil utilized in the Detention Area construction, is 401,323 yd^3.

During the soil excavation activities, the WRS Frog Pond Detention Area design drawings will be utilized to ensure that the excavation activities extend to the outer edges of the levees and berms. The soil excavation activities will be documented and inspections conducted of the areas excavated to ensure removal of impacted soil, as much as practical, and oversee that the relocation of the impacted soils along the outer edge of the east perimeter containment levee and the inlet channel levee locations are properly stockpiled along the outer edge of the levees. Following initial soil excavation activities, residual soils may be present in the limestone cap-rock depressions. The post soil relocation survey will identify areas where over-excavation may be required in the limestone cap-rock depressions.

5.7.3 Excavation Survey

Subsequent to the soil excavation activities, an inspection of the excavated area will be conducted to confirm and document that the impacted soils have been excavated to the required extent and depths, as much as practical. Initially a visual inspection will be conducted of the excavated area via a four-wheel drive vehicle. The excavated area will be traversed in north-south transects. The surface will be inspected for depressions in the limestone cap-rock. The depressions will be identified using a hand held Global Positioning System (GPS) receiver and documented. After inspecting the excavated area, the depressions in the limestone cap-rock will then be inspected on foot to determine the amount of residual soil in the depressions. The aerial

extent of the depressions will be measured and a calibrated rod will be utilized to determine the depth of residual soil. Based on these measurements, the volume of soils in the depressions will be calculated. Areas where the depth of the residual soils is less than one inch will not be over-excavated. In areas that are more than ¼-acre in size with a residual soil thickness of more than three inches, the contractor will over-excavate these areas as much as practical. The area will be re-inspected to document the effectiveness of the over-excavation.

5.7.4 Soil Confirmation Sampling

After the impacted soils have been excavated and relocated and the survey conducted, confirmation soil samples will be collected. Subsequent to excavation of impacted soils, the sampled locations will be located using a portable GPS receiver. At each of the sample locations, a five point, close proximity discrete composite soil sample from the excavated ground surface will be collected. The discrete sample will be collected from the residual soils remaining on top of the limestone bedrock. The soil sample will be placed in a pre-cleaned stainless steel bowl and thoroughly mixed with a stainless steel spoon. The soil will then be placed in a labeled, pre-cleaned, laboratory-supplied bottleware and subsequently placed in a sample cooler with ice. The samples will be submitted under chain-of-custody procedures to a State certified laboratory and analyzed for organochlorine pesticides (EPA Method 8081), copper, and zinc.

The number of samples to be collected was determined according to the quantifiable measure for determining adequate sample size recommended by the United States Environmental Protection Agency (EPA, 1989, Section 6.3.2). The sample size is driven by three factors: (a) the chosen decision errors, (b) the variability of the potential contaminants of concern, and (c) the desired resolution, *i.e.*, the difference between the baseline and subsequent datasets that needs to be detected at the chosen confidence. The resulting equation is

$$n = \frac{(z_{1-\alpha} + z_{1-\beta})^2 s^2}{\Delta^2}$$

where,

n = number of grids to be sampled each year

α = the false positive rate, Type I error, or the significance (tolerable error for missing an actual difference between the baseline and subsequent datasets)

$1-\alpha$ = the confidence (probability of correctly identifying a significant change)

β = the false negative rate, or Type II error (tolerable error for incorrectly declaring a difference between the baseline and subsequent datasets)

$1-\beta$ = the test power (probability of correctly identifying the absence of no difference)

$z_{1-\alpha}$, $z_{1-\beta}$ = the confidence and power normal deviates

s^2 = standard deviation of parameter of concern

Δ = The minimum difference between the mean concentrations of the baseline and subsequent datasets to be detected at the chosen confidence

Samples collected from 50-acre grids at the Frog Pond as part of the Phase I/II ESA and subsequent sampling to fully characterize the revised footprint were used as the baseline for

calculating an adequate post-scraping sample size. Review of the data indicated that chromium, copper, zinc and 4,4'-DDE were elevated above screening-level benchmarks at the site. Concentrations of 4,4'-DDE were mostly non-detect and were only elevated above TEC SQAG in one grid indicating that widespread risks are not likely from 4,4'-DDE (SFWMD and USFWS 2008) so it was not included in the sample size calculations.

The concentrations of chromium, copper, and zinc in composite samples from the revised footprint as well as their corresponding summary statistics are shown in **Table 2**. The mean and standard deviation are then used in **Table 3** to calculate the number of samples required following soil scraping at the Frog Pond based on the chosen decision errors. In these calculations, the desired minimum difference is set as 20% of the computed mean pre-scraping concentrations allowing for a statistically adequate measurement of a 20% change in pre- to post-scraping soil concentrations. The data for copper indicates the highest sample size, which is selected to ensure the conservative nature of the proposed post-scraping confirmation sampling plan. This results in the need for 37 or more samples to be randomly selected for confirmation purposes following soil scraping.

Based on correspondence with the District, Service, and FDEP on the initial SMP confirmation sampling plan, an additional 13 samples will be collected for a total of 50 discrete confirmation samples. The soil samples will be collected from 0 to 6 inches bls in solution cavities / depressional areas where residual soils remain subsequent to scrapping activities.

5.7.5 Soil Confirmation Sampling Procedure

As discussed with the Service, the confirmation soil sampling activities will involve sub-dividing the project area into five, approximately 125 acre cells. Each of the five, 125 acre cells will be inspected to identify and measure all depressional areas greater than 100 ft^2 for evaluation of sampling. The 10 largest depressional areas greater than 100 ft^2 in each 125 acre cell will be selected for confirmation soil sampling. Soil samples collected from these 10 depressional areas will be sampled from 0 to 6 inches for a total of 50 confirmation soil samples.

In addition, in order to evaluate the vertical impacts in the depressional areas, of the 10 largest depressional areas greater than 100 ft^2, five vertical confirmation soil samples will be collected in each of the 125 acre cells from 6 inches to refusal for a total of 25 soil samples. To augment the mass balance work conducted to date that indicates copper is mostly confined to the top two inches of residuals soils in the depressional areas, of the 10 largest depressional areas greater than 100 ft^2, five confirmation soil samples will be collected from each of the five, 125 acre cells from 0 to 2 inches for a total of 25 samples.

The confirmation soil samples will be analyzed for copper and zinc. Based on the location of the 50 confirmation samples to be collected from 0 to 6 inches, 50% of the confirmation samples will also be analyzed for organochlorine pesticides by EPA Method 8081. It is the District's opinion that the 25 confirmation samples selected for organochlorine pesticide analysis will be representative of the Frog Pond Detention Area. In the event that elevated organochlorine pesticide concentrations are detected, the remaining confirmation soil samples will be analyzed for organochlorine pesticides.

Depressional areas that are less than 100 ft^2 but greater than 25 ft^2 will be measured in one representative 125 acre cell. This data will then be extrapolated as a representation of the entire Frog Pond Detention Area. In addition, at least two, one acre areas will be selected in each of the five, 125 acre cells to measure depressional areas less than 25 ft^2. However, samples will not be collected from these smaller depressional areas.

5.7.6 Quality Assurance / Quality Control (QA/QC)

Quality assurance procedures utilized during the post scraping sampling activities will include compliance with the FDEP Standard Operating Procedures (SOP) for Laboratory Operation and Sample Collection Activities. Laboratory analytical parameters, procedures, and quality control will be conducted in accordance with Test Methods for Evaluating Solid Waste, Physical Chemical Methods, Third Edition (EPA SW-846) methodologies.

In addition to the 50 discrete confirmation soil samples to be collected following soil scraping, five duplicate discrete soil samples will be collected per the District's Quality Assurance System Requirements (QSAR) document developed for the Comprehensive Everglades Restoration Program (CERP) requiring an additional 10% samples be collected for quality assurance. Five soil samples will also be split and submitted to a separate laboratory per the Service. The split samples will evaluate the correlation between the parent sample and the split sample analyzed by a separate laboratory. Both the duplicate and split samples will be analyzed for organochlorine pesticides (EPA Method 8081), copper, and zinc.

In order to validate the field and laboratory procedures, in addition to ensuring that the data reported is representative of site conditions, equipment blanks, trip blanks, matrix spike and matrix spike duplicate samples will also be collected. As required, the QA/QC samples will be analyzed for organochlorine pesticides (EPA Method 8081), copper, and zinc. The equipment blanks will be representative of the stainless steel equipment used (hand auger, mixing bowl, and mixing spoon) during sampling activities.

The FDEP Automated Data Processing Tool (ADaPT) for data validation will be utilized for each group of samples that will be submitted to the laboratories.

5.8 LEVEE CONSTRUCTION

The contractor will be given the choice to build the proposed levees out of clean imported material or to mix the scraped surficial soil with clean fill. If the contractor chooses to mix materials, in light of geophysical considerations, the scraped soil in the mixture should be limited to a maximum 33% by volume.

A site-specific leachability study conducted at the Frog Pond (July 2009) indicated that soil mixtures with copper concentrations greater than 91.9 mg/kg have the potential to leach copper into the surface water at concentrations that exceed the surface water quality criterion. Any soil mixture must also result in copper concentrations that are below the Service's Interim Value of 85 mg/kg. Soils mixtures containing less than 85 mg/kg of copper will therefore meet both the site-specific water leachability concentration, and Service's Interim Value.

It is important to note that, if the contractor chooses to use mixed soil to construct the core of the levees, the contractor will install a 1-foot thick cap of clean fill over the levee core. **Figure 5** illustrates the cross section details for the levees.

5.9 SOIL RELOCATION AND STAGING

The District selected contractors will be responsible for onsite activities and safety. The District's contractor and the District onsite PM will implement the following protocol. Because the site is located in a rural area, noise control is not likely to be an issue during the excavation activities. The contractor should develop a site specific HASP. The site specific HASP may require that hearing protection be worn by the contractor crewmembers.

Work activities will be planned and scheduled as such to minimize the number of times the impacted soils are handled or disturbed. Excavation, loading, transportation, and stockpiling will be planned to minimize the aerial extent of waste or work area exposed. Vehicular traffic, which will include principally truck traffic, will be controlled on-site by implementing and enforcing traffic routes for all vehicles. These routes will be clearly marked and drivers will be informed of the traffic plan in writing prior to performing any work at the site. When impacted soil is removed from the Detention Area by truck, the driver will be prohibited from leaving his truck cab and will be so instructed. Radios will be used on-site to control traffic entering and exiting the site. Route markers (e.g., traffic cones and traffic signs) will be placed as necessary to mark site access and routes of travel. The contractor will also coordinate as necessary with all other site activities occurring during the soil removal.

The excavated soil will be placed in an area that is not proposed for inundation or flooding. Based on the limited residual agro-chemicals in the soil, no berms or liner are proposed or necessary for the stockpiles to limit the impacted soil from leaching to the surface water or ground water. Excavated soil will be transported to one of the three soil stockpiles on-site. The northern, central, and southern stockpiles will contain approximately 317,439 yd^3 of scrapped soils. **Figure 4** illustrates the locations of the stockpiles.

In an effort to limit soil erosion and sediment control of the soil stockpiles, both non-structural and structural controls will be used to control storm water run-off and related erosion from the soil stockpiles. The District's selected contractor will place the soil in the stockpiles at two foot lifts. The soil stockpiles will be compacted using the placement equipment to minimize soil erosion, in addition to the stockpiles being graded in a manner to limit erosion and accumulation of stormwater and the resultant need for other controls. Grass seeds will be dispersed on the soil stockpiles to promote restoration and limit erosion. The soil stockpiles will be posted with signs that inform on-site personnel that access to these areas are off limits to control traffic and surface erosion. Structural controls, such as hay bales, will be used in conjunction with silt fencing and diversion ditches to control surface water runoff. The exact locations of structural controls will be determined and constructed, where practical and identifiable, prior to use of heavy equipment. Controls will be implemented concurrently with all construction activity and will be continued throughout the period of construction. Additionally, the District's selected contractor will implement controls dictated by periods of intense weather. Weather forecasts will be monitored to provide an alert of such weather conditions.

The District's selected contractor will install suitable erosion and sediment control measures around the site prior to initiation of any site activities. The contractor will augment the existing erosion controls as necessary, including the strategic placement of silt fence and hay bales. The controls will be inspected after each rain event by the contractor to ensure continued performance.

5.10 GROUNDWATER MONITORING

To document that scraped soils will not impact groundwater, four groundwater monitor wells will be installed following the excavation and soil relocation activities. The wells will be installed to 12 feet bls using eight inch hollow stem flight augers and a truck-mounted drill rig. The wells will be constructed of 10 feet of 0.010 slot screen and five feet of solid PVC riser. A 6/20 silica sand filter pack will be placed in the annular space, between the auger boring hole and the well, to 11 feet. The upper foot will be finished with cement grout. The wells will be installed such that three feet is above land surface and housed in a secured steel casing for protection set in a two by two foot cement pad. Each well will have a secured water tight cap.

Three groundwater monitor wells will be located just southeast of the soil stockpile areas, one at each stockpile, and one groundwater monitor well will be located just south of the Detention Area's south perimeter levee. **Figure 6** illustrates the proposed groundwater monitor well locations for the Frog Pond Detention Area.

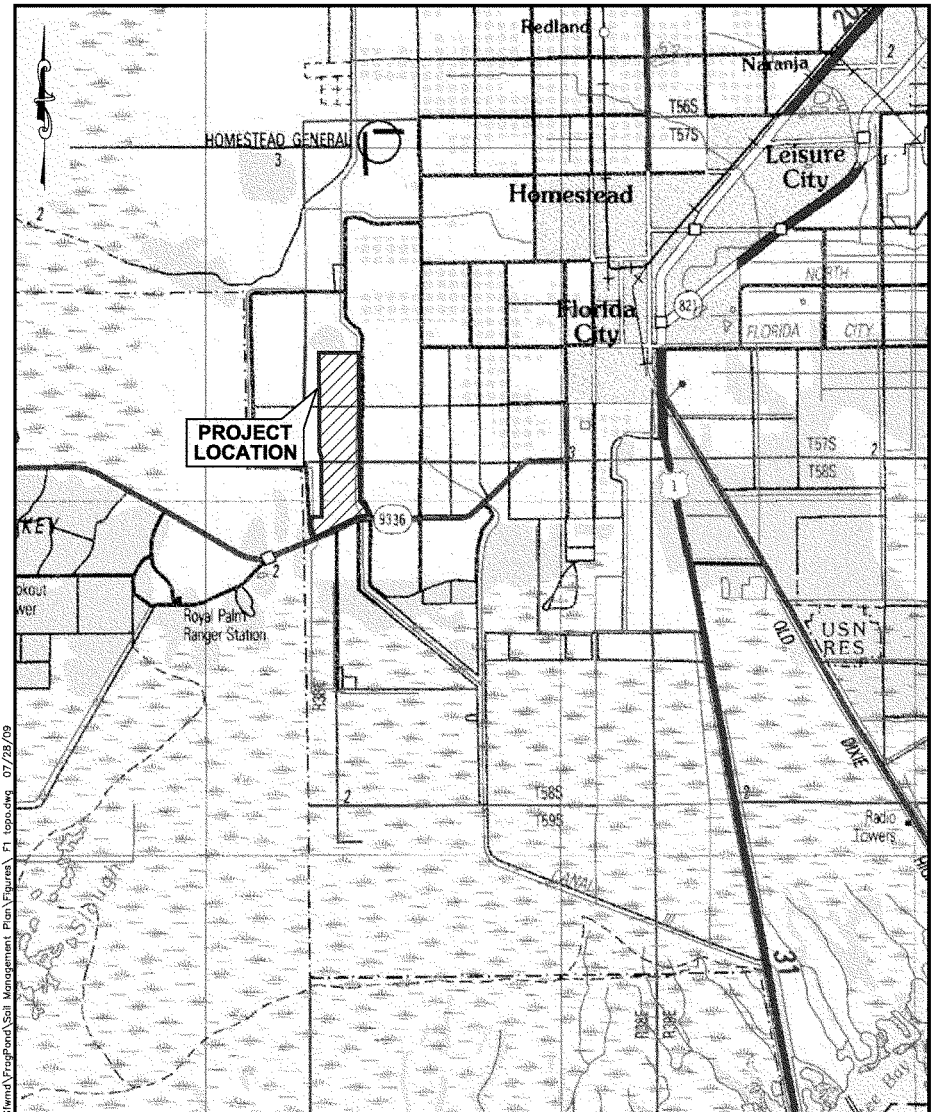
Surface water sampling within the Detention Area will be addressed as part of the District construction and operation permit with FDEP and the Service. Therefore no surface water samples are recommended as part of this SMP.

6.0 SUMMARY REPORT

A report documenting field activities and summarizing the soil confirmation results will be prepared. The data collected will be tabularized, and illustrated on figures documenting the confirmation sample locations and corresponding copper concentrations. The figures will illustrate pre- and post- soil relocation areas with associated survey maps.

Quarterly reports will be formulated for the groundwater sampling events. The reports will summarize the data collected during the sampling events, and the data will be tabulated and illustrated on figures. Conclusion and recommendations will also be given in the quarterly reports.

FIGURES



GENERAL SITE VICINITY MAP

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FROG POND
SOIL MANAGEMENT PLAN
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-408 DATE: JULY 2009

FIGURE: 1

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DRAWN: R.A.C. CHECKED: E.L. DATE: JULY 09	REVISIONS	BY	DATE

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SOIL MANAGEMENT PLAN
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JOB NO.: 38617-408 DATE: JULY 2009

DETENTION AREA SITE MAP

FIGURE: 2

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JOB NO.: 38617-408 DATE: JULY 2009

COPPER & ZINC
TEC / PEC EXCEEDANCE MAP

FIGURE: 3

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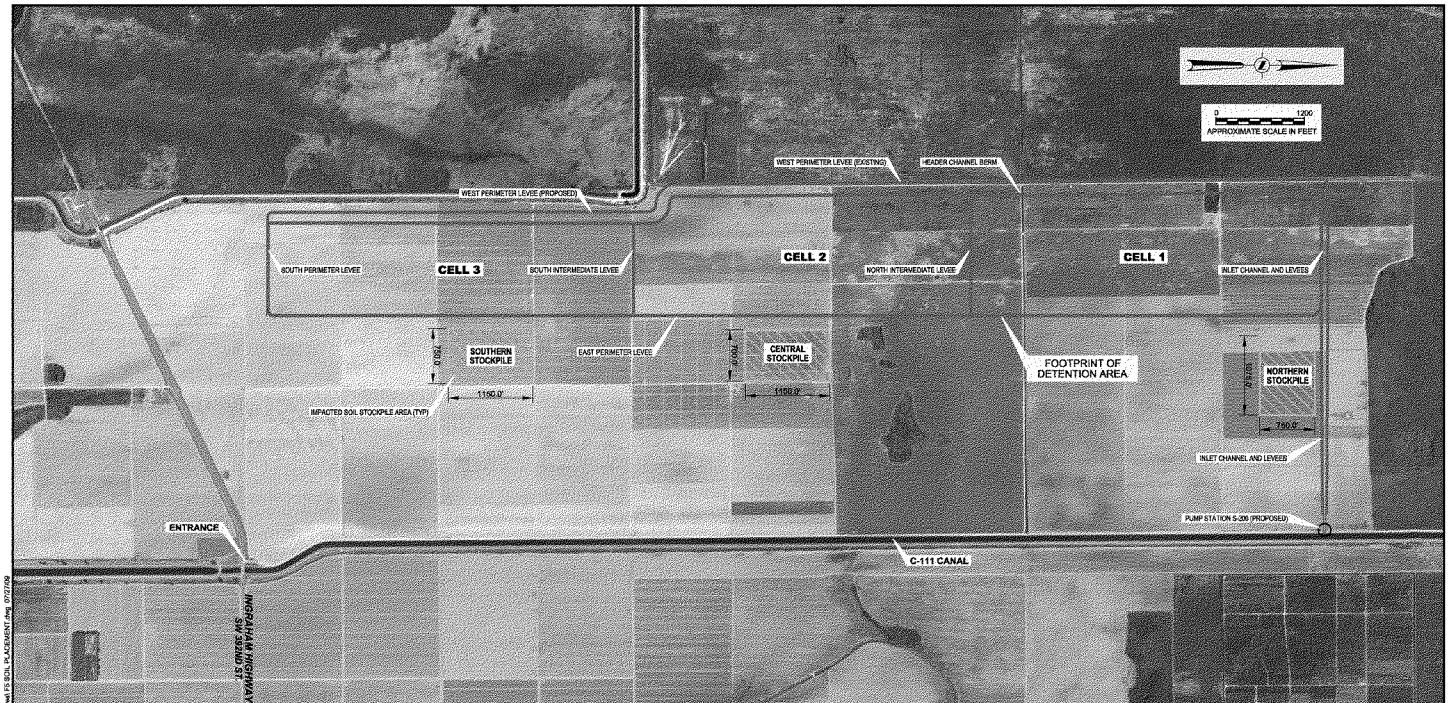
SOIL MANAGEMENT PLAN
MIAMI-DADE CO., FLORIDA

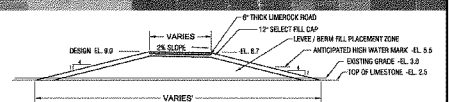
JOB NO.: 38617-408 DATE: JULY 2009

AREAS OF PROPOSED IMPACTED SOIL RELOCATION MAP

FIGURE: 4



CROSS SECTION
SOIL STOCKPILE AREA



CROSS SECTION
PERIMETER LEVEES / BERMS

NOTE:
25% OF LEVEE / BERM CORE CONSTRUCTION WILL CONSIST OF EXCAVATED COPPER AND ZINC IMPACTED SOILS. REMAINING 75% WILL CONSIST OF CLEAN FILL.

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FROG POND
SOIL MANAGEMENT PLAN
MIAMI-DADE CO., FLORIDA

DATE: JULY 2009

PERIMETER AND INLET LEVEE CONSTRUCTION AND EXCAVATED SOIL PLACEMENT

FIGURE: 5

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JOB NO.: 38617-408 DATE: JULY 2009

LOCATION OF PROPOSED GROUNDWATER MONITOR WELLS

FIGURE: 6

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TABLES

TABLE 1
SUMMARY OF HISTORICAL PESTICIDES, HERBICIDES, PARAQUAT, AND METAL SOIL ANALYTICAL RESULTS
FROG POND
SOIL INVESTIGATIONS - 2006 and 2009
FLORIDA CITY, MIAMI-DADE COUNTY, FLORIDA
Job No. 39817-408

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS			G-3	G-8	G-9	G-14	G-15	G-20	G-21	G-26	G-27
Laboratory Analysis	**TEC[1]**	**PEC[1]**	**SCTL[2]**	**6/21/06**	**6/21/2006**	**6/22/2006**	**6/22/06**	**6/22/2006**	**6/23/06**	**6/23/2006**	**6/28/2006**	**6/28/06**
EPA Method 8081A (µg/kg)												
4,4-DDD	4.9	28	4,200	<0.57	<0.61	<0.54	<0.63	<0.55	<0.60	<0.70	<0.59	<0.57
4,4-DDE	3.2	31	2,900	1.6	17	2.2	<0.20	<0.17	<0.19	0.50	0.46	<0.18
4,4-DDT	4.2	63	2,900	<0.19	3.7	0.66	<0.21	<0.18	<0.20	<0.23	<0.19	<0.19
Aldrin	266[#]	---	60	1.3	<0.26	<0.25	<0.29	<0.25	0.73	0.45	1.1	0.65
Dieldrin	1.9	62	60	<0.34	<0.36	0.50	<0.37	<0.32	<0.35	0.55	0.46	<0.34
Heptachlor Epoxide	2.5	16	100	<0.20	<0.22	<0.19	<0.22	<0.19	<0.21	<0.25	0.42	<0.20
Alpha-BHC	2.4	---	100	0.49	<0.24	<0.21	<0.25	<0.22	0.51	<0.28	0.42	<0.23
Beta-BHC	2.4	---	500	0.86	<0.36	0.97	<0.37	<0.32	<0.35	<0.41	<0.35	<0.34
Gamma-BHC (Lindane)	2.4	5.0	700	<0.73	<0.79	<0.69	<0.81	<0.70	<0.76	<0.90	<0.75	<0.73
Delta-BHC	2.4	---	24,000	<0.18	1.5	<0.17	0.77	<0.17	<0.19	<0.22	0.72	0.65
Endosulfan (alpha+beta+sulfate)	9.14[#]	---	450,000	1.69	11.34	11.5	22.24	66.3	1.38	0.40	27.5	10.34
Alpha-Chlordane	3.2	18	2,800	0.78	1.5	1.8	1.2	1.2	0.43	<0.22	1.2	1.5
Gamma-Chlordane	3.2	18	2,800	<0.90	1.5	<0.85	1.0	0.94	<0.94	<1.2	<0.93	<0.90
Chlordane, Total	3.2	18	2,800	0.78	3.0	1.8	2.2	2.14	0.43	<1.42	1.2	1.5
Other EPA Method 8081 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8151 scanned by 8321 (µg/Kg)												
All EPA 8151 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8141 scan by 8270SLI (µg/Kg)												
Atrazine (Triazine Herbicide)	0.30	---	4,300	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Simazine (Triazine Herbicide)	0.34	---	7,800	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
All Other EPA 8141 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 549.2-Mod (mg/Kg)												
Paraquat	5.646[#]	---	340	0.86	1.4	1.5	1.2	2.1	1.1	2.4	1.7	1.2
8 RCRA Metals - EPA Method 6010B (mg/Kg)												
Arsenic	9.8	33	2.1	**4.1**	**4.0**	**7.3**	1.9	**2.8**	**3.7**	**2.8**	**3.0**	**3.0**
Barium	20	60	120	12	20	20	17	17	15	13	18	14
Cadmium	1.0	5.0	82	0.49	0.96	0.88	0.70	0.80	0.23	0.29	<0.22	<0.20
Chromium	43	110	210	38	48	55	60	57	32	33	37	25
Lead	36	130	400	7.9	21	16	11	13	10	10	15	6.6
Mercury (EPA Method 7471A)	0.18	1.1	3	0.0098	0.025	0.014	0.012	0.015	0.023	0.013	0.011	<0.00051
Selenium	1.0[*]	---	440	<0.89	<0.92	<0.86	<0.98	<0.83	<0.94	<1.1	<0.91	<0.84
Silver	1.0	2.2	410	0.18	0.24	0.33	0.24	0.25	<0.18	<0.20	<0.17	<0.16
Other Metals - EPA Method 6010B (mg/Kg)												
Copper	32	85[**]	150	**93**	**200**	**220**	**200**	**200**	79	**120**	**120**	27
Zinc	120	460	26,000	60	140	140	140	130	80	90	74	29

Notes:

[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Table 5.1 (MacDonald *et al.* 2003)

[2] FAC Chapter 62-777, Table 2-Technical Background Document, Direct Exposure Residential Soil Cleanup Target Levels (SCTLs)

[3] Split - Soil sample was submitted to Pace Analytical Services, Inc. (PAS) (formerly ELAB, Inc.) for analysis

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

[*] U.S. Fish and Wildlife Service - Screening Value

[**] U.S. Fish and Wildlife Service Interim Value

[#] Site Specific (Equilibrium Partitioning Based) Sediment Quality Guideline

µg/Kg = micrograms per Kilogram

mg/Kg = milligrams per Kilogram

--- = Not Applicable and/or guidance concentrations have not been established

U - Analyte included in analysis, but not detected

I - value between laboratory method detection limit (MDL) and laboratory practical quantitation limit (PQL)

BDL= Below Laboratory Detection Limit

Atrazine and Simazine resulting data were reported as being greater than Threshold Effect Concentration (TEC)

BOLD - Sample analytical result exceeded the SCTL

Sample analytical result exceeded the TEC

Sample analytical result exceeded the PEC

TABLE 1 continued

SUMMARY OF HISTORICAL PESTICIDES, HERBICIDES, PARAQUAT, AND METAL SOIL ANALYTICAL RESULTS

FROG POND

SOIL INVESTIGATIONS - 2006 and 2009

FLORIDA CITY, MIAMI-DADE COUNTY, FLORIDA

Job No. 38617-408

SAMPLE IDENTIFICATION	GUIDANCE CONCENTRATIONS			G-28	G-29	G-30	G-31	G-32	G-33	G-34	G-35	G-36
Laboratory Analysis	TEC[1]	PEC[1]	SCTL[2]	6/28/06	6/28/2006	1/13/2009	1/13/2009	1/13/09	1/13/09	1/13/2009	1/13/09	1/13/2009
EPA Method 8081A (µg/kg)												
4,4-DDD	4.9	28	4,200	<0.56	<0.56	0.66 U	0.64 U	0.69 U	0.64 U	0.61 U	0.58 U	0.54 U
4,4-DDE	3.2	31	2,900	1.6	0.52	0.21 U	0.20 U	0.21 U	0.20 U	0.19 U	0.18 U	0.62 I
4,4-DDT	4.2	63	2,900	<0.18	<0.19	0.22 U	0.21 U	0.23 U	0.21 U	0.20 U	0.19 U	0.18 U
Aldrin	288[4]	---	60	0.59	<0.26	0.31 U	0.29 U	0.32 U	0.30 U	0.28 U	0.27 U	0.25 U
Dieldrin	1.9	62	60	<0.33	<0.33	0.39 U	0.37 U	0.41 U	0.38 U	0.36 U	0.34 U	0.32 U
Heptachlor Epoxide	2.5	16	100	<0.19	<0.20	0.23 U	0.22 U	0.24 U	0.23 U	0.22 U	0.21 U	0.19 U
Alpha-BHC	2.4	---	100	<0.22	<0.22	0.26 U	0.25 U	0.27 U	0.25 U	0.24 U	0.23 U	0.21 U
Beta-BHC	2.4	---	500	<0.33	<0.33	0.39 U	0.37 U	0.41 U	0.38 U	0.36 U	0.34 U	0.32 U
Gamma-BHC (Lindane)	2.4	5.0	700	<0.70	<0.72	0.85 U	0.81 U	0.89 U	0.82 U	0.78 U	0.74 U	0.69 U
Delta-BHC	2.4	---	24,000	0.91	<0.17	0.21 U	0.20 U	0.21 U	0.20 U	0.19 U	0.18 U	0.17 U
Endosulfan (alpha+beta+sulfate)	9.14[4]	---	450,000	9.2	18.0	0.84 U	0.80 U	0.87 U	2.5	4.88	0.73 U	0.85 I
Alpha-Chlordane	3.2	18	2,800	1.1	1.1	0.21 U	0.20 U	0.21 U	0.20 U	0.19 U	0.18 U	0.17 U
Gamma-Chlordane	3.2	18	2,800	<0.87	<0.88	1.1 U	1.1 U	1.1 U	1.1 U	0.97 U	0.92 U	0.85 U
Chlordane, Total	3.2	18	2,800	1.1	1.1	1.31 U	1.30 U	1.31 U	1.30 U	1.16 U	1.10 U	1.02 U
Other EPA Method 8081 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8151 scanned by 8321 (µg/Kg)												
All EPA 8151 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 8141 scan by 8270SLI (µg/Kg)												
Atrazine (Triazine Herbicide)	0.30	---	4,300	<0.014	<0.014	21 U	20 U	21 U	20 U	19 U	18 U	17 U
Simazine (Triazine Herbicide)	0.34	---	7,800	<0.013	<0.013	20 U	19 U	19 U	19 U	17 U	16 U	16 U
All Other EPA 8141 Constituents	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPA Method 549.2-Mod (mg/Kg)												
Paraquat	5.646[4]	---	340	2.6	2.6	0.076 U	0.071 U	0.075 U	0.071 U	0.067 U	0.062 U	0.06 U
8 RCRA Metals - EPA Method 6010B (mg/Kg)												
Arsenic	9.8	33	2.1	**2.6**	**3.0**	**6.1**	**6.0**	**6.9**	**8.0**	**6.4**	**7.2**	12
Barium	20	60	120	18	18	19	17	25	19	19	17	17
Cadmium	1.0	5.0	82	0.51	0.58	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.3 I
Chromium	43	110	210	49	50	37	34	39	58	55	41	51
Lead	36	130	400	11	16	6.4	3.5	5.7	8.0	8.7	7.9	11
Mercury (EPA Method 7471A)	0.18	1.1	3	0.011	0.016	0.028 I	0.035	0.024 I	0.028 I	0.029 I	0.023 I	0.025 I
Selenium	1.0*	---	440	<0.82	<0.85	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.6 U	0.6 U
Silver	1.0	2.2	410	0.25	0.30	0.3 U	0.3 U	0.4 U	0.3 U	0.3 U	0.3 U	0.3 U
Other Metals - EPA Method 6010B (mg/Kg)												
Copper	32	85**	150	**210**	**230**	**167**	83	37	95	136	**206**	**224**
Zinc	120	460	26,000	140	160	97	66	64	70	102	124	138

Notes:

[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Table 5.1 (MacDonald *et al.* 2003)

[2] FAC Chapter 62-777, Table 2-Technical Background Document, Direct Exposure Residential Soil Cleanup Target Levels (SCTLs)

[3] Split - Soil sample was submitted to Pace Analytical Services, Inc. (PAS) (formerly ELAB, Inc.) for analysis

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

* U.S. Fish and Wildlife Service - Screening Value

** U.S. Fish and Wildlife Service Interim Value

[4] Site Specific (Equilibrium Partitioning Based) Sediment Quality Guideline

µg/Kg = micrograms per Kilogram

mg/Kg = milligrams per Kilogram

--- = Not Applicable and/or guidance concentrations have not been established

U - Analyte included in analysis, but not detected

I - value between laboratory method detection limit (MDL) and laboratory practical quantitation limit (PQL)

BDL= Below Laboratory Detection Limit

Atrazine and Simazine resulting data were reported as being greater than Threshold Effect Concentration (TEC)

BOLD - Sample analytical result exceeded the SCTL

Sample analytical result exceeded the TEC

Sample analytical result exceeded the PEC

Table 2
50-Acre Grid Composite Samples for the Revised Frog Pond Project Footprint - Potential Risk Issues

Grid	4,4-DDE (ug/kg)	Chromium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)
January 2009 Samples				
G-30	<0.21	37	167	97
G-31	<0.2	34	83	66
G-32	<0.21	39	37	64
G-33	<0.2	56	65	70
G-34	<0.19	56	136	102
G-35	<0.18	47	206	124
G-36	0.62	58	224	138
October 2006 Samples				
G-3	1.6	38	93	60
G-8	11	48	200	140
G-9	2.2	65	220	140
G-14	<0.2	60	200	140
G-15	<0.17	51	200	130
G-20	<0.19	35	100	80
G-21	<0.24	33	120	90
G-26	<0.19	37	120	74
G-27	<0.19	25	27	29
Min	0.62	25	27	29
Max	11	65	224	140
Average	3.9	44.9	137	96.5
Median	1.9	43	128	93.5
95% UCL	7.83	50	166.5	112
Standard Deviation	4.8	11.7	66.4	35.3
SQAG-TEC	3.2	43	32	120
SQAG-PEC	31	110	150	460

Note:
1/2 of the detection limit used to calculate summary statistics

Table 3
Sample Size Calculations (Post Scraping Confirmation)

Decision Parameters	Selected Value	Normal Variate	
Significance = alpha	5%	$z_{1\text{-alpha}}$ =	1.64
Power = 1 - beta	80%	$z_{1\text{-beta}}$ =	0.84
Delta as % of Baseline Mean	20%		

Chemical-Specific Parameters	Chromuim (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)	4,4'-DDE (ug/kg)
Resolution (20% Reduction in Post-Scraping Concentration)	8.98	27.4	19.3	N/A
Baseline Mean*	44.9	137	96.5	N/A
Baseline Standard Deviation*	11.7	66.4	35.3	N/A
n (Number of Samples)	**11**	**37**	**21**	N/A

*Computed based on revised footprint data

NOTE: 4,4'-DDE not considered for sample number calculations because it was detected in only 4 grids and only one sample had concentrations greater than a TEC. 4,4'-DDE is not expected to be a post-scraping risk issue. See NewFields February 20, 2009 memo for a more detailed explanation.

APPENDIX A

URS

September 23, 2009

Mr. Paul Wierzbicki, P.G.
Waste Cleanup Supervisor
Florida Department of Environmental Protection, Southeast District
400 North Congress Avenue
West Palm Beach, Florida 333401

RE: **Response to FDEP Comments**
Soil Leachability Study for Frog Pond
Miami-Dade County, Florida
Job # 38617-355/408

Dear Mr. Wierzbicki:

URS Corporation (URS) is in receipt of the Florida Department of Environmental Protection (FDEP) Southeast District comments in the September 2, 2009 memorandum on URS' letter report titled "*Soil Leachability Study for the Frog Pond section of the C-111 Spreader Canal.*" The report was submitted to the FDEP on July 22, 2009. A copy of the FDEP memorandum is attached.

The leachability study was conducted in support of the URS Soil Management Plan (SMP) and in response to the FDEP Southeast District comments on the Additional Soil Investigations - Frog Pond, dated April 28, 2009, to determine if the soils within the Frog Pond Detention Area have the potential to leach contaminates into the surface and groundwater above applicable guidance concentrations. A copy of the FDEP memorandum requesting the leachability study is attached.

As requested, given below is the additional information requested in the FDEP memorandum as well as acknowledgement that the clean fill soils that will be imported from offsite and the mixed soils will be sampled as part of the SMP. We appreciate your timely review and comment and assistance on this important restoration project. The District has also recently agreed with the US Fish & Wildlife Service (Service) and the FDEP to modify the SMP. The modification includes the collection of additional samples from the proposed scrapped area of the project and the collection of samples for the analysis of the organochlorine pesticide 4,4-DDT and its metabolites. This additional confirmation sampling should provide the necessary confidence concerning site wide soil contaminate concentrations post scrapping. It is our opinion based on the investigations conducted over the last three years that this project can be constructed without

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posing an unacceptable human health or ecological risk. The construction of this project will include scrapping and relocation of loose soil impacted with agricultural chemicals, which are present above the cap rock. Assuming that these soils are properly removed from within the project area the identified potential risk should be eliminated or significantly reduced.

Below are the FDEP comments and URS' responses.

FDEP Comment # 1 *- Page 3, paragraph 5 details the calculation of a copper concentration in soil above which the copper would desorb. The calculated value is 91 mg/kg, which exceeds the Service's accepted concentration of 85 mg/kg for the protection of the Snail Kite. The next paragraph states that the actual desorption concentration will probably be even higher than 91 mg/kg, but provides no analytical basis for that conclusion.*

URS Response #1: The results of the assessments indicate that if the copper impacted soils within the project area are left in place, potential impacts to the surface water and/or ecological receptors may exist.

As discussed above the District's engineering plans require that the soils above the cap rock are scrapped from the project area and relocated to an area that will not be inundated. A limited amount of these soils may be used in the berm, but would first be mixed with clean fill material brought in from an off-site source. The scrapping and relocation of these soils is detailed in the URS *Soil Management Plan*, dated July 29, 2009 and the *Soil Management Plan Addendum*, dated September 10, 2009. Based on calculations it is anticipated that the residual soils remaining within the Detention Area will have a site wide average copper concentration of 79.9 milligrams per kilogram (mg/kg) after the project area is scrapped. The site wide copper average is below the Service's 85 mg/kg benchmark.

This post scrapping site wide average residual soil concentration is based on the District's pilot study at the Detention Area and the recent work completed by the United States Army Corp. of Engineer's (Corp) in the L31 N project area. However, it is important to note that the District has agreed to conduct post scrapping sampling. In the event that the post scrapping confirmation sampling indicates areas within the project exceed 85 mg/kg for copper, additional scrapping of the residual soils will be conducted as warranted. The purpose of the additional scrapping sampling is to reduce the site average to at or below 79.9 mg/kg as well as reduce the potential impacts to surface water and ecological receptors. The information below is a detailed explanation of how the 91 mg/kg copper leachability value referenced above was developed.

Using the SPLP results, URS estimated that at soil concentrations greater than or equal to 91 mg/kg copper could desorb from soils into water at concentrations exceeding the hardness-specific water chronic quality criterion. A graph illustrating the SPLP results and estimated concentration is attached. The NewFields memorandum on the SPLP results, dated July 10, 2009, which supports this conclusion, is attached. To reach this conclusion, the SPLP data were fitted to a Fruendlich adsorption isotherm equation with a very high correlation coefficient (R^2 = 0.99). Although a slightly lower soil concentration 83.3 mg/kg was presented by NewFields due to the calculation of a lower water quality criterion [17.9 micrograms per kilogram (µg/kg)] the conclusion remains the same. The difference between the soil concentrations calculated in the NewFields memorandum was the result of applying the FDEP conversion factor which converts the water quality to a dissolved criterion which may more closely represent the SPLP data which are filtered prior to analysis.

Information given below which was provided in the NewFields memorandum indicates that under field conditions surface water concentrations expected in the Detention Area are unlikely to exceed surface water criteria (dissolved or total) at the calculated soil concentrations or even greater and provides the following rationale for that conclusion:

1) The Fruendlich adsorption isotherm equation assumes that the soil is in equilibrium with all of the water. This is not the case in many environmental settings because the adsorbed copper must diffuse out of the sediment and mix within the overlying water column before reaching equilibrium. Likewise, in a quiescent water column, a concentration gradient would be present between the sediment/water interface and the surface of the water where only the water at the interface will be in equilibrium with the sediment surface.

2) The infiltration rate of the Frog Pond soil/sediment will likely exceed the diffusion rate of copper out of the sediment into the overlying water column. There is a chance that little to no copper desorbed from the soil/sediment will be present in the overlying water column because of the downward flux of water through the sediment and into the vadose zone is vastly greater than the diffusion rate of copper from the sediment into the overlying water column.

3) The water in the standard SPLP test is adjusted to pH 5 at the beginning of the test. This may be more acidic than the natural waters flowing into the Frog Pond. The more acidic conditions at test start may have liberated more copper than would be expected with higher pH water.

Following scraping, and based on the results of the detailed sampling and analysis in the Pilot Study area conducted by the District as part of the Frog Pond Expanded Ecological Risk Assessment, the area-weighted 95 percent upper confidence limit (UCL) soil copper concentration is estimated to be equal to 79.9 mg/kg. That concentration is lower than both the 85 mg/kg copper benchmark and any predicted conservative estimates of leachability concerns. Finally, the NewFields memorandum presents a mass balance evaluation based on operating parameters and the mass of copper predicted to remain in the detention area following scraping. **Figure 3** in the Newfields July 10, 2009 Memorandum shows that after repeated flooding events, the mass of copper available for desorption is expected to be rapidly reduced. Again using the surface water concentrations predicted by the Fruendlich adsorption isotherm equation, the estimated maximum possible surface water concentration is expected to be much lower than the surface water criterion after a short period of operation.

All of these factors were considered in the conclusion that the likelihood of surface water concentrations in the Frog Pond Detention Area exceeding the chronic surface water criterion for copper following construction, which includes scraping the majority of soils from the site, is very low.

FDEP Comment # 2 - *The explanation of the use of the contaminated soils in the project berms is based on the assumption that the fill materials will have copper concentrations less than 50 mg/kg. What assurances can be provided that that is the case? Have the fill soils been sampled and analyzed? If they have, why weren't those results presented in the document?*

URS Response #2: As discussed above, approximately 15% of the impacted soil scrapped from the former cultivated area within the project area may be used to construct 25% of the interior portion of the levee. The estimated amount of impacted soils that may be used is 18,150 cubic yards. The use of this material is only an option and has not been decided on at this time. The District included the option of using the scrapped soil within the construction bid package. In the event the contractor selects to use the material within the former cultivated area onsite, the scrapped soil will need to be mixed with 'clean' fill to meet geotechnical parameters for levee construction. Upon completion of the soil mixing samples will be collected for both geotechnical and copper analysis. Mixed soils that exceed 91 mg/kg would be deemed unacceptable for use within the Detention Area levees. To minimize potential disruptions to the construction process a conservative soil post mixing value has been calculated. This value was based on the average soil copper concentration within the cultivated area of 166 mg/kg, and the mixing with a maximum clean imported soil copper concentration of 50 mg/kg. Using these conservative numbers for maximum copper concentrations, once the soils are mixed at this ratio, the resulting copper concentration is anticipated to be 67 mg/kg. At this copper concentration,

the mixed soils would not pose a potential risk to surface water or ecological receptors. It is important to note that the District will collect soil samples post mixing to confirm these assumptions.

The source of the 'clean' fill material is unknown at this time and as such the copper concentrations in that material are unknown. As presented in the NewField's memorandum dated July 17, 2009, on the potential of leaching copper from the berm, 50 mg/kg was chosen as a conservative default concentration. The Newfield's July 17, 2009 memorandum is attached. According to *Chen et al.* (1999), the average background soil copper concentration in south Florida is equal to 1.4 $\pm$ 13 mg/kg. As a result, it is thought that the assumption of an average concentration of clean fill equal to or less than 50 mg/kg is an adequately conservative assumption.

Chen, M., L.Q. Ma, W.G. Harris and A.G. Hornesby. 1999. Background Concentrations of Trace Metains in Florida Surface Soils: Taxonomic and Geographical Distributions of Total-total and Total-recoverable Concentrations of Trace Metals. Report #99-7.

FDEP Comment # 3 *- Based on the information supplied at this time, the Waste Cleanup Section cannot concur that the soils will not leach to surface waters at concentrations that exceed the surface water standards. What analytical results can be provided based on other similar properties or bench scale testing? What contingencies can be proposed that would provide assurances of leachability, especially with respect to copper, will not cause exceedances of surface water criteria?*

URS Response #3: Bench scale testing of surface water concentrations overlying Frog Pond soils was provided in the Ecological Risk Assessment (ERA) of Frog Pond Soils (NewFields 2009). Soils were placed in aquaria and were overlain by surface water for a total of 76 days with periodic renewal to simulate conditions following construction at the Frog Pond. The results of this analysis are presented in **Figures 3.1-4** and **3.1-8** of the ERA. Surface water copper concentrations exceeded the chronic surface water quality criterion (calculated at 225 mg/kg hardness) only in one sample which had highly elevated copper concentration of 365.3 mg/kg in the soil. No surface water concentrations exceeded the surface water criterion in either of the samples with lower copper concentrations of 140 mg/kg and 97 mg/kg, respectively. As discussed in the response to comment #1, surface water concentrations decreased with subsequent flooding events resulting in concentrations much lower than the surface water criterion after only a few flooding events. These results indicate that the analysis presented in the NewFields July 17, 2009 memorandum are conservative relative to what might be expected under operating conditions in the Frog Pond.

The soil concentrations presented in this memorandum represent the lowest average soil concentrations that could remain following scraping that conservatively could result in surface water concentrations within the Detention Area and in water leaching through the berm that exceed the chronic surface water criterion for copper. It is unlikely that even if upper bound average soil copper concentrations remaining after construction and soil scraping marginally exceed the concentrations presented based on the conservative assumptions. That situation is unlikely because the concentrations provided in this memorandum are higher than the 85 mg/kg benchmark for copper.

Based on the results of the data collected and analyses presented, the District does not believe that additional testing is required and that post-scraping confirmation sampling as described in the *Soil Management Plan* and *Soil Management Plan Addendum* will provide adequate confidence that copper leaching from soils into surface water will not be problematic provided that the area-weighted average of copper in the remaining soils is less than the 85 mg/kg benchmark as required by the Service.

We appreciate your timely review, comments, and assistance on this important restoration project. Please note that the above comments and responses have and/or will be incorporated into the *Soil Management Plan*. If you have any questions concerning the above responses or require additional information concerning this project please contact URS at your convenience.

Respectfully Submitted,

URS CORPORATION

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Vice President

Attachments
FDEP Memorandums dated September 2, 2009
FDEP Memorandum dated April 28, 2009
Graph – Copper Concentration at which SPLP Exceedance Occurs
NewFields Memorandum, July 10, 2009
NewFields Memorandum, July 17, 2009

C: Robert Taylor, District
Robert Frakes, Ph.D., U.S. Fish and Wildlife Service – Vero Beach, FL
Ligia Mora Applegate – FDEP Tallahassee
Joe Allen, NewFields

ATTACHMENTS

FDEP Memorandum dated September 2, 2009

FDEP Memorandum dated April 28, 2009

Graph – Copper Concentration at Which SPLP Exceedance Occurs

NewFields Memorandum, July 10, 2009

NewFields Memorandum, July 17, 2009

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Joe Lurix, Waste Program Administrator**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: SEP - 2 2009
SUBJECT: **Soil Leachability Study for the Frog Pond area at the C-111 Spreader Canal**

As requested, I have reviewed the Soil Leachability Study for the Frog Pond section of the C-111 Spreader Canal Project, dated July 29, 2009, (received July 31, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Page 3, paragraph 5 details the calculation of a copper concentration in soil above which the copper would desorb. The calculated value is 91 mg/kg, which exceeds the Service's accepted concentration of 85 mg/kg for the protection of the Snail Kite. The next paragraph states that the actual desorption concentration will probably be even higher than 91 mg/kg, but provides no analytical basis for that conclusion.

2. The explanation of the use of the contaminated soils in the project berms is based on the assumption that the fill materials will have copper concentrations less than 50 mg/kg. What assurances can be provided that that is the case? Have the fill soils been sampled and analyzed? If they have, why weren't those results presented in the document?

3. Based on the information supplied at this time, the Waste Cleanup Section cannot concur that the soils will not leach to surface waters at concentrations that exceed the surface water standards. What analytical results can be provided based on other similar properties or bench scale testing? What contingencies can be proposed that would provide assurances that leachability, especially with respect to copper, will not cause exceedances of surface water criteria?

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Inger Hansen, Engineer IV, Watershed Management & Planning

090692

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: Joe Lurix, Waste Program Administrator
THROUGH: Paul Wierzbicki, Waste Cleanup Supervisor
FROM: Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section
DATE: APR 28 2009
SUBJECT: Additional Soil Investigations Frog Pond - C-111 Spreader Canal, Leaky Reservoir

As requested, I have reviewed the Additional Soil Investigations Frog Pond for the Leaky Reservoir area of the C-111 Spreader Canal Project, dated March 30, 2009, (received April 1, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Based on the information supplied, it would seem prudent to proceed to scrape the soils in grids 31, and 33. The copper results for the composite sample in grid 31 are very close to the interim screening level value, and grid 33 has a chromium concentration that exceeds the TEC as well.

2. While it is under stood that this current project does not call for the use of grids 5 and 6, please ensure that should the soils in those grids be disturbed, they are handled in such a way that they do not come in contact with surface waters.

3. Please furnish the Department with confirmatory soil samples after the excavation is finished.

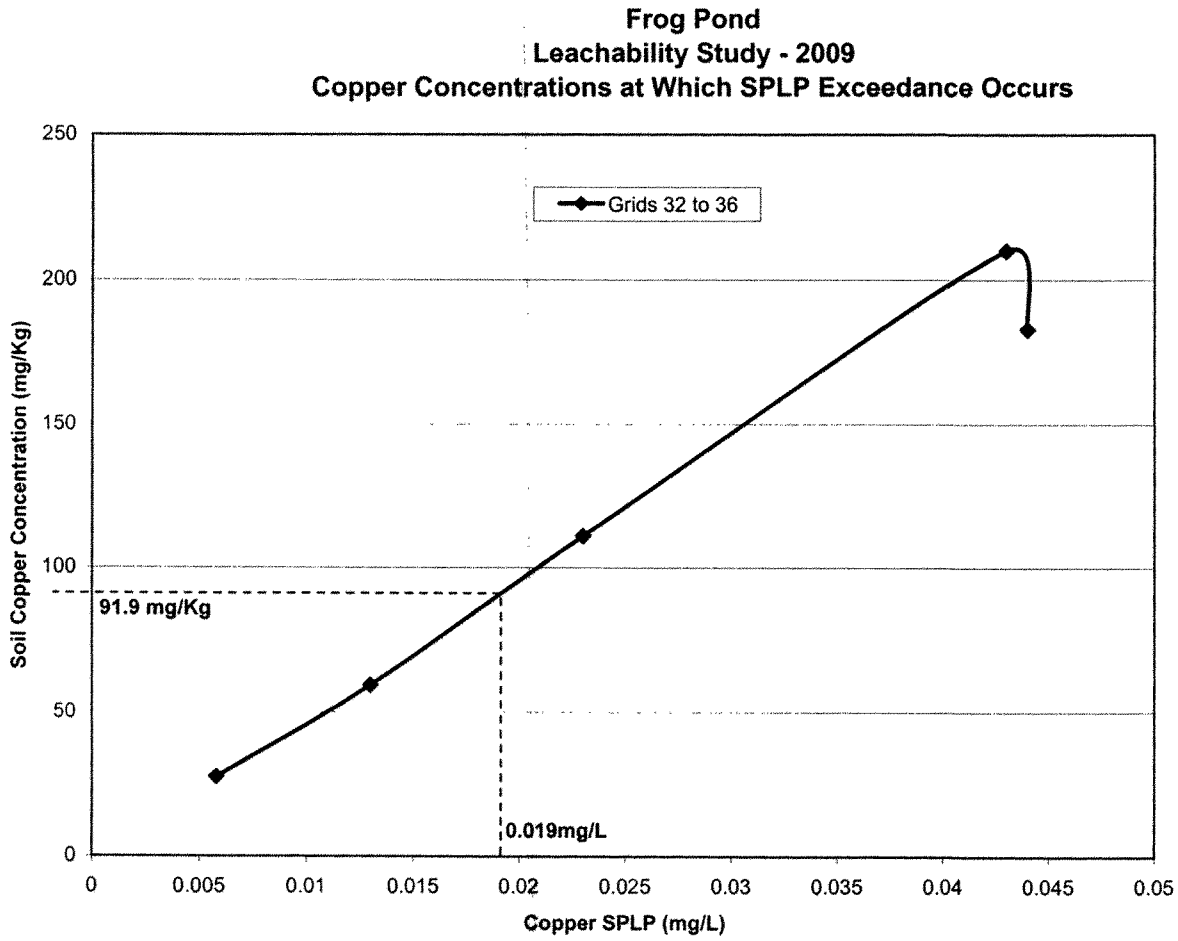
4. What is the rationale for not conducting sampling and analysis in the NW corner of the parcel, outside the grid?

5. It is noted on page 8 that a "Soil Management Plan" is being developed. Please ensure that excavated soils are managed so that they do not pose a leachability threat to surface or groundwater.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Inger Hansen, Engineer IV, Watershed Management & Planning

090331


Frog Pond
Leachability Study - 2009
Copper Concentrations at Which SPLP Exceedance Occurs
Grids 32 to 36
91.9 mg/Kg
0.019mg/L
Soil Copper Concentration (mg/Kg)
Copper SPLP (mg/L)
250
200
150
100
50
0
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05

NEWFIELDS

MEMORANDUM

TO: Ed Leding; URS Corporation

CC: Robert Taylor; SFWMD

FROM: Joe Allen, Jim Jonas and Mark Lewis

DATE: July 10, 2009

SUBJECT Analysis of Frog Pond Detention Area SPLP Results

Mr. Leding:

At your request, NewFields has reviewed the results of the five composite samples collected from the 50-acre grid cells along the western side of the planned Frog Pond Detention Area (FPDA). These samples were analyzed for total copper and leachable copper (SPLP) among other inorganic COPCs.

The general trend present when comparing these two set of results suggests that the copper may be adsorbed to the soil (Figure 1).

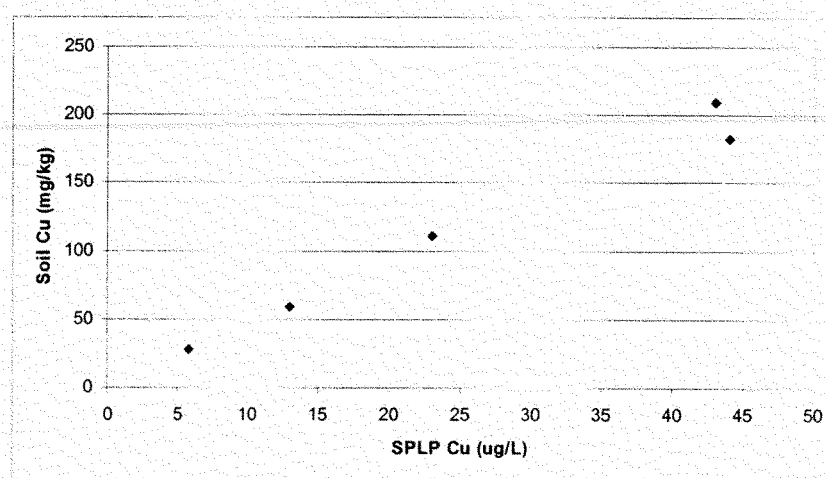


Figure 1. Soil and SPLP copper concentrations from grid cells (G-32, G-33, G-34, G-35, and G-36).

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Boulder, Colorado 80301
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www.newfields.com

In order to test if desorption is the major release mechanism for copper, the Fruendlich adsorption isotherm equation (shown below) was fitted to the data.

$$\frac{x}{m} = KC^n \quad \text{or} \quad \log\frac{x}{m} = \log K + n\log C \text{ (linearized)}$$

Where: x/m = soil concentration (mg/kg)
K = constant
C = water concentration (ug/L)
n = constant

The logarithm of the data was plotted then a linear regression was completed to determine if the data fit the Fruendlich adsorption isotherm equation and then to determine the constants within the equation. Figure 2 shows this equation fitting exercise. The results of the linear regression indicate that the data do follow the Freundlich adsorption isotherm equation. The site-specific equation is shown below.

$$\frac{x}{m} = 4.986C^{0.976}$$

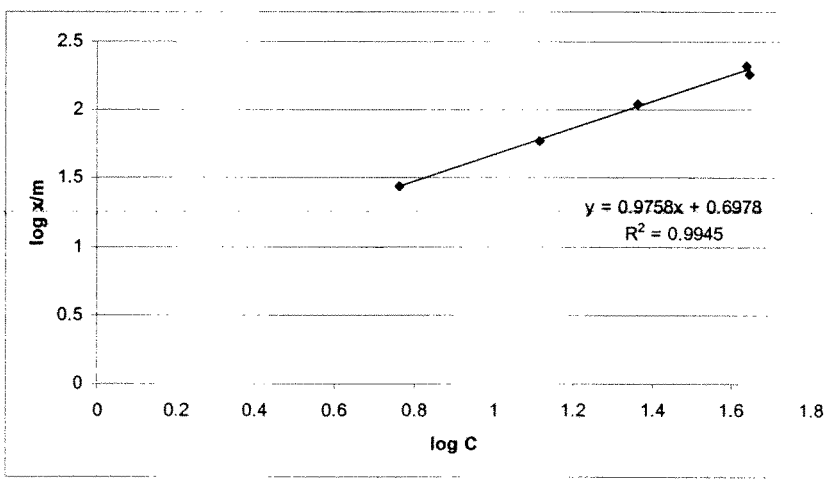


Figure 2. Linear regression of the results to determine Freundlich adsorption isotherm constants.

Using a typical hardness value (225 mg/L CaCO3) for water that will be within the Frog Pond (determined using historic data from the C-111 canal at monitoring station S176), the chronic surface water quality criterion for copper was calculated to be 17.9 ug/L. The corresponding

sitewide average soil copper concentration at which surface water concentrations would equal the criterion based on the site-specific Freundlich isotherm was determined to be 83.3 mg/kg.

The soil copper concentration calculated using the Freundlich adsorption isotherm equation is highly conservative for the conditions expected to be present at the Frog Pond and the actual soil copper concentration will likely need to be much higher to exceed the chronic water quality criterion in the overlying water column for the following reasons:

- The Freundlich adsorption isotherm equation assumes that the soil is in equilibrium with all of the water. This is not the case in many environmental settings because the adsorbed copper must diffuse out of the sediment and mix within the overlying water column before reaching equilibrium. Likewise, in a quiescent water column, a concentration gradient would be present between the sediment/water interface and the surface of the water where only the water at the interface will be in equilibrium with the sediment surface.
- The infiltration rate of the Frog Pond soil/sediment will likely exceed the diffusion rate of copper out of the sediment into the overlying water column. There is a chance that little to no copper desorbed from the soil/sediment will be present in the overlying water column because of the downward flux of water through the sediment and into the vadose zone is vastly greater than the diffusion rate of copper from the sediment into the overlying water column.
- The water in the standard SPLP test is adjusted to pH 5 at the beginning of the test. This may be more acidic than the natural waters flowing into the Frog Pond. The more acidic conditions at test start may have liberated more copper than would be expected with higher pH water.

Scraping of the soils will leave only a thin veneer of soil (<1") over the majority of the FPDA base which will significantly reduce the mass of copper available to desorb. Therefore, the copper concentration within the overlying water column is expected to decrease with subsequent floodings. This geochemical process was modeled using the site-specific adsorption equation, an average soil depth after scraping (1 inch), and the estimated 95% upper confidence limit (95%UCL) of the soil copper concentration after scraping (79.9 mg/kg).

The estimated 95% UCL soil copper concentration and the estimation of soil depth were obtained from the Ecological Risk Assessment (ERA) conducted by NewFields at the site (NewFields 2009). The ERA included detailed depth samples of copper in areas with soils deeper than 1 inch. These data showed that at depths deeper than 1 inch, copper concentrations were greatly reduced from those found on the surface following soil scraping.

The model results are shown in Figure 3 on a per acre basis. It is estimated that the FPDA may receive approximately 200 acre-feet per acre per year on average when water is available for use in the FPDA.

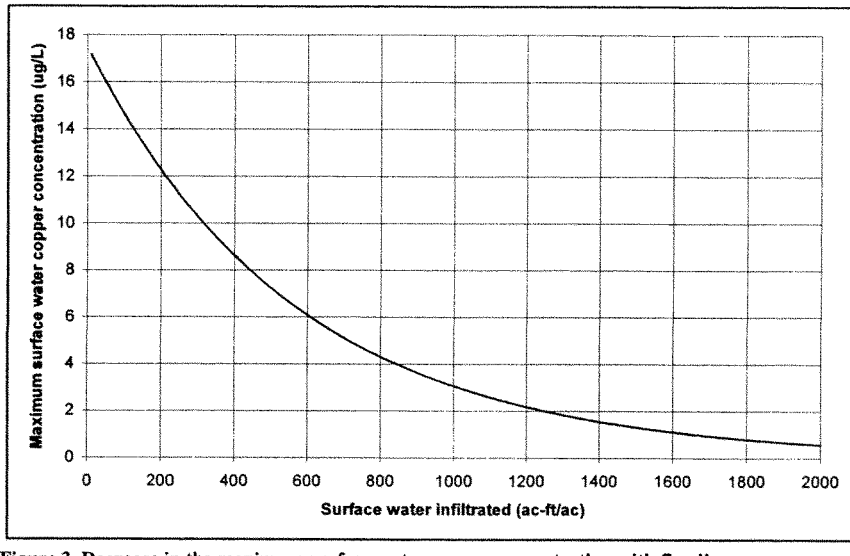


Figure 3. Decrease in the maximum surface water copper concentration with flooding.

While surface water concentrations in the FPDA are not expected to exceed chronic water quality criteria, repeated flooding and infiltration are expected to greatly reduce the mass of copper remaining in the soils. This further reduces the probability for desorption into surface water following soil scraping.

NEWFIELDS

MEMORANDUM

TO: Ed Leding; URS Corporation

CC: Robert Taylor; SFWMD

FROM: Joe Allen, Jim Jonas and Mark Lewis

DATE: July 17, 2009

SUBJECT Analysis of the Potential Leaching of Copper into Surface Water or Ground Water Adjacent to Berms Constructed Using Scraped Soils.

Mr. Leding:

At your request, NewFields has evaluated the potential for the Frog Pond berms to leach copper into water diffusing through them. This evaluation has been completed using the adsorption model developed and described in a memorandum sent to you on July 10, 2009 and information received from you regarding the design of the berms.

The berms will be constructed with an inner core and an outer cover (Figure 1). The outer cover consists of 100% clean soil (i.e., no copper) while the inner core consists of 85% clean soil and 15% scraped soil (containing adsorbed copper). When the Frog Pond is filled with water, at least a portion of the berm will be saturated and some water may pass through the inner core before either infiltrating into the underlying limestone or emerging as a seep on the outside of the berm. Water that migrates through the inner core has the potential to leach copper from the scraped soils used to construct this portion of the berm.

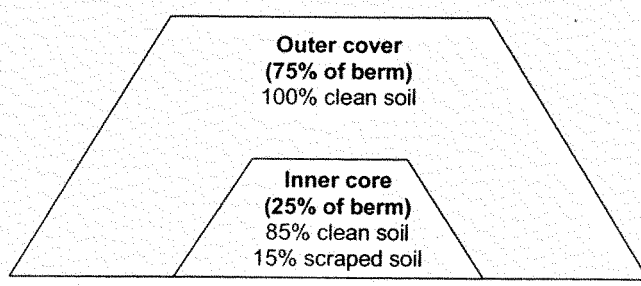


Figure 1. Schematic of berm.

NEWFIELDS
2500 55th ST. ~ Suite 200
Boulder, Colorado 80301
303-442-0267 *tel.* • 303-442-3679 *fax*
www.newfields.com

Adsorption and desorption are the primary geochemical mechanisms that will control the leachability of copper from the inner core of the berm. These mechanisms are illustrated in Figure 2. When the inner core is initially saturated, some copper from the scraped soils will desorb and enter into the pore water until equilibrium is reached. The dissolved copper will diffuse with the pore water through the clean soil and it will be removed from the pore water via adsorption until the clean soil has reached equilibrium with the pore water. If the clean soil has the same sorption properties as the scraped soil, these processes will redistribute the copper resulting in all of the soil within the inner core having the same copper concentration. This equilibrium copper concentration will be less than the initial scraped soil concentration and proportional to the percentage of the inner core constructed from scraped soil.

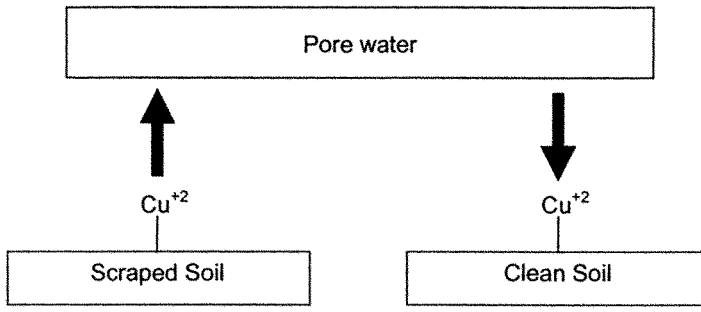


Figure 2. Geochemical mechanisms involved in redistributing the adsorbed copper within the inner core of the berm include desorption from the scraped soil and adsorption to the clean soil. After redistribution of the copper (i.e., at equilibrium), the clean soil copper concentration will be equivalent to the scraped soil copper concentration.

For this model, the initial scraped soil copper concentration within the berm was set equal to the 95% UCL of the revised frog pond footprint (166.5 mg/kg) and the copper concentration in clean fill was set equal to a default 50 mg/kg. Based on this starting copper concentration and following the proposed soil mixing, the model predicted that the copper concentration within the pore water (and subsequently water leaving the inner core of the berm) would be 14.4 ug/L.

Using a typical hardness value (225 mg/L $CaCO_3$) for water that will be within the Frog Pond (determined using historic data from the C-111 canal at monitoring station S176), the chronic surface water quality criterion for copper was calculated to be 17.9 ug/L. The corresponding scraped soil copper concentration within the inner core of the berm that would result in pore water concentrations equal to or greater than the criterion based on the site-specific Freundlich isotherm was determined to be equal to or greater than 272 mg/kg. This is based on the inner core being constructed of 15% scraped soil.

This analysis does not include the interactions of dissolved copper within the pore water with the outer cover clean soil. The outer cover would act similar to the clean soil within the inner core such that the copper concentration within the pore water exiting the berm would be less than predicted in this analysis due to increased adsorption sites within the berm lowering the average copper concentration adsorbed to the soils.

The re-distribution of copper within the saturated portion of the berm will result in an average copper concentration at least six times lower than the scraped soil (<27 mg/kg). Additionally, pore water exiting the berm is expected to have a copper concentration no greater than 14.4 ug/L which is less than the chronic surface water quality criterion for copper (17.9 ug/L).

APPENDIX B

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 27, 2009

Robert Taylor
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the Ecological Risk Assessment (ERA) and the Additional Soil Investigation for the Frog Pond, prepared by Newfields and URS Corporation (URS), respectively. These documents report contaminant concentrations and the predicted risk associated with using the Frog Pond for the construction of a 570-acre water detention area in the C-111 Spreader Canal Project. The proposed detention area is intended to act as a 'leaky' reservoir, allowing water to infiltrate to groundwater. The infiltration is expected to create a hydrologic buffer that will force groundwater flows into Taylor Slough to the west and keep regional groundwater from flowing into the C-111 canal to the east.

A 2006 Phase II Environmental Site Assessment on 1,380 acres at the Frog Pond identified soil concentrations of copper, zinc, and 4,4′-DDE that predicted risk to Service trust resources (Service comment letter dated May 1, 2007). Since this Phase I/II assessment, the footprint of the water detention area shifted to the west, resulting in an area of approximately 350 acres that had not undergone sampling. In the Additional Soil Investigation, composite soil samples were collected from seven, 50-acre grids throughout this 350-acre area within the new Frog Pond Detention Area footprint. Analytical results were compared to Florida Department of Environmental Protection Sediment Quality Assessment Guidelines (SQAG) and the Florida Administrative Code Soil Cleanup Target Levels.

A low concentration, below the SQAG, of the organochlorine pesticide 4,4′-DDE was detected in one of the seven composite samples. Endosulfan, which has no SQAG, was detected in four of the composite samples at concentrations below the calculated site-specific SQAG (9.14 μg/kg). All other pesticides were below their respective laboratory detection limits. Four of the composite samples detected copper at a concentration above the interim screening level for the protection of the endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (85 mg/kg), ranging from 136 to 224 mg/kg. Zinc concentrations slightly exceeded the SQAG threshold effect concentration (TEC) (120 mg/kg) in two of the composite samples.

In 2007, a pilot scraping study was conducted in a 5-acre portion of the 350-acre Frog Pond area to determine if contaminated soils (mean of 202 mg/kg copper and 172 mg/kg zinc) could be effectively removed from the solution riddled limestone. Results from this study found that copper and zinc concentrations in the scraped area remained above the interim screening level (85 mg/kg) and the TEC (120 mg/kg), respectively.

TAKE PRIDE IN AMERICA

The Frog Pond detention area will likely be subject to frequent wetting/drying cycles. Standing water is likely to persist in solution areas, where soils were shown to remain after scraping. The length of time water would persist is hard to predict, but if these areas persist long enough, an aquatic community could become established and attract aquatic feeding avian fauna. To further evaluate the risk associated with flooding Frog Pond soils, an Ecological Risk Assessment was performed with soils from the Frog Pond. Bulk soil samples were collected from three locations at the Frog Pond: two samples (CS-8 [copper = 140 mg/kg] and CS-10 [copper = 97 mg/kg]) were collected from the scraped pilot study area and one sample (grid 6) was collected from an area identified as having the highest observed copper concentration (365 mg/kg). Bioaccumulation tests (28 day) were conducted using the worm, *Lumbriculus variegatus*, and the Florida apple snail, *Pomacea paludosa*. Toxicity tests (10-day acute) were performed using *Chironomus dilutus* and *Hyalella azteca*. A survey was also conducted in the 5-acre pilot study area to determine the depth and aerial extent of soil remaining after scraping. Soil samples were collected from the survey area at both shallow (soil < 1 inch deep) and deep (soil > 1 inch deep) locations.

In an attempt to mimic the repeated wetting cycles detention areas undergo, soils were acclimated six times through static-renewal with synthetic freshwater (renewals at days 7, 12, 17, 27, 37, and 48). Results from the acclimation phase of the study found a general decrease in the concentration of copper in the soil/sediments, with the greatest rate of decline between day 1 and 7. At the end of the acclimation period, copper in sediments exceeded the TEC (32 mg/kg) in CS-8 (79 mg/kg) and CS-10 (63 mg/kg) and the SQAG probable effect concentration (PEC) (150 mg/kg) in grid 6 (225 mg/kg). Soils with higher copper concentrations resulted in higher dissolved copper in the water. Copper (dissolved) in surface water in the acclimation phase increased from day 1 to day 7 and then sharply decreased to day 17 and remained relatively constant throughout the end of the acclimation phase at day 48. There was relatively little difference in the concentrations of dissolved copper at day 1 and day 48, especially for CS-10 and grid 6. Concentrations of copper in water were at or above the Florida Administrative Code Surface Water Quality Criteria throughout 6 of the 7 sampling events for grid 6 and in one sampling event with soils from CS-8. Endosulfan sulfate (0.02 to 0.04 μg/L) also exceeded the surface water quality critera (≤ 0.056 μg/L) at three of the sampling events.

The 28-day bioaccumulation test run with *L. variegatus* in acclimated grid 6 soils (365 mg/kg copper) detected an average of 282 mg/kg dw copper in worms, compared to 23 mg/kg dw in worms from control soils. Apple snails bioaccumulated copper at an average of 121 mg/kg dw with CS-8 soils, 70.2 mg/kg dw with CS-10 soils, and 325 mg/kg dw with grid 6 soils, compared to only 19.8 mg/kg dw from control soil.

Survival and growth for *H. azteca* and *C. dilutus* in CS-8 and CS-10 soils (acclimated and unacclimated) were not significantly different from the control. *H. azteca* in grid 6 soils (acclimated and unacclimated) had significantly lower survival and biomass as compared to the control. Mean growth and survival for *C. dilutus* in grid 6 (unacclimated) soils was significantly lower than the control.

Five samples collected from the pilot study area showed considerably higher levels of copper (mean of 140 mg/kg) in the shallow soil samples (0 to 1 inch deep) than those collected from deep soils (0 to a minimum of 6 inches deep) within solution cavities (mean of 14 mg/kg). The survey to determine the percent of soil remaining after scraping found approximately 39 percent of the area with no soil, 50 percent with thin soils (<1 inch), and 11 percent with thick soils (>1 inch). Vertical delineation sampling at eight locations found that copper concentrations greatly decline with depth. None of the samples collected at depths greater than 1 inch exceeded 85 mg/kg.

To reduce the risk from elevated copper concentrations, URS recommended that the proposed 570-acre Frog Pond detention area undergo soil scraping, with the exception of grids G-31, G-32, and G-33, which did not exceed the interim screening value for copper. Excavated soils are planned for use in construction of detention area berms or will be placed east of the project towards the C-111 Canal. In addition, confirmatory sampling is recommended to document the effectiveness of soil scraping.

Summary and Comments

The detected levels of copper in the proposed Frog Pond detention area present a concern for Service trust resources, specifically the endangered Everglade snail kite. Average (148 mg/kg) and 95 percent upper confidence level (UCL) (177 mg/kg) copper concentrations in the proposed Frog Pond detention area exceed the interim screening value (85 mg/kg) for the protection of the snail kite. The copper bioaccumulation study with apple snails found considerably lower biota-sediment accumulation factors (BSAF) (0.9) than a study by Frakes et al. (2008) (7 to 37). This is likely due to the lack of exposure through diet, which has been shown by Hoang et al. (2008) to be a more important route of uptake as compared to sediment exposure. Because no dietary route of uptake was considered, the bioaccumulation study did not represent the potential bioaccumulation upon inundation of Frog Pond soils. Even without accounting for dietary exposure to copper, the maximum concentrations observed using grid 6 soils (426 mg/kg dw) approached the critical snail body burden (estimated at 450 mg/kg dw). Using the snail tissue concentrations from the bioaccumulation study in place of the default BSAF in the food-web model, highly underestimates the exposure to snail kites.

The Service does not concur with the ERA conclusion that bioavailable copper concentrations are expected to be reduced with repeated flooding. The soil acclimation phase of the ERA detected water concentrations that exceeded the surface water quality criteria. There was little difference between the copper concentrations in overlying water from the initial flooding and the seventh flooding during the acclimation phase. A study by Hoang et al. (2008) showed that while there may be a slight decrease in dissolved copper concentration in water with repeated flooding events, the concentration of free copper (Cu^{+2}), which is highly bioavailable, increased with the number of flooding events due to a decrease in dissolved organic carbon (DOC).

Detected concentrations of other metals and pesticides were noticeably lower than previously sampled areas outside of the project footprint. The site-wide 95 percent UCL for endosulfan (20.37 μg/kg) exceeded its calculated site-specific SQAG (9.14 μg/kg). The maximum observed

concentration of endosulfan (66.3 μg/kg) predicted no risk to avian fauna using the food-web model (hazard quotients [HQ] < 0); however, impacts to the aquatic community and fish are possible. Mean concentrations for 4,4'-DDE (1.2 μg/kg), chlordane (1.1 μg/kg), and zinc (102 mg/kg) were below SQAG. The mean (45.3 mg/kg) and 95 percent UCL (49.8 mg/kg) for chromium were just above the TEC (43 mg/kg), but have a low potential of posing risk to the benthic community.

Confirmatory sampling conducted as part of the pilot scraping study found an average residual copper concentration of 145 mg/kg with a 95 percent UCL of 173 mg/kg. Further sampling conducted in the ERA to determine the vertical distribution of copper at the scraped grid found an average copper concentration of 93 mg/kg with a 95 percent UCL of 106 mg/kg. Newfields used this 95 percent UCL for copper (106 mg/kg) to calculate the area-weighted concentration expected after soil scraping. An estimated 65 mg/kg of copper was calculated for the area-weighted concentration, which is below the 85 mg/kg interim screening value. There is no mention of the pilot study confirmatory sampling results in the ERA. If the 95 percent UCL from the confirmatory sampling is used in place of the 95 percent UCL from the vertical delineation, then the area-weighted copper concentration estimated for scraped soils (106 mg/kg) exceeds the interim screening value for copper. Unless there is a valid reason to discount confirmatory sampling results, the Service recommends that all available data should be used to estimate the area-weighted average copper concentration. Using the Service calculated 95 percent UCL from both the ERA and the draft pilot study report resulted in an estimated area-weighted average of 80 mg/kg copper. Regardless of the 95 percent UCL that is used in the area-weighted calculation, we feel that five acres is an insufficient area to calculate a 95 percent UCL for a 570-acre site.

The Service concurs with the recommendation for soil scraping, provided that post-scraping confirmatory sampling be conducted on a representative percentage of the project site. Confirmatory sampling should include a measure of the relative percent of soil remaining and the concentration of copper within these soils. These data should be used to calculate an estimated area-weighted average for the entire Frog Pond detention area. Once these confirmatory samples are collected, determination about the need for monitoring or further remediation can be made. We recommend that if Frog Pond soils are to be reused in the construction of berms, they pass all leachability testing criteria.

Thank you for the opportunity to provide comments regarding the Frog Pond Property. If you have any questions, please contact Emily Bauer at 772-562-3909, extension 335.

Sincerely yours,

Robert Trahan

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc: electronic only
DEP, West Palm Beach, Florida (Joe Lurix)
Corps, West Palm Beach, Florida (Tori White)
Newfields, Boulder, Colorado (Joe Allen)
URS, Boca Raton, Florida (Edward Leding)

LITERATURE CITED

Frakes, R.A., T.A. Bargar, E.A. Bauer. 2008. Sediment copper bioavailability to freshwater snails in south Florida: risk implications for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*). Ecotoxicology 17:598-604.

Hoang, T.C., E.C. Rogevich, G.M. Rand, R.A. Frakes. 2008. Copper uptake and depuration by juvenile and adult Florida apple snails (*Pomacea paludosa*). Ecotoxicology 17:605-615.

Hoang, T.C., L.J. Schuler, E.C. Rogevich, P.M. Bachman, G.M. Rand, R.A. Frakes. 2008. Copper release, speciation, and toxicity following multiple flooding of copper enriched agriculture soils: Implications in Everglades restoration. Water Air Soil Pollut. 199:79-93.

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: Joe Lurix, Waste Program Administrator
THROUGH: Paul Wierzbicki, Waste Cleanup Supervisor
FROM: Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section
DATE: APR 28 2009
SUBJECT: Additional Soil Investigations Frog Pond - C-111 Spreader Canal, Leaky Reservoir

As requested, I have reviewed the Additional Soil Investigations Frog Pond for the Leaky Reservoir area of the C-111 Spreader Canal Project, dated March 30, 2009, (received April 1, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Based on the information supplied, it would seem prudent to proceed to scrape the soils in grids 31, and 33. The copper results for the composite sample in grid 31 are very close to the interim screening level value, and grid 33 has a chromium concentration that exceeds the TEC as well.

2. While it is under stood that this current project does not call for the use of grids 5 and 6, please ensure that should the soils in those grids be disturbed, they are handled in such a way that they do not come in contact with surface waters.

3. Please furnish the Department with confirmatory soil samples after the excavation is finished.

4. What is the rationale for not conducting sampling and analysis in the NW corner of the parcel, outside the grid?

5. It is noted on page 8 that a "Soil Management Plan" is being developed. Please ensure that excavated soils are managed so that they do not pose a leachability threat to surface or groundwater.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Inger Hansen, Engineer IV, Watershed Management & Planning

090331

38617-408

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: Joe Lurix, Waste Program Administrator
THROUGH: Paul Wierzbicki, Waste Cleanup Supervisor
FROM: Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section
DATE: NOV 09 2009
SUBJECT: Response to Comments on the Soil Leachability Study for the Frog Pond area at the C-111 Spreader Canal, Miami-Dade County, Florida

I have reviewed the Response to Comments on the Soil Leachability Study for the Frog Pond area at the C-111 Spreader Canal, dated September 23, 2009, (received September 25, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. The responses to comments 1 through 3 are accepted as presented.

2. As long as the copper concentration in the post-scraping soils is below the 85 mg/kg benchmark, the inundation of the area should not pose a risk to ecoreceptors; therefore, the site should be acceptable for the District's intended use.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Robert Taylor, South Florida Water Management District
Inger Hanson, Engineer IV, Watershed Management & Planning
Ed Leding, P.G., URS Corporation
Brian Dougherty, Bureau of Waste Cleanup (Brian.Dougherty@dep.state.fl.us)

090899

URS

SOIL MANAGEMENT PLAN
Aerojet Canal Extension
C-111 Spreader Canal Phase I Project
Florida City, Miami-Dade County, Florida

Prepared for:
SOUTH FLORIDA WATER
MANAGEMENT DISTRICT
3301 Gun Club Road
West Palm Beach, Florida 33406

Prepared by:
URS CORPORATION
7800 Congress Avenue
Boca Raton, FL 33487

JOB #: 38617-461

November 15, 2010

URS

November 15, 2010

Mr. Robert J. Taylor
Lead Environmental Engineer
Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

RE: Soil Management Plan
Aerojet Canal Extension
Florida City, Miami-Dade County, Florida
Job # 38617-461

Dear Mr. Taylor:

Herewith transmitted is URS Corporation's (URS') report of the Soil Management Plan for the copper impacted soils at the Aerojet Canal Extension within the C-111 Spreader Canal Phase I Component.

URS appreciates the opportunity to support the District on this important project. If you have any questions with the information contained in this report or this project, please contact URS at your convenience.

Respectfully Submitted,

URS Corporation

Edward A. Leding, P.G.
Project Manager

William F. Marcus
Projects Director

TABLE OF CONTENTS

1.0 INTRODUCTION / BACKGROUND 1
- 1.1 PROJECT DESCRIPTION 1
- 1.2 SITE ASSESSMENTS/INVESTIGATIONS 2
  - 1.2.1 Phase I/II ESA (2009) 2
  - 1.2.2 Hydrologic Evaluation (2009) 3

2.0 WATER QUALITY 4
- 2.1 GROUNDWATER 4
- 2.2 SURFACE WATER 4

3.0 OBJECTIVE 5

4.0 EXTENT OF IMPACTED SOILS 5
- 4.1 CONSTITUENTS OF CONCERN 5
- 4.2 LATERAL AND VERTICAL EXTENT 5
- 4.3 SOIL REMEDIATION 6

5.0 SOIL REMEDIATION METHODOLOGY 6
- 5.1 HEALTH AND SAFETY PLAN 6
- 5.2 PRE-SOIL EXCAVATION SURVEY 7
- 5.3 UTILITIES PROTECTION 7
- 5.4 STORMWATER 7
- 5.5 PERMITS 7
  - 5.5.1 Environmental Permits 7
  - 5.5.2 Construction Permit 7
- 5.6 PROJECT CONTROLS AND MANAGEMENT MEASURES 7
  - 5.6.1 Dust Control 7
  - 5.6.2 Watering 8
  - 5.6.3 Roadway Dust Control 8
- 5.7 SOIL EXCAVATION PROCEDURE AND EQUIPMENT 8
  - 5.7.1 Soil Profile 8
  - 5.7.2 Soil Excavation Activities 8
  - 5.7.3 Excavation Survey 9
  - 5.7.4 Soil Confirmation Sampling 9
  - 5.7.5 Quality Assurance / Quality Control (QA/QC) 10

5.8 LEVEE CONSTRUCTION 11
5.9 SOIL RELOCATION AND STAGING 11
5.10 GROUNDWATER MONITORING 12
6.0 SUMMARY REPORT 13

LIST OF FIGURES

Figure 1 General Site Vicinity Map
Figure 2 Aerial Site Map
Figure 3 Copper TEC/PEC Exceedance Map
Figure 4 Area of Proposed Impacted Soil Relocation Map
Figure 5 Location of Proposed Groundwater Monitor Well

LIST OF TABLES

Table 1 Summary of Historical Pesticide, Herbicide, and Metal Soil Analytical Results

APPENDICES

Appendix A U.S. Fish and Wildlife Service's and Florida Department of Environmental Protection Approval Letters

1.0 INTRODUCTION / BACKGROUND

The C-111 Spreader Canal, Phase I project is comprised of the Frog Pond Detention Area improvements and the Aerojet, C-110, and L-31 modifications all of which are located west of Florida City in Miami-Dade County, Florida. The Aerojet Canal modifications mainly entail an approximately 8,000-ft extension to the existing canal through previously cultivated lands in order to create a connection with the C-111 Canal (see Figures 1 &2). The canal extension, which hereinafter is referred to as the Aerojet Canal Extension, is the focus of this Soil Management Plan (SMP).

The Aerojet Canal Extension also involves the construction of levees adjoining both sides of the extended canal, a pump station (S-199), one concrete box culvert, four weirs, one earth plug, and an approximately 5,000-ft long berm along the west bank of the existing Aerojet Canal.

As indicated in the "Final Geotechnical Report" dated May 14, 2009, the existing surficial soils within the footprint of the proposed improvements (e.g. levees, canal lining, and pump station) have poor geotechnical properties and are required to be removed in order to provide adequate foundation support or seepage control.

Environmental investigations in the area of the proposed Aerojet Canal Extension revealed the presence of copper impacted soils in concentrations that pose a potential ecological risk. Because the surficial soils to be removed have elevated concentrations of copper, a soil management plan must be developed. This Soil Management Plan (SMP) provides procedures for the handling and management of copper impacted soil, during construction, within the proposed Aerojet Canal Extension

1.1 PROJECT DESCRIPTION

The C-111 Spreader Canal Phase I Aerojet, C-110, and L-31E Canal Modifications are located in an area primarily used as a wildlife and environmental protection area by the Florida Fish and Wildlife Conservation Commission. The proposed Aerojet Canal Extension element of the project is located within the area of the former Aerojet facility just east of the L-31W Canal and south of Ingraham Highway (see Figure 2). Structures located in the area of the Aerojet facility include one for testing Solid Rocket Boosters (SRBs) along with support structures. A former Juvenile Correction Center occupies approximately five acres east of the L-31W Canal and north of the former Aerojet facility area. The South Florida Aquaculture Center, also known as Blue Heron Aqua Farms, formerly occupied approximately 49 acres immediately east of the L-31W Canal and northwest of the former Aerojet facility area, which was historically used to raise hybrid striped bass.

A portion of the proposed Aerojet Canal Extension encroaches into 50 acres of former tomato lands which were recently cultivated for row crops. Another portion of the proposed Aerojet Canal Extension will also be located in an area that was formerly used for cultivation 30 to 40 years ago. Soils within the project area are relatively thin, at only 6 to 8 inches, and are underlain by limestone cap-rock. According to the United States Department of Agriculture (USDA) *Soil Conservation Service Soil Survey of Miami-Dade County Area, Florida*, surficial soils in the area of the 50 acres are primarily the soils of the Freshwater and Sawgrass Marsh

including the Lauderhill-Dania-Pahokee and Perrine-Biscayne-Pennsuco Associations. The project site vicinity map is included as **Figure 1**. The 50 acres of currently cultivated row crops is located in Sections 7 and 18, Township 58 South, Range 38 East. A site location map illustrating the subject property is included as **Figure 2**.

1.2 SITE ASSESSMENTS/INVESTIGATIONS

An Environmental Site Assessment (ESA) and a hydrologic evaluation were conducted in the area of the proposed Aerojet Canal Extension. The ESA was conducted to evaluate whether historical activities on or near the project area may have resulted in contamination by hazardous substances or wastes. The hydrologic study is currently being conducted to evaluate the groundwater quality surrounding the Aerojet Canal as well as the groundwater recharge and flow direction within the area of the Aerojet Canal. Given below is a brief overview of the results of each assessment/study.

1.2.1 Phase I/II ESA (2009)

In June, 2009, a Phase I/II ESA was conducted on the 73,220 acres of the C-111 Spreader Canal Phase I Project. The Phase I ESA identified nine areas of potential environmental concern, of which two were located in the Aerojet Canal Extension element of the C-111 Spreader Canal Phase I Project. The ESA identified sediment in the Aerojet Canal as a potential environmental concern based on observations of surface water runoff and the potential for contaminates to accumulate in the canal sediments. The second potential environmental concern identified by the ESA was in the former and current cultivation fields located north of the former Aerojet facility. Based on historical and current land use, there is a potential environmental concern in the soils at the cultivation fields from the agrochemicals that were historically (and currently) applied. The historical and current cultivation fields are located in the vicinity of the proposed Aerojet Canal Extension construction boundaries.

In conjunction with the Phase I ESA identifying the areas of potential environmental concern, Phase II ESA activities were conducted by collecting soil and sediment samples from the areas of potential environmental concern. Based on the potential environmental concern of sediment in the canal immediately west of the former Aerojet facility, three discrete sediment samples were collected from the Aerojet Canal adjacent to the northern most structures at the former Aerojet facility.

Sediment analytical results exhibited arsenic concentrations at 4.4 milligrams per kilogram (mg/kg), 8.0 mg/kg, and 6.9 mg/kg, above the arsenic Residential Soil Cleanup Target Level (SCTL) of 2.1 mg/kg in all three sediment samples collected. The remaining petroleum, organochlorine pesticide, and metal constituents analyzed for were below applicable Soil Quality Assessment Guideline – Threshold Effects Concentrations (SQAG-TEC), SCTLs, or below laboratory detection limits (BDL).

Two composite soil samples, identified as G-100 and G-99, were collected from the 100 acres of current and historically cultivated land located in the project area. The soils were evaluated for impacts from the farming operations.

Soil sample G-99 exhibited a copper concentration of 83.7 mg/kg above the copper SQAG-TEC of 32 mg/kg. One duplicate sample was collected from grid G-99 and exhibited a copper concentration of 144 mg/kg above the United States Fish and Wildlife Service's (Service) Interim Value for copper of 85 mg/kg. Both copper concentrations are below the copper Residential SCTL of 150 mg/kg.

Arsenic was exhibited in the duplicate sample from grid G-99 at 2.2 mg/kg above the arsenic Residential SCTL of 2.1 mg/kg but below the 9.8 mg/kg SQAG-TEC and the 33 mg/kg SQAG Probable Effects Concentration (PEC). Chromium was exhibited in the duplicate sample from grid G-99 at 41.7 mg/kg above the chromium Residential SCTL of 38 mg/kg but below the 43 mg/kg SQAG-TEC and the 110 mg/kg SQAG PEC. The organochlorine pesticides and remaining metal constituents analyzed were below applicable SQAG-TECs, SCTLs, or BDL.

Soil analytical results from the Phase I/II ESA for the two, 50 acre grids, G-100 and G-99, are summarized in **Table 1.**

Based on the Phase II ESA (2009) soil analysis, the copper impacted soils within grid G-99, in the area of the proposed Aerojet Canal Extension, pose a potential ecological risk. The Phase I/II ESA recommended scraping and placing the copper impacted soils outside the footprint of the Canal unlined channel and berms. A portion of the scraped soils may be used in the construction of the canal's levees. Also, based on the future intended land use of the C-111 Spreader Canal Phase I project area, it is recommended that a human health risk assessment be conducted to ensure that the general public is not exposed to concentrations of agrochemicals, specifically arsenic, that would pose a human health risk.

1.2.2 Hydrologic Evaluation (2009)

A hydrologic evaluation was conducted of the groundwater quality, recharge, and flow direction surrounding the C-111 Spreader Canal – Aerojet Canal Extension. The hydrologic study involved installing five temporary monitoring wells along the length of the Aerojet Canal and sampling on a quarterly basis. The groundwater samples were analyzed for volatile organic compounds (VOCs) by EPA Method 8260 and Semi-VOC's by EPA Method 8270. In addition to the groundwater sampling, In-Situ Level Troll 500 pressure transducers were installed in the five monitoring wells to monitor the groundwater level and the flow direction in the vicinity of the Aerojet Canal.

The groundwater analytical results for the First Year, First Quarter sampling event conducted on September 11, 2009 indicated VOC's and Semi-VOC's were below Groundwater Cleanup Target Levels (GCTLs) per Chapter 62-777, Florida Administrative Code (F.A.C.) or BDL.

The groundwater samples collected during the First Year, Second Quarter will continue to be analyzed for VOC's and Semi-VOC's. In the event that the VOC's and Semi-VOC's are BDL, the samples will not be analyzed for VOC's and Semi-VOC's during the First Year, Third and Fourth Quarters. In addition to the initial groundwater sampling event the five monitoring wells will be sampled for organochlorine pesticides (endosulfan) by EPA Method 8081, eight Resource Conservation and Recovery Act (RCRA) Metals (arsenic, barium, cadmium,

chromium, lead, mercury, selenium, and silver), copper, and zinc by EPA Method 6010B during the First Year, Second, Third, and Fourth Quarters.

2.0 WATER QUALITY

2.1 GROUNDWATER

A hydrologic study to evaluate the groundwater quality surrounding the C-111 Spreader Canal – Aerojet Canal Extension will be conducted. Groundwater samples are to be collected from five monitoring wells for a period of one year; with one sample collected per well every three months. The groundwater samples are to be analyzed for VOC's by EPA Method 8260 and Semi-VOC's by EPA Method 8270.

The Year One, First Quarter groundwater analytical results did not detect VOC's or Semi-VOC's above laboratory reporting limits. Based on correspondence with the District, the groundwater samples collected during the First Year, Second Quarter will continue to be analyzed for VOC's and Semi-VOC's. In the event that the VOC's and Semi-VOC's are BDL, the samples will not be analyzed for VOC's and Semi-VOC's during the Fist Year, Third and Fourth Quarters. In addition, the monitor wells will be sampled for organochlorine pesticides (endosulfan) by EPA Method 8081, eight RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), copper, and zinc by EPA Method 6010B during the First Year, Second, Third, and Fourth Quarters.

2.2 SURFACE WATER

In June 2009, a leachability study was conducted on soils in the Frog Pond Detention Area project, which is located less than ½ mile north of the proposed Aerojet Canal Extension. Five composite soil samples were collected and tested for leachability of arsenic, chromium, copper, and zinc by the Synthetic Precipitation Leaching Procedure (SPLP).

The two sites are similar with respect to soil types, with the soils being relatively thin, at only 6 to 8 inches of soil, and underlain by limestone cap-rock, and both sites utilized for agricultural production. Based on these similarities, the results of the leachability study for the Frog Pond Detention Area were considered applicable to what can be expected with respect to the residual soils within the footprint of the proposed Aerojet Canal Extension project as well as the surface water quality. Results of the Frog Pond Detention Area surface water evaluations are detailed below.

The SPLP results were compared to the Surface Water criteria to evaluate if the residual soils remaining in the Frog Pond Detention Area, after scraping, had the potential to desorb metal(s) into the surface water above Surface Water Quality Classifications (SWQCs). The Frog Pond Detention Area site-specific SPLP results for copper ranged between 0.0058 milligrams per liter (mg/L) to 0.044 mg/L of which three samples exceeded the estimated SWQC of 0.019 mg/L. The SPLP result for arsenic was below the SWQC of 50 mg/L, and for chromium and zinc the SPLP results were below the calculated SWQCs of 0.0167 mg/L and 0.238 mg/L, respectively.

Based on review of the Frog Pond Detention Area SPLP test results, the potential environmental risk posed by copper desorbing from the residual soils into the surface water in the Aerojet Canal

Extension is anticipated to be low. Only a thin veneer of impacted soil and isolated vugs of impacted soils, with limited aerial and vertical extent will be present after scraping. The majority of the scraped soil will be located outside of the unlined canal.

It is anticipated that any copper that desorbs from the residual soils at the proposed Aerojet Canal Extension will be below the 0.019 mg/L SWQC. The water flow within the proposed Aerojet Canal Extension is expected to be dynamic, thus diluting any copper that is desorbing from the residual soils. The more acidic conditions that soil samples are exposed to as part of the SPLP tests are not expected to be present in the Aerojet Canal Extension or the waters flowing into the canal. The Aerojet Canal Extension is underlain by limestone cap rock, which will cause the surface water and groundwater to be slightly basic, as opposed to acidic. Therefore this basic condition should decrease the potential for leaching of the absorbed metals into the groundwater and surface waters. Additionally, water is not anticipated to pond within the Aerojet Canal Extension for an extended period of time, creating an environment that would be conducive for copper to desorb from the soils/sediment. Any copper that leaches out of the levees is also estimated to be at concentrations below the 0.019 mg/L SWQC. In addition, the copper concentrations in the residual soils and water column are expected to decrease over time.

3.0 OBJECTIVE

The purpose of the SMP is to provide the procedures required for the permitting, excavation, and relocation of the copper impacted soils, and how the soils are associated with the design of the proposed Aerojet Canal Extension for the C-111 Spreader Canal Phase I Project. The SMP will be presented for review and concurrence from applicable regulatory agencies. A Health and Safety Plan (HASP) will also be developed prior to initiation of field activities.

4.0 EXTENT OF IMPACTED SOILS

Elevated copper concentrations detected in the composite soil sample from grid G-99, just east of the proposed Aerojet Canal Extension, are illustrated in **Figure 3**.

4.1 CONSTITUENTS OF CONCERN

Results of the Phase I/II ESA conducted at the Aerojet Canal portion of the C-111 Spreader Canal Phase I identified an agricultural area impacted with copper at concentrations that would potentially pose an unacceptable ecological risk to the Snail Kite and Osprey, Service trustee species. Residual organochlorine pesticides, including 4,4-DDE, as well as arsenic and chromium were not identified in the soil samples collected at the Aerojet Canal at concentrations that would cause undo-risk to the Service's trustee species.

4.2 LATERAL AND VERTICAL EXTENT

Results from the Phase II ESA sampling identified an agricultural area impacted with copper concentrations above the Service's Interim Value. These concentrations may pose a risk to the snail kite.

The following range of copper impacts was observed from the 50 acre grid (G-99):

- 0-6" below land surface (bls) – from 83.7 mg/kg to 144 mg/kg

No areas were sampled below 6 inches bls. The nature of the soils and geology are similar to the Frog Pond, which is located just north of the project area. The anticipated vertical extent of copper impacted soils is 8 inches to 1 foot bls.

Approximately 50 acres, located in the northern portion of the proposed Aerojet Canal Extension, exhibited a copper concentration above the Service's Interim Value for copper. Based on previously collected information the depth of soils within the impacted 50 acres is 6 to 8 inches bls. The approximate volume of soil from grid G-99 requiring excavation and relocation is 12,100 cubic yards (yd^3).

The Service has approved excavation and relocation of impacted soils from grid G-99, east of the proposed Aerojet Canal Extension. A copy of the Service's approval letter is included in **Appendix A**.

4.3 SOIL REMEDIATION

Based on results from the Phase I/II ESA, it has been determined that the soil scraping, which is inherent to the design of the proposed improvements, eliminates and/or minimizes the potential risks of the copper impacted soils to the Service's trustee species. Therefore the excavation of the top 6 to 8 inches of soil down to the limestone cap-rock and either relocating the spoils east of the proposed Aerojet Canal Extension or mixing the spoils with clean fill material for the levees at specific ratios constitute alternative solutions that may be used. The Pilot Study (2007) and the Expanded ERA (2009) performed at the Frog Pond property, ½ mile directly north of the proposed Aerojet Canal Extension, determined that scraping the impacted soils from the underlying limestone bedrock and relocating the soils outside of the construction limits is an effective corrective action method and poses no significant risk to the Service's trustee species.

5.0 SOIL REMEDIATION METHODOLOGY

Fifteen (15) of the 50 acres of impacted soils within grid G-99 fall under the footprint for the Aerojet Canal Extension and will be scraped per the geotechnical engineer's recommendation. Based on site-specific conditions, the copper impacted surficial soils will be excavated and relocated east of the proposed Aerojet Canal Extension construction. The District's selected contractor can utilize the designated stockpile area for storage of impacted surficial soils. The following sections detail the soil excavation, relocation, and verification sampling methodology.

5.1 HEALTH AND SAFETY PLAN

Prior to implementing any field work, the District's selected contractor should develop a health and safety plan (HASP) for worker exposure to impacted dust/soil during the relocation process. Soil analytical data collected at the proposed Aerojet Canal Extension exhibited arsenic concentrations above the Residential SCTLs of 2.1 mg/kg. Exceedances above the Direct Exposure Commercial/Industrial SCTLs were not detected in any of the soil analytical data. The arsenic and copper exceedances at the proposed Aerojet Canal Extension do not represent a significant human health risk. The site specific HASP should provide the details for the health and safety component of this project. Details on excavation safety and worker safety should be included in the site specific HASP.

5.2 PRE-SOIL EXCAVATION SURVEY

The District Engineer or project manager (PM) will work with the earthwork contractor to identify the area to be scraped. The final engineering plans indicate that all of the soil within the proposed Aerojet Canal Extension will be scraped to the top of the limestone cap-rock. Site visits will be conducted by District representatives to coordinate the areas to be scraped with the construction contractor. District representatives will confirm that the area to be scraped is properly marked. In the event that additional markings are necessary or if there is a discrepancy in the area to be scraped, then the District representative will coordinate with the District onsite PM to resolve these issues.

5.3 UTILITIES PROTECTION

The District's selected contractor will be required to obtain the necessary utility clearance prior to beginning any excavation work, in addition to notifying the Miami-Dade County Public Works Department (PWD). If necessary, a site surveying crew will assist in the location of identified utilities and verify the depths of existing piping or utilities. Utilities within or near the site will be flagged prior to commencement of work.

5.4 STORMWATER

The District's selected contractor will be required to obtain the necessary Storm Water Management Plan. The District's representative will coordinate with the selected contractor to ensure that the site work associated with soil excavation and soil stockpiling is consistent with the issued storm water permit.

5.5 PERMITS

5.5.1 Environmental Permits

The District has, as part of the project permitting, already obtained the necessary Federal, State, and Local permits for the construction and operation of this project. The soil excavation and relocation of the soil will be conducted in conjunction with the permits.

5.5.2 Construction Permit

The District's selected earthwork will obtain all necessary State and Local permits.

5.6 PROJECT CONTROLS AND MANAGEMENT MEASURES

The District's selected contractor will implement engineering controls to limit the impact of the excavation/construction on the site and surrounding areas. These measures will also preclude cross-contamination by controlling dust emissions, surface erosion, and stormwater run-on and run-off.

5.6.1 Dust Control

Engineering controls and work practices, which will be used to control emissions, are outlined below.

5.6.2 Watering

Water will be applied to site and work area surfaces where other engineering controls (such as temporary liners) are not employed and when airborne dust emissions are present. The use of numerous open hole wells will be employed.

5.6.3 Roadway Dust Control

The District's selected contractor will ensure that haul and access roads and pathways are properly maintained to enhance dust control. Material transport vehicles will be loaded in a manner to avoid spillage during transport. Any spillage of impacted soils or waste materials during transport will be cleaned up immediately. Water may also be used for dust control on roadways, if necessary.

5.7 SOIL EXCAVATION PROCEDURE AND EQUIPMENT

5.7.1 Soil Profile

Soils within the proposed Aerojet Canal Extension area are relatively thin, approximately 6 to 8 inches thick, and are underlain by solution-riddled limestone cap-rock. Historically, soils on agricultural properties in the vicinity of the Aerojet Canal, specifically the Frog Pond property, which is located just north of the project area, have been either rock-plowed or mechanically scarified and cultivated. These activities have resulted in the thin layer of soil with fragments of the underlying cap-rock.

During the Pilot Study (2007) and the Expanded ERA (2008) for the Frog Pond Detention Area, depressions were observed in the limestone cap-rock that contained residual soils beyond 6 to 8 inches bls following soil scraping activities. After conducting the pilot test at the Frog Pond, on average, the depth of the residual soils in the depressions was less than 1 inch, however in some areas the thicknesses of soils in the solution-riddled cap-rock measured 1 to 2 feet in thickness. The soil analytical data collected during the Pilot Study and the Expanded ERA for the Frog Pond Detention Area indicated that copper concentrations were present in the soils above the Service's Interim Value of 85 mg/kg. The thin veneer of residual soils remaining on the cap-rock after scraping also had elevated copper above 85 mg/kg. However, the copper in the soils located in the solution riddled cap-rock attenuated with depth to concentrations below 85 mg/kg.

With the similarities between the Frog Pond site and the proposed Aerojet Canal Extension area, it is believed that following soil scraping activities in the proposed Aerojet Canal Extension area, residual soils in the solution riddled cap-rock will attenuate with depth to copper concentrations below 85 mg/kg.

5.7.2 Soil Excavation Activities

The final construction plans indicate that 15 acres of impacted soil within the proposed Aerojet Canal Extension will require excavation from the soil surface down to the limestone cap-rock and relocated to one stockpile area on-site. The proposed area for relocation of the impacted soils is along the eastern outer edge of the proposed Aerojet Canal Extension and south of the S-199

Lined Conveyance Channel and proposed Aerojet Canal Extension intersection. The location of the stockpile area is illustrated on **Figure 4**. The estimated amount of soils that will be relocated to the stockpile area is 22,296 yd^3. The amount of stockpiled soils will be comprised of approximately 12,100 yd^3 of copper impacted soil and 10,196 yd^3 of clean soil excavated from the southern portion of the proposed Aerojet Canal Extension.

During the soil excavation activities, the proposed Aerojet Canal Extension design drawings to ensure that the excavation activities extend to the outer edges of the canal extension. District representatives will take photographs to document the soil excavation activities, conduct inspections of the excavated areas to ensure removal of impacted soil, as much as practical, and confirm that the relocation of the impacted soils along the eastern outer edge of the proposed Aerojet Canal Extension is adequately stockpiled. Following initial soil excavation activities, residual soils may be present in the limestone cap-rock depressions. The post soil relocation survey will identify areas where over-excavation may be required in the limestone cap-rock depressions.

5.7.3 Excavation Survey

Subsequent to the soil excavation activities, an inspection of the excavated area will be conducted to confirm and document that the impacted soils have been excavated to the required extent and depths, as much as practical. Initially a visual inspection will be conducted of the excavated area via a four-wheel drive vehicle. The excavated area will be traversed in north-south transects. The surface will be inspected for depressions in the limestone cap-rock. The depressions will be identified using a hand held Global Positioning System (GPS) receiver and documented. After inspecting the excavated area, the depressions in the limestone cap-rock will then be inspected on foot to determine the amount of residual soil in the depressions. The aerial extent of the depressions will be measured and a calibrated rod will be utilized to determine the depth of residual soil. Based on these measurements the volume of soils in the depressions will be determined. Areas where the depth of the residual soils is less than 1 inch will not be over-excavated. Areas that are ¼-acre in size with a residual soil thickness of more than 3 inches, will be over-excavated by the contractor, as much as practical, at the direction of the District represenatives. The area will be re-inspected to document the effectiveness of the over-excavation.

5.7.4 Soil Confirmation Sampling

After the impacted soils have been excavated and relocated and the survey conducted, confirmation soil samples will be collected. Subsequent to excavation of impacted soils, District representatives will locate the sampled locations using a portable GPS receiver. At each of the sample locations, a close proximity discrete composite soil sample from the excavated ground surface will be collected. The discrete sample will be collected from the residual soils remaining on top of the limestone bedrock. As noted in correspondence with the Service, all confirmation soil samples will be composed of a 5-point close proximity composite. The soil sample will be placed in a pre-cleaned stainless steel bowl and thoroughly mixed with a stainless steel spoon. The soil will then be placed in a labeled, pre-cleaned, laboratory-supplied bottleware and subsequently placed in a sample cooler with ice. The samples will be submitted under chain-of-custody procedures to a State certified laboratory and analyzed for organochlorine pesticides by EPA Method 8081 and copper.

The confirmation sampling plan is based on correspondence with the Service as well as the Florida Department of Environmental Protection (FDEP). Based on approval by the FDEP for the Frog Pond Detention Area sampling plan, where a total of 50 discrete confirmation samples will be collected over 600 acres, a similar sampling plan will be employed for the proposed Aerojet Canal Extension following soil excavation activities. The rate of sampling at the Frog Pond Detention Area equates to approximately four to five discrete samples per 50 acres. Given the acreage to be scraped for the proposed Aerojet Canal Extension of approximately 15 acres, three confirmation samples will be collected from the scraped area. The soil samples will be collected from 0 to 6 inches bls in solution cavities / depressional areas where residual soils remain after scraping.

Additionally, the project area will be surveyed, subsequent to the soil over-excavation activities, to determine the area-weighted average of the residual copper concentrations in the vugs and solution cavities within the limestone bedrock. The site inspection will be conducted within the 15 acres of copper impacted soil, from a portion of the proposed Aerojet Canal Extension, to identify solution cavities greater than 100 square feet (ft^2) for evaluation of sampling. Smaller solution cavities / depressional areas that are less than 100 square feet but greater than 25 square feet will also be measured. This data will be extrapolated for the entire scrapped project area. In addition, at least two, 1-acre areas will be selected and all solution / depressional areas less than 25 square feet will be measured.

The confirmation soil sampling protocol discussed with the Service will consist of measuring all solution cavities / depressional areas greater than 100 ft^2 identified in the 15 acres. Of all the solution cavities / depressional areas measured, five of the greater than 100 ft^2 depressional areas will be selected for confirmation soil sampling and analysis of copper. Confirmation soil samples will be collected from 0 to 6 inches from the five selected solution cavities / depressional areas greater than 100 ft^2 within the 15 acres. In addition, five vertical confirmation soil samples will be collected in the 15 acres from 6 inches to refusal to evaluate vertical impacts in solution cavities / depressional areas below the proposed Aerojet Canal Extension. Smaller solution cavities / depressional areas that are less than 100 ft^2 and greater than 25 ft^2 will be surveyed; however samples will not be collected.

Using this approach 13 soil samples will be collected for confirmation purposes following soil scraping activities.

5.7.5 Quality Assurance / Quality Control (QA/QC)

Quality assurance procedures utilized during the post scraping sampling activities will include compliance with the FDEP Standard Operating Procedures (SOP) for Laboratory Operation and Sample Collection Activities, and the District's environmental consultant's' Quality Assurance Manual. Laboratory analytical parameters, procedures, and quality control will be conducted in accordance with Test Methods for Evaluating Solid Waste, Physical Chemical Methods, Third Edition (EPA SW-846) methodologies.

In addition to the 13 discrete confirmation soil samples to be collected following soil scraping, one duplicate discrete soil sample will be collected per the District's Quality Assurance System Requirements (QSAR) document developed for the Comprehensive Everglades Restoration

Program (CERP) requiring an additional 10 percent (%) samples be collected for quality assurance. One soil sample will also be split and submitted to a separate laboratory per the Service. The split sample will evaluate the correlation between the parent sample and the split sample analyzed by a separate laboratory. Both the duplicate and split samples will be analyzed for organochlorine pesticides (EPA Method 8081) and copper.

In order to validate the field and laboratory procedures, in addition to ensuring that the data reported is representative of site conditions, equipment blanks, trip blanks, matrix spike, and matrix spike duplicate samples will also be collected. As required, the QA/QC samples will be analyzed for organochlorine pesticides (EPA Method 8081) and copper. The equipment blanks will be representative of the stainless steel equipment used (hand auger, mixing bowl, and mixing spoon) during sampling activities.

The District will utilize the FDEP Automated Data Processing Tool (ADaPT) for data validation of each group of samples that will be submitted to the laboratories.

5.8 LEVEE CONSTRUCTION

The contractor will be given the choice to build the proposed levees out of clean imported material or to mix the scraped surficial soil with clean fill. If the contractor chooses to mix materials, in light of geophysical considerations, the scraped soil in the mixture should be limited to a maximum 27% by volume.

A site-specific leachability study conducted at the Frog Pond (July 2009) indicated that soil mixtures with copper concentrations greater than 91.9 mg/kg have the potential to leach copper into the surface water at concentrations that exceed the surface water quality criterion. Any soil mixture must also result in copper concentrations that are below the Service's Interim Value of 85 mg/kg. Soils mixtures containing less than 85 mg/kg of copper will therefore meet both the site-specific water leachability concentration, and Service's Interim Value.

It is important to note that, if the contractor chooses to use mixed soil to construct the core of the levees, the contractor will install a 1-foot thick cap of clean fill over the levee core.

5.9 SOIL RELOCATION AND STAGING

The District construction contractor will be responsible for onsite activities and safety. The District will work with the contractor and the District onsite PM to implement the following protocol. Because the site is located in a rural area, noise control is not likely to be an issue during the excavation activities. The contractor should develop a site specific HASP. The site specific HASP may require that hearing protection is worn by the contractor crewmembers.

Work activities will be planned and scheduled as such to minimize the number of times the impacted soils are handled or disturbed. Excavation, loading, transportation, and stockpiling will be planned to minimize the aerial extent of waste or work area exposed. Vehicular traffic, which will include principally truck traffic, will be controlled on-site by implementing and enforcing traffic routes for all vehicles. These routes will be clearly marked and drivers will be informed of the traffic plan in writing prior to performing any work at the site. When impacted soil is removed from the proposed Aerojet Canal Extension by truck, the driver will be prohibited from

leaving his truck cab and will be so instructed. Radios will be used on-site to control traffic entering and exiting the site. Route markers (e.g., traffic cones and traffic signs) will be placed as necessary to mark site access and routes of travel. The contractor will also coordinate as necessary with all other site activities occurring during the soil removal.

The excavated soil will be placed in an area that is not proposed for inundation or flooding. Based on the limited residual agro-chemicals in the soil, no berms or liner are proposed or necessary for the stockpile to limit the impacted soil from leaching to the surface water or ground water. Excavated soil will be transported to the soil stockpile area on-site, which is illustrated on **Figure 4**.

In an effort to limit soil erosion and sediment control of the soil stockpile, both non-structural and structural controls will be used to control storm water run-off and related erosion from the soil stockpile. The District's selected contractor will place the soil in the stockpile at 2 foot lifts. The soil stockpile will be compacted using the placement equipment to minimize soil erosion, in addition to the stockpile being graded in a manner to limit erosion and accumulation of stormwater and the resultant need for other controls. Grass seeds will be dispersed on the soil stockpile to promote restoration and limit erosion. The soil stockpile will be posted with signs that inform on-site personnel that access to these areas are off limits to control traffic and surface erosion. Structural controls, such as hay bales, will be used in conjunction with silt fencing and diversion ditches to control surface water runoff. The exact locations of structural controls will be determined and constructed, where practical and identifiable, prior to use of heavy equipment. Controls will be implemented concurrently with all construction activity and will be continued throughout the period of construction. Additionally, the District's selected contractor will implement controls dictated by periods of intense weather. Weather forecasts will be monitored to provide an alert of such weather conditions.

The District's selected contractor will install suitable erosion and sediment control measures around the site prior to initiation of any site activities. The contractor will augment the existing erosion controls as necessary, including the strategic placement of silt fence and hay bales. The controls will be inspected after each rain event by the contractor to ensure continued performance.

5.10 GROUNDWATER MONITORING

To document that scraped soils will not impact groundwater, up to three groundwater monitor wells following the excavation and soil relocation activities are being proposed. The wells will be installed to 12 feet bls using 8 inch hollow stem flight augers and a truck-mounted drill rig. The well will be constructed of 10 feet of 0.010 slot screen and 5 feet of solid PVC riser. A 6/20 silica sand filter pack will be placed in the annular space, between the auger boring hole and the well, to 11 feet. The upper foot will be finished with cement grout. The well will be installed such that 3 feet is above land surface and housed in a secured steel casing for protection set in a two by two foot cement pad. The well will have a secured water tight cap.

The groundwater monitor wells will be located just south of the soil stockpile area and along the south portion of the unlined canal. **Figure 5** illustrates the proposed groundwater monitor well locations for the proposed Aerojet Canal Extension. Groundwater samples will be collected

from the wells once every three months for one year. The groundwater samples will be submitted to a State certified and District approved laboratory for analysis of copper and for organochlorine pesticides.

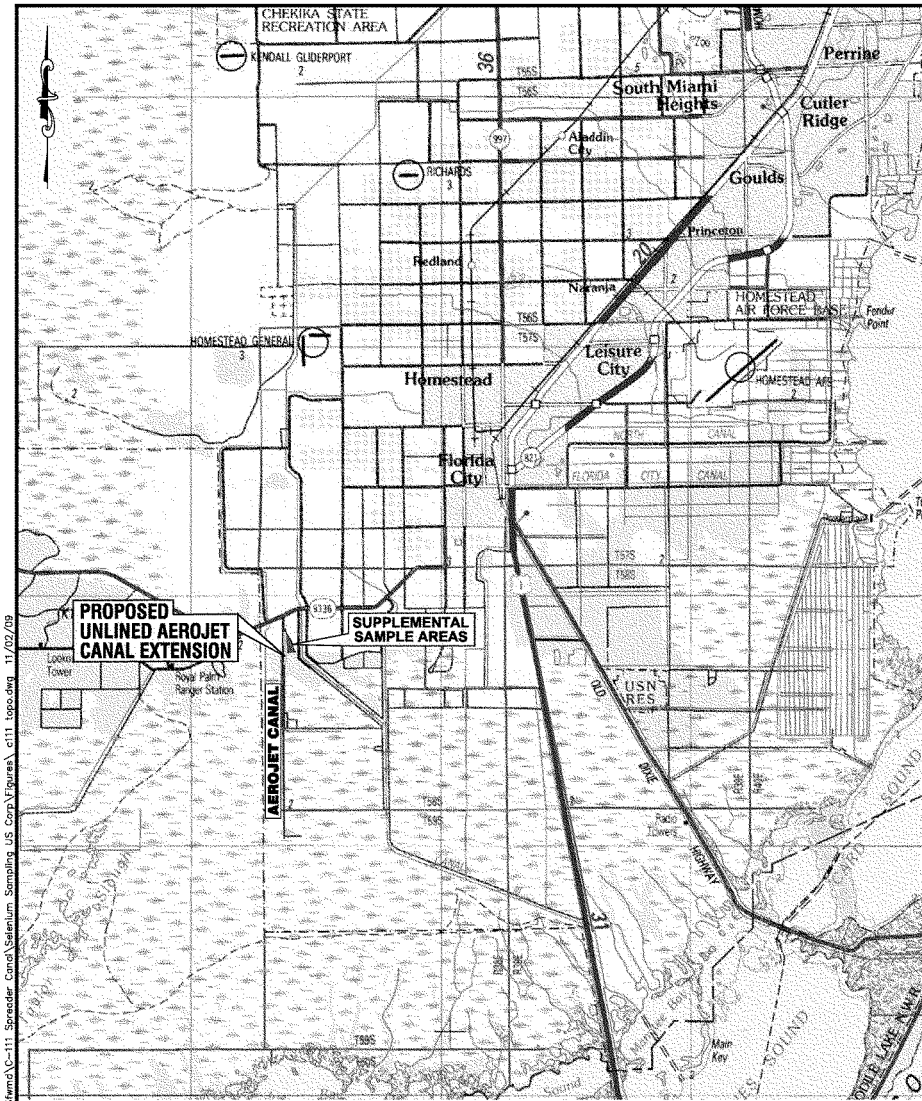
Surface water sampling within the proposed Aerojet Canal Extension will be addressed as part of the District construction and operation permit with FDEP and the Service. Therefore no surface water samples are recommended as part of this SMP.

6.0 SUMMARY REPORT

A report will be prepared documenting field activities and summarizing the soil confirmation results. The data collected will be tabularized, and illustrated on figures documenting the confirmation sample locations and corresponding copper concentrations as well as organochlorine pesticides, if present. The figures will illustrate pre- and post- soil relocation areas with associated survey maps.

Quarterly reports will be formulated for the groundwater sampling events. The reports will summarize the data collected during the sampling events, and the data will be tabulated and illustrated on figures. Conclusion and recommendations will also be given in the quarterly reports.

FIGURES



[redacted] CINITY MAP

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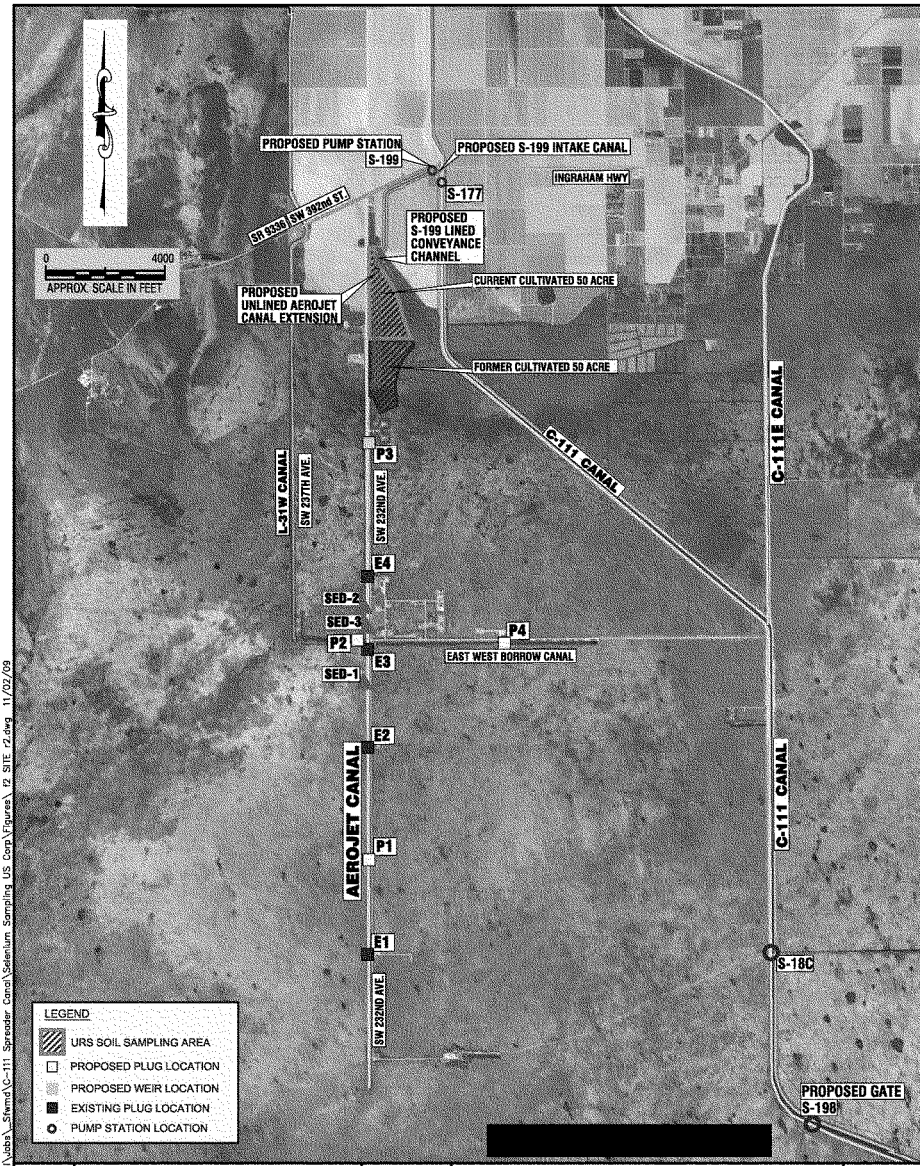
DRAWN: R.A.C. DATE: SEPT 09	URS 7800 CONGRESS AVENUE, SUITE 200 BOCA RATON, FLORIDA 33487 PHONE (561) 994-6500 FAX (561) 994-8524		**SOIL MANAGEMENT PLAN** **UNLINED AEROJET CANAL EXTENSION** MIAMI-DADE CO., FLORIDA JOB NO.: 38617-461 DATE: SEPTEMBER 2009	FIGURE: 1



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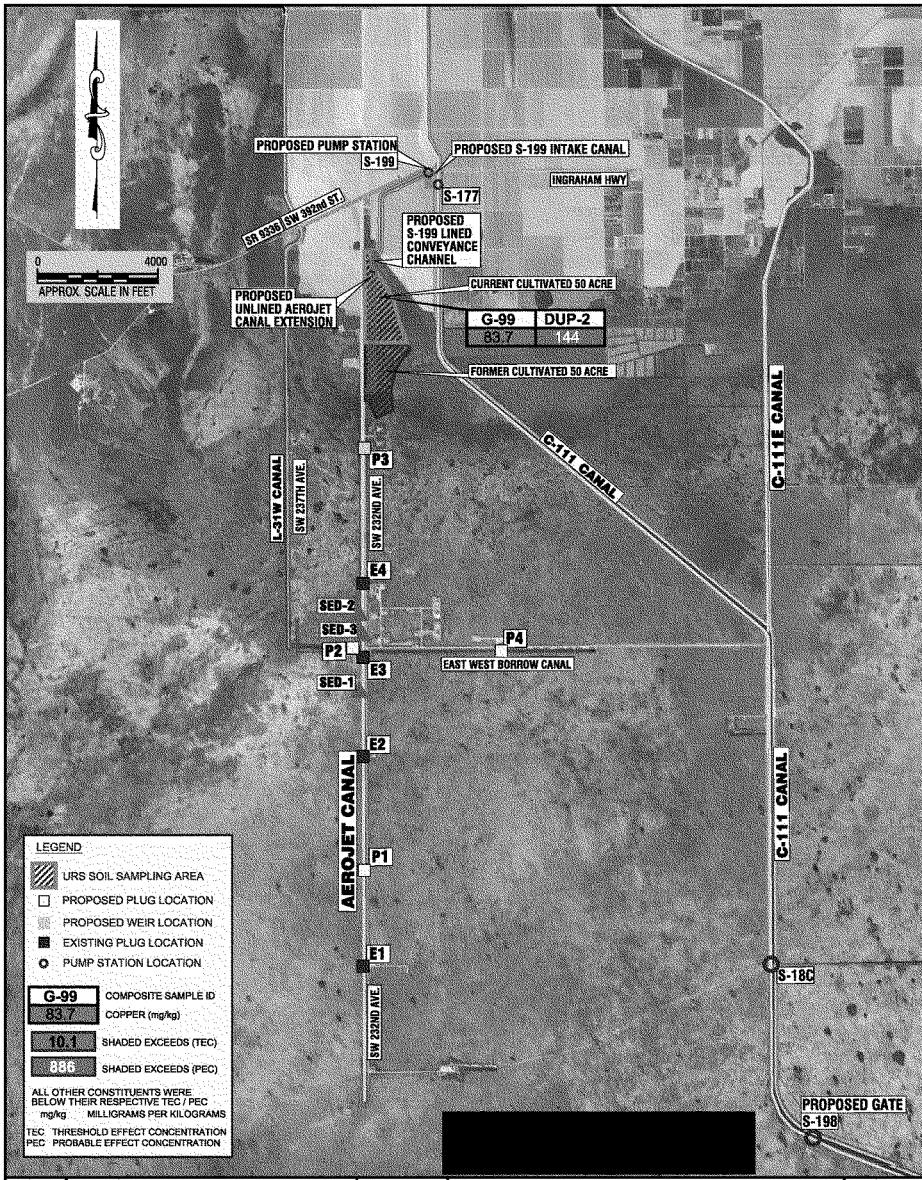
DRAWN: R.A.C.
DATE: SEP 09

URS
7800 CONGRESS AVENUE, SUITE 200
BOCA RATON, FLORIDA 33487
PHONE: (561) 994-5500
FAX: (561) 994-5524

SOIL MANAGEMENT PLAN
UNLINED AEROJET CANAL EXTENSION
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-461 DATE: SEPTEMBER 2009

FIGURE: 2


PROPOSED PUMP STATION
S-199
PROPOSED S-199 INTAKE CANAL
S-177
INGRAHAM HWY
SR 9336 SW 392nd ST.
PROPOSED S-199 LINED CONVEYANCE CHANNEL
0 4000
APPROX. SCALE IN FEET
PROPOSED UNLINED AEROJET CANAL EXTENSION
CURRENT CULTIVATED 50 ACRE
G-99 83.7
DUP-2 144
FORMER CULTIVATED 50 ACRE
C-111 CANAL
C-111E CANAL
L-31W CANAL
SW 237TH AVE.
SW 232ND AVE.
P3
E4
SED-2
SED-3
P2
P4
E3
SED-1
EAST WEST BORROW CANAL
E2
AEROJET CANAL
P1
E1
C-111 CANAL
S-18C
SW 232ND AVE.
PROPOSED GATE
S-198
LEGEND
URS SOIL SAMPLING AREA
PROPOSED PLUG LOCATION
PROPOSED WEIR LOCATION
EXISTING PLUG LOCATION
PUMP STATION LOCATION
G-99 COMPOSITE SAMPLE ID
83.7 COPPER (mg/kg)
10.1 SHADED EXCEEDS (TEC)
886 SHADED EXCEEDS (PEC)
ALL OTHER CONSTITUENTS WERE BELOW THEIR RESPECTIVE TEC / PEC
mg/kg MILLIGRAMS PER KILOGRAMS
TEC THRESHOLD EFFECT CONCENTRATION
PEC PROBABLE EFFECT CONCENTRATION
DRAWN: R.A.C.
DATE: SEP 09
URS
7800 CONGRESS AVENUE, SUITE 200
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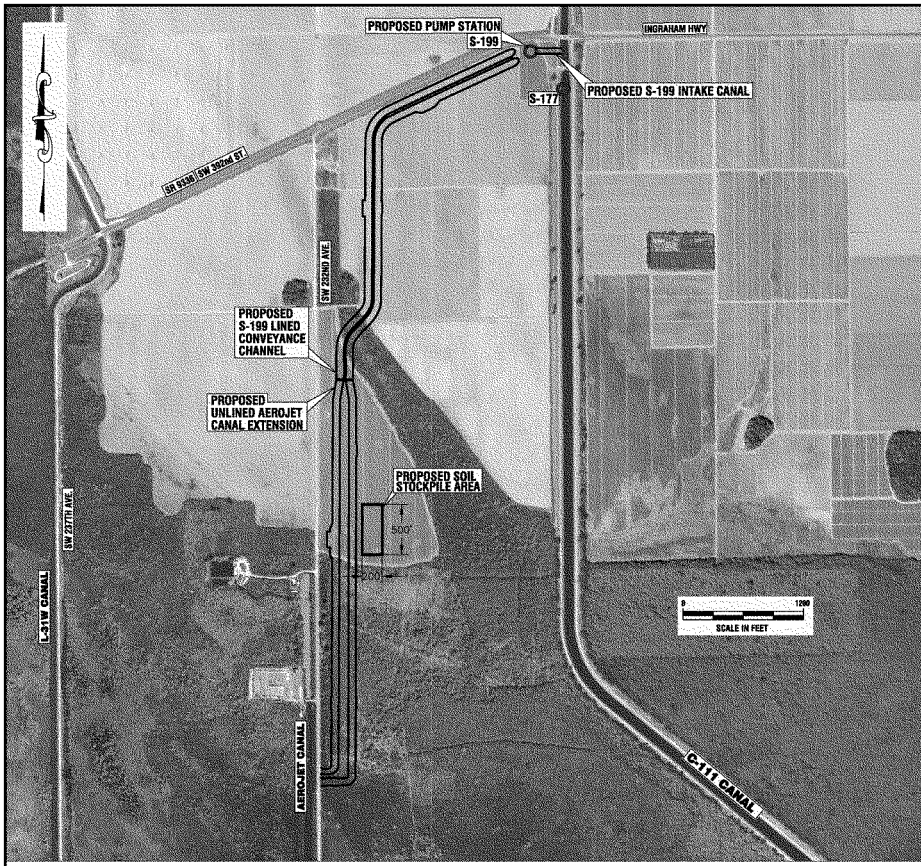
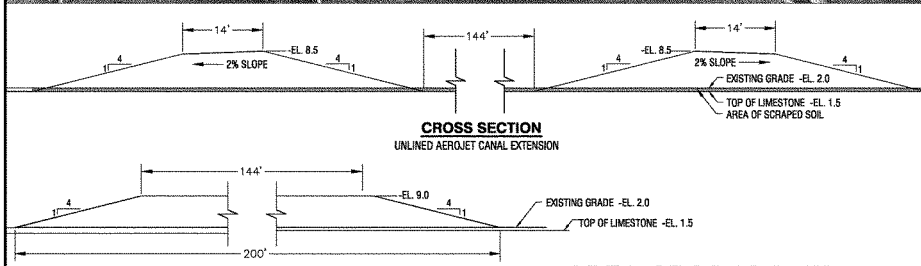
SOIL MANAGEMENT PLAN
UNLINED AEROJET CANAL EXTENSION
MIAMI-DADE CO., FLORIDA
JOB NO.: 38617-461
DATE: SEPTEMBER 2009
FIGURE: 3





CROSS SECTION
UNLINED AEROJET CANAL EXTENSION

CROSS SECTION
SOIL STOCKPILE AREA

AREA OF PROPOSED IMPACTED SOIL RELOCATION MAP

DRAWN: R.A.C.
DATE: SEPT 09

URS
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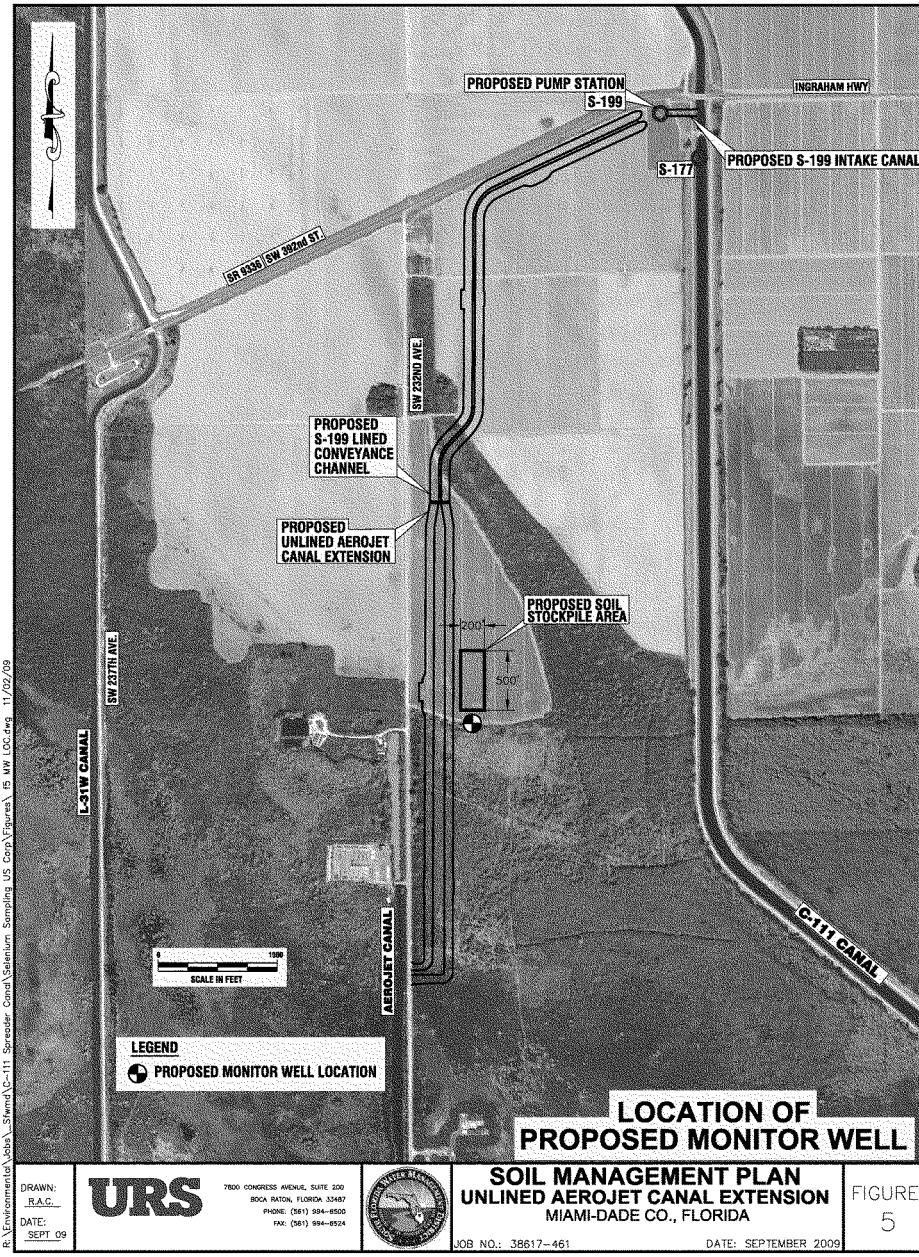
SOIL MANAGEMENT PLAN
UNLINED AEROJET CANAL EXTENSION
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-461
DATE: SEPTEMBER 2009

FIGURE: 4



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DRAWN: R.A.C.
DATE: SEPT 09

URS
7800 CONGRESS AVENUE, SUITE 200
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SOIL MANAGEMENT PLAN
UNLINED AEROJET CANAL EXTENSION
MIAMI-DADE CO., FLORIDA

JOB NO.: 38617-461 DATE: SEPTEMBER 2009

FIGURE: 5

TABLES

TABLE 1
SUMMARY of HISTORICAL PESTICIDE, HERBICIDE, and METAL SOIL ANALYTICAL RESULTS
C-111 SPREADER CANAL - UNLINED AEROJET CANAL EXTENSION
MIAMI-DADE COUNTY, FLORIDA
Job No. 38617-461

					East of SW 232nd Avenue		
SAMPLE IDENTIFICATION	**GUIDANCE CONCENTRATIONS**				**G-99**	**DUP-2**	**G-100**
				Sample Date	**4/17/2009**	**4/17/2009**	**4/17/2009**
Laboratory Analysis	**TEC[1]**	**PEC[1]**	**SCTL[2]**	**SCTL[2A]**			
EPA Method 8081 (µg/Kg)							
4,4-DDD	4.9	28	4,200	5,800	0.77 U	0.79 U	1.6 U
4,4-DDE	3.2	31	2,900	18,000	1.5 I	2.0 I	1.6 U
4,4-DDT	4.2	63	2,900	11,000	0.77 U	0.79 U	1.6 U
Alpha-Chlordane	NG	NG	NG	NG	0.38 U	0.40 U	0.79 U
Gamma-Chlordane	NG	NG	NG	NG	0.38 U	0.40 U	0.79 U
Total Chlordane	3.2	18	2,800	9,600	0.76 U	0.80 U	1.58 U
Other EPA Method 8081 Constituents	---	---	---	---	BDL	1.51 I *	BDL
8 RCRA Metals by EPA Method 6020 (mg/Kg)							
Arsenic	9.8	33	2.1	NG	1.8	**2.2**	1.9
Barium	20	60	120	1,600	9.0	13.5	12.9
Cadmium	1.0	5.0	82	7.5	0.25	0.35	0.13 I
Chromium	43	110	210	38	29.4	*41.7*	6.1
Lead	36	130	400	NG	10.1	15.4	18.0
Mercury (EPA Method 7471A)	0.18	1.1	3	2.1	0.040 I	0.042 I	0.15 I
Selenium	NG	2.0[A]	440	5.2	0.11 U	0.11 U	0.44 I
Silver	1.0	2.2	410	17	0.024 I	0.069 I	0.0086 U
Other Metals by EPA Method 6020 (mg/Kg)							
Copper	32	85[A]	150	NG	83.7	144	14.6
Zinc	120	460	26,000	NG	44.7	67.4	6.5

Notes:

[1] Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters, Table 5.1 (MacDonald *et al.* 2003)

[2] FAC Chapter 62-777, Table 2-Technical Background Document, Soil Cleanup Target Levels (SCTLs), Residential Direct Exposure

[2A] FAC Chapter 62-777, Table 2-Technical Background Document, Soil Cleanup Target Levels (SCTLs), Leachability Based on Groundwater Criteria

TEC = Threshold Effect Concentration, expressed in µg/kg

PEC = Probable Effect Concentration, expressed in µg/kg

µg/Kg = micrograms per Kilogram

mg/Kg = milligrams per Kilogram

NG = No guidance concentrations have been established

[A] - U. S. Fish and Wildlife Service Screening Value

U = Analyte included in analysis, but not detected

I = The reported value is between the laboratory Method Detection Limit (MDL) and laboratory Practical Quantitation Limit (PQL)

BDL= Below Laboratory Detection Limit

Sample analytical result exceeded the TEC

Sample analytical result exceeded the PEC

BOLD - Sample analytical result exceeded the Residential SCTL

* Soil sample DUP-2 collected from Grid G-99, also exhibited Endosulfan Sulfate at 0.91 I µg/Kg and Endosulfan I at 0.60 I µg/Kg. A site specific equilibrium partioning based sediment quality guideline of 9.14 µg/Kg was established for a site immediately north of G-99 which was not exceeded in this sample.

APPENDIX A

38617-407

Florida Department of Environmental Protection

Jack Long, Director
Southeast District Office

Southeast District Office
400 N. Congress Avenue, Suite 200
West Palm Beach, FL 33401
(561) 681-6600

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

July 9, 2009

Mr. Robert J. Taylor, Sr. Environmental Engineer
Land Acquisition Support Division
South Florida Water Management District
3301 Gun Club Road, Bldg. B-1
West Palm Beach, FL 33416-4680

WCU – Miami_Dade County
C-111 Spreader Canal

Re: Phase I & Limited Phase II Environmental Site Assessment Report for
C-111 Spreader Canal Phase I Component
Miami-Dade County, Florida

Dear Mr. Taylor:

Staff of the Waste Cleanup Section has reviewed the document entitled, Phase I & Limited Phase II Environmental Site Assessment Report for the C-111 Spreader Canal Phase I Component, Miami-Dade County, Florida, prepared by URS Corporation (URS), for the South Florida Water Management District, dated June 5, 2009 (received on June 8, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. Based on the information supplied, it appears that the Western Component of the study area, not including the former and current cultivated areas, is suitable for the proposed project. The former and current cultivated areas are currently being assessed for agricultural contaminants of concern. Please forward the assessment addendum when it becomes available.

2. The Former Agricultural Areas in the Central Component still need to be sampled and assessed for organochlorine pesticides and metals that may have been applied as agricultural amendments.

3. The results of the samples taken from the stockpiled soils excavated from the C-110 Canal indicate that the area may be suitable for inundation. All assessed analyte concentrations were below their respective Sediment Quality Assessment Guidelines (SQAGs).

4. The Department concurs that additional follow-up assessments and closures will be required should the District acquire the Everglades Youth Development Center and the former Navy listening facility.

5. With the exception of the former Navy listening facility, there appear to be no other areas of concern that would render the Eastern Component unsuitable for inundation as proposed for this project.

Should you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

Sincerely,

Paul Alan Wierzbicki

Paul Alan Wierzbicki, P.G.
Waste Cleanup Supervisor

cc: Brian Dougherty, FDEP, Tallahassee (Brian.Dougherty@dep.state.fl.us)
Joe Lurix, FDEP, WPB (Joe.Lurix@dep.state.fl.us)
Chad Kennedy, FDEP, WPB (William.C.Kennedy@dep.state.fl.us)
Wilbur Mayorga, Miami-Dade Department of Environmental Resource Management (mayorw@miamidade.gov)

090544

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

August 5, 2009

Robert Taylor
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the documents entitled, "Phase I and Limited Phase II Environmental Site Assessment Report, C-111 Canal Phase I Component, Miami-Dade County, Florida" and "Supplemental Soil Assessment Addendum, C-111 Spreader Canal Phase I Component, 700 Acres at Aerojet Canal Extension and Northern C-110 Canal, Florida City, Miami-Dade County, Florida," submitted to the South Florida Water Management District (District) by URS Corporation (URS). These reports summarize the results from additional soil sampling conducted in the C-111 Spreader Canal Phase I Component project area.

The C-111 Spreader Canal Phase I Component is designed to provide ecosystem restoration of freshwater wetlands, tidal wetlands, and near-shore habitat, and maintenance of flood protection in the Southern Glades wetlands area. The western section of the project includes the Aerojet Canal extension into 100 acres of former and currently cultivated agricultural lands. The central component of the project involves using former agricultural soils for plug material in the C-110 Canal. Approximately 600 acres of former agricultural lands could potentially be inundated as a result of the proposed C-110 Canal plugs.

To evaluate the potential ecological risk associated with using these areas in the C-111 Spreader Canal Phase I Component, soil and sediment samples were collected. Three discrete sediment samples were collected from the Aerojet Canal adjacent to the northernmost Aerojet facility, and two composite samples were collected from the 100 acres of former and current agricultural land in the area of the proposed Aerojet Canal extension. In the central component, two, 5-point composite soil samples were collected at plug locations. Twelve, 50-acre composite soil samples were collected from the 600-acre former agricultural area. Analytical results were compared to Florida Department of Environmental Protection Sediment Quality Assessment Guidelines (SQAG) and the Florida Administrative Code Soil Cleanup Target Levels (SCTL).

Results

The three sediment samples from the Aerojet Canal detected concentrations of methylene chloride (mean of 7.9 μg/kg) below its SCTL (20 μg/kg). Arsenic (mean of 6.4 mg/kg) was detected above the SCTL (2.1 mg/kg) in all sediment samples. One of the 50-acre grid composite samples (grid 99) collected from the current agricultural area at the site of the

TAKE PRIDE IN AMERICA

proposed Aerojet Canal extension detected a concentration of copper (84 mg/kg) in exceedance of its SQAG threshold effect concentration (32 mg/kg). The duplicate sample from this location detected 144 mg/kg copper, which is above the interim screening level for the protection of the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (85 mg/kg). The soil samples from C-110 Canal plug locations detected arsenic at concentrations above the SCTL (2.1 mg/kg), but below the (TEC) (9.8 mg/kg). The approximately 600-acre former agricultural area north of the C-110 canal also detected arsenic in excess of the SCTL at 9 of 50-acre grids.

URS concluded that copper impacted soils north of the Aerojet Canal (50-acre grid 99) pose an unacceptable ecological risk. They recommended further assessment or corrective actions for this area.

Service Comments

To insure no risk from copper exposure to the snail kite, the Service concurs with the recommendation for further sampling or corrective actions for 50-acre grid 99, located in the proposed area of the Aerojet Canal extension. The detected levels of arsenic and methylene chloride are unlikely to pose risk to Service trust resources. Pending successful remediation, verified through confirmatory sampling for copper impacted soils at grid 99, we concur that this site is suitable for its intended use in the C-111 Spreader Canal Phase I Component.

Thank you for the opportunity to review these additional sampling investigations for the C-111 Spreader Canal Phase I Component. If you have any questions regarding these comments, please contact Emily Bauer at 772-562-3909, extension 335.

Sincerely yours,

Robert Trahan

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc: electronic copy only
Corps, West Palm Beach, Florida (Tori White)
DEP, West Palm Beach, Florida (Joe Lurix)
URS, Boca Raton, Florida (Ed Leding)

DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE CLEANUP SECTION

MEMORANDUM

TO: **Inger Hansen, Engineer IV, Watershed Management & Planning**
THROUGH: **Paul Wierzbicki, Waste Cleanup Supervisor**
FROM: **Bridget Armstrong, Environmental Specialist III, Waste Cleanup Section**
DATE: SEP 18 2009
SUBJECT: **Supplemental Soil Assessment Addendum for the C-111 Spreader Canal Site**

As requested, I have reviewed the Supplemental Soil Assessment Addendum for the C-111 Spreader Canal Site, dated July 16, 2009, (received July 17, 2009) and have the following comments within the scope of the Waste Cleanup Section.

1. The Department concurs with the consultant's recommendation for additional assessment and possible corrective actions within Grid 99, due to copper impacts.

2. The recommendation to conduct quarterly groundwater monitoring is also accepted.

3. Based on the information supplied, I cannot concur that No Further Action is warranted in Grids 44, 53 and 82. It appears that there is an assessment report for these areas that has not yet been forwarded and reviewed. Comments for that document will be sent separately.

4. The recommendation to prepare a human health risk assessment, if the public is granted access to the project area, is also acceptable.

If you have any questions, feel free to contact Ms. Bridget Armstrong at (561) 681-6679.

cc: Joe Lurix, Waste Program Administrator

090675

A.5 WATER QUALITY CERTIFICATION PERMIT

Florida Department of Environmental Protection
Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

COMPREHENSIVE EVERGLADES RESTORATION PLAN REGULATION ACT (CERPRA) PERMIT-CONSTRUCTION AND OPERATIONS AUTHORIZATION

PERMITTEE:
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

ATTENTION:
Mr. Kenneth G. Ammon
Deputy Executive Director, CERP
Everglades Restoration Resource Area

Permit Number: 293559-001
Project: C-111 Spreader Canal Phase 1 (Western) Project
County: Miami-Dade

Date of Issue: October 08, 2009
Expiration Date: October 08, 2014

This permit is issued under the authority of the Comprehensive Everglades Restoration Plan Regulation Act (CERPRA), Chapter 373.1502, Florida Statutes (F.S.); Title 62, Florida Administrative Code (F.A.C.); and pursuant to the Department of Environmental Protection's (Department) authority under Chapter 373 and 403, F.S. The activity is not exempt from the requirement to obtain a CERPRA Permit.

The above named permittee is hereby authorized to initiate the activities described on the application, associated drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof. The activities authorized by this permit must be conducted in conformance with all the provisions of this permit. Failure to comply with all permit conditions and documents referenced herein shall constitute grounds for revocation of the permit and appropriate enforcement action.

This permit constitutes a finding of consistency with Florida's Coastal Zone Management Program, as required by Section 307 of the Coastal Zone Management Act, 14 U.S.C. § 1456, and constitutes certification of compliance with water quality standards under Section 401 of the Clean Water Act, 33 U.S.C. § 1341 authorization pursuant to Chapter 373, F.S. The South Florida Water Management (District/permittee) shall comply with all the conditions herein.

PROJECT DESCRIPTION:

The C-111 Spreader Canal Project (C-111 SC Phase 1), is a project component of the Comprehensive Everglades Restoration Plan (CERP) as defined in Section 373.1501(1), F.S. The Water Resources Development Act of 2000 approved CERP under Section 601 as a framework for modifications to the Central and South Florida Project necessary to restore the South Florida ecosystem. The C-111 Spreader Canal Project was also identified as an expedited project (formerly Acceler8) which the State of Florida is accelerating the funding, design, and construction of in order to realize immediate environmental benefits. The objective of the C-111 Spreader Canal Phase 1 Project is to improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough, improve hydroperiod and hydropattern in the Southern Glades and Model Lands and reduce ecologically damaging flows to Florida Bay and other receiving waters. The project objectives will be accomplished by implementing multiple, often separable, project features in phases.

The initial phase of the C-111 Spreader Canal Phase 1 Project is also known as the "Western Components" in the Project Implementation Report (PIR). The "Eastern Components" identified in the PIR are not part of this authorization; however, an application for the C-111 Spreader Canal Design Test Project has been deemed complete and a draft permit been issued by the Department for activities to be initiated by the Corps of Engineers in association with the Eastern Components.

C-111 Spreader Canal - Phase 1 Project

The following features are associated with the C-111SC Phase 1 Project:

- The Frog Pond Detention Area (FPDA) and S-200 Inflow Pump Station
- The Aerojet Canal Impoundment/Modifications and S-199 Inflow Pump Station
- Plugging of the C-110 Canal (north of the C-111 Canal)
- Canal Plug on the L-31E Canal (south of the S-20 Structure)
- Incremental operational adjustments to Structures S-18C and S-20
- Construction of the S-198 Control Structure

The total work area in, on, or over wetlands for all of the above features is approximately 213 acres of wetlands (5.6 acres in other surface waters). The surface waters and wetlands to be impacted by construction of this project phase are Class III Waters (the C-111, Aerojet, C-110 and L-31E Canals). The FPDA and Aerojet Canal features are intended to work in unison to create an approximately nine-mile hydraulic ridge adjacent to Everglades National Park. The ridge will serve to block groundwater flows from moving into the C-111 Canal from ENP, therefore retaining water in Taylor Slough and improving the quantity, timing, and distribution of flows into Florida Bay. The remaining features of the C-111 Phase I Project will serve to assist the environmental restoration in the Southern Glades and Model Lands surrounding the C-111, C-110 and L-31E canals.

The proposed plugs within the C-110 canal will benefit approximately 2,240 acres of wetlands adjacent to the C-110 canal by increasing the storage of surface water in wetlands and allowing the volume and timing of freshwater flows to occur in a more natural manner, expanding the continuity of natural habitat by combining the project lands with surrounding natural area and improving the ecological health and habitat characteristics of these wetlands.

PROJECT COMPONENTS:

1. Frog Pond Detention Area (FPDA) and S-200 Inflow Pump Station

The S-200 Inflow Pump Station, which is comprised of three 75 cfs electrical pumps for a total capacity of 225 cfs, will route excess water from the C-111 Canal into a lined, above-ground channel for delivery of water into an unlined header channel located adjacent to the L-31W levee. The header channel will create a hydraulic seepage barrier between Taylor Slough to the west and the C-111 Canal to the east, thus reducing groundwater seepage losses from the slough to the canal. As the header channel stages increase, water will discharge eastward through weirs into the adjacent detention cells. The above-ground header channel and three detention cells (Cells 1-3) include approximately 516 acres of land and are known collectively as the Frog Pond Detention Area (FPDA).

Levees will be constructed along the lined and unlined sections of the header channel and around the detention cells to create the above-ground features. Three articulated block weirs (S-202A, S-202B and S-202C) will allow discharges from the unlined header channel into adjacent detention cells (Cells 1, 2 and 3, respectively). From north to south (S-202A to S-202C), the weir elevations are 5.25 ft., 4.5 ft. and 3.5 ft. NAVD with lengths of 150 ft., 300 ft. and 400 ft. respectively, allowing for release into the southernmost

cell (Cell 3) first, then Cell 2 and Cell 1. An emergency overflow weir (S-203A, S-203B and S-203C), also consisting of articulated block, is provided along the eastern levee of each detention cell at an elevation of 5.5 ft. NAVD with lengths of 400 ft. for Cells 1 and 2 and 300 ft. for Cell 3. A culvert crossing (S-201) consisting of three 11 ft. x 3 ft. box culverts will provide access across the header channel to the L-31W levee and S-175 Structure. Three spoil pile areas have been identified east of the detention cells for storage of unusable soils from the site.

2. Aerojet Canal Impoundment and S-199 Inflow Pump Station
The S-199 Inflow Pump Station, which is comprised of three 75 cfs electrical pumps for a total capacity of 225 cfs, will route water from the C-111 Canal to the existing Aerojet Canal via an above-ground channel with initial sections lined to minimize seepage losses. Stages within the unlined channel section and the Aerojet Canal will be increased by constructing several weirs and earthen plugs in the system, thus creating a hydraulic seepage barrier between Everglades National Park/Taylor Slough to the west and the C-111 Canal to the east and reducing groundwater seepage losses from the slough to the canal.

Levees will be constructed along the lined and unlined sections of the channels to create the above-ground features. Berm segments (Segments 1 through 3) will also be constructed along the west side of the Aerojet Canal. One concrete weir (AJ-1) will be constructed at the southern end of the unlined channel and three weirs (AJ-2, AJ-3 and AJ-4) constructed of an earthen plug with rip-rap protection, will be located within the Aerojet Canal. Both AJ-1 and AJ-2 have an elevation of 2.1 ft. with AJ-3 set at 1.5 ft. and AJ-4 at 1.0 ft., NAVD. Three earthen canal plugs will be installed; two within the E-W Borrow Canal on either side of the intersection with the Aerojet Canal (Plug 1 and 2) and one located in the southern section of the existing Aerojet Canal (AJ-5). A culvert crossing S-201 consisting of a single 10 ft. x 8 ft. box culvert will be constructed under SW 232nd Avenue (Aerojet Road) connecting the unlined channel with the existing Aerojet Canal. This project feature may be phased with the initial construction of weirs AJ-1 and AJ-2 along with berm segments 2 and 3. If the seepage results are not showing improvement, the two remaining weirs AJ-3 and AJ-4 and berm segment 1 will be constructed.

3. C-110 Canal Plugging
Ten earthen plugs will be constructed within the C-110 Canal north of the C-111 Canal in order to reduce seepage and conveyance losses and improve hydroperiods within wetlands adjacent to the C-110 Canal known as the Southern Glades.

4. L-31E Canal Plug
This feature includes an earthen plug constructed within the L-31E Canal just south of structure S-20A in order reduce seepage and conveyance losses and improve hydroperiods within wetlands in the vicinity known as the Model Lands. This plug will "divide" the L-31E Canal operationally.

5. S-198 Control Structure
The S-198 Control Structure, which is proposed between S-18C and the theoretical confluence of C-111 and C-110 Canals, is intended to reduce current levels of seepage and conveyance into the lower C-111, while preserving existing levels of flood damage reduction. The maximum design capacity for S-198 is 2,400 cfs, which equals the maximum design capacity of the existing S-197 structure, using three 26 ft. x 14 ft. roller gates. This structure may be constructed during a future phase following completion of other features.

6. Incremental operational adjustments to Structures S-18C and S-20
Temporary incremental changes to the operations of both the S-18C Structure and the S-20 Structure will be included as part of this project in order to maximize restoration efforts within the project area.

Hydrometeorological monitoring and reporting of the upstream and adjacent areas will be required prior to implementation of each incremental change. Permanent changes to the operations will require a separate authorization.

PROJECT LOCATION:

The project features, which are generally situated in southern Miami-Dade County in an area bounded by Everglades National Park, the Florida City-Homestead area and Manatee Bay, are located as follows:

1. FPDA and S-200 Inflow Pump Station: Sections 6, 25, 30, 31 & 36, Township 57S & 58S and Range 37E & 38E, Miami-Dade County.
2. Aerojet Canal Impoundment and S-199 Inflow Pump Station: Sections 6, 7, 18, 19, 30 & 31, Township 58S & 59S and Range 38E, Miami-Dade County.
3. C-110 Canal Plugs: Sections 1, 2, 11, 13, 14, 23, 24, 25, 26, 35 & 36, Township 58S & 59S and Range 38E, Miami-Dade County.
4. L-31E Canal Plug: Section 32, Township 57S and Range 40E, Miami-Dade County.
5. S-198 Control Structure: Sections 10, Township 59S and Range 38E, Miami-Dade County.

DECLARATION OF REASONABLE ASSURANCES:

In issuing this permit, the Department finds that the District has given reasonable assurances sufficient to satisfy the requirements of the Comprehensive Everglades Restoration Plan Regulation Act, Section 373.1502, F.S., and the project is clearly in the public interest. The Department bases these findings on the following documents, listed by Department document number:

1) South Florida Water Management District, C-111 Spreader Canal - Phase I Project, Comprehensive Everglades Restoration Plan Permit Application and associated materials (January 2009);

2) South Florida Water Management District, C-111 Spreader Canal - Western Project Permit Application Request for Additional Information-I Response Package (April 2009);

3) South Florida Water Management District, C-111 Spreader Canal - Western Project Permit Application Request for Additional Information-II Response Package (June 2009);

4) South Florida Water Management District and United States Army Corps of Engineers, Jacksonville District, Draft Integrated Project Implementation Report for C-111 Spreader Canal - Western Project (April 2009);

5) South Florida Water Management District, C-111 Spreader Canal - Phase I Project, North and South Components Intermediate design report, Volume 1: Design Report (March 2009);

6) South Florida Water Management District, C-111 Spreader Canal - Phase I Project, North and South Components Intermediate design report, Volume 2: Design Report - continued (March 2009);

7) South Florida Water Management District, C-111 Spreader Canal - Phase I Project, North and South Components Intermediate design report, Volume 3: Technical Specifications (March 2009);

8) South Florida Water Management District, C-111 Spreader Canal - Western Project, Pre-final Design Plans and Specifications (May 2009);

9) South Florida Water Management District, C-111 Spreader Canal - Western Project, Final Plans and Specifications (July 2009);

10) South Florida Water Management District, C-111 Spreader Canal - Western Project, Draft Project Operating Manual (Draft PIR/EIS, April 2009);

11) South Florida Water Management District, Phase I and Limited Phase II Environmental Site Assessment Report C-111 Spreader Canal Phase I component (June 2009);

12) Real Estate Memos for the C-111 Spreader Canal - Western Project (April 2009).

13) United States Army Corps of Engineers, Jacksonville District, Draft Endangered Species Act C-111 Spreader Canal Western Project Draft Biological Assessment (February 2009);

14) United States Fish and Wildlife Service, Planning Aid Letters (April 2009);

15) South Florida Water Management District, C-111 Spreader Canal - Western Project, Regulatory Plan: Water Quality Compliance (August 2009);

16) South Florida Water Management District, C-111 Spreader Canal - Western Project Hydrometeorological Monitoring Plan (Draft PIR/Final EIS- July 2009);

17) South Florida Water Management District, C-111 Spreader Canal - Western Project Ecological Monitoring Plan (Draft PIR/Final EIS- July 2009);

18) South Florida Water Management District, C-111 Spreader Canal - Western Project, Uniform Mitigation Assessment Method documentation (August 2009);

19) United States Fish and Wildlife Service, C-111 Spreader Canal Phase 1, Fish and Wildlife Coordination Act Report (August 2009);

20) United States Fish and Wildlife Service, C-111 Spreader Canal - Western Project, Biological Opinion (August 2009);

21) South Florida Water Management District, Draft C-111 Spreader Canal - Phase I, Project Mitigation Proposal (July 2009).

Specifically, there are reasonable assurances, pursuant to section 373.1502, F.S., that

- "The project component will achieve the design objectives set forth in the detailed design documents submitted as part of the application." This finding is based on documents on file with the Department, including document 1, document 2, document 3, document 4, document 5, document 6, document 7, document 8, document 9 and document 16 in their entirety.

- "State water quality standards, including water quality criteria and moderating provisions, will be met. Under no circumstances shall the project component cause or contribute to violation of state water quality standards." This finding is based on documents on file with the Department, including document 1, document 2, document 3, document 4, and document 11, and document 18.

- "Discharges from the project component will not pose a serious danger to public health, safety, or welfare." This finding is based on documents on file with the Department, including document 1, document 2, document 3, document 4, document 9, document 11, document 15 and document 16.

- "Any impacts to wetlands or threatened or endangered species resulting from implementation of the project component will be avoided, minimized, and mitigated, as appropriate." This finding is based on documents on file with the Department, including document 1 in its entirety, with emphasis on letters and email communications between the U.S. Fish and Wildlife Service, document 2, document 3, document 4, document 5, document 11, document 13, document 14, document 17, 18, document 19 document 20 and document 21.

The District agrees to construct the project features in accordance with the provisions of this permit, permit application, and associated documentation on file with the Department. The District is responsible for construction, operation, maintenance, repair, replacement, and rehabilitation of each of this project 's components. All conditions found herein apply to the District.

GENERAL CONDITIONS:

In accordance with Subsection 373.1502(3)(e)(2) of the CERPRA, this permit may include any standard conditions provided by Department rule, which are appropriate and consistent with the CERPRA.

1. **Enforcement**. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Chapters 373.129, 403.141, 403.727, 403.859 through 403.861 F.S. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. **Scope of permit.** This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. **Limitation of rights.** The issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit. However, this permit is in lieu of other permits under Chapter 373 or Chapter 403, F.S., except for permits issued under s. 403.0885, if applicable.

4. **Limitations upon title.** This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. **Liability.** This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this

permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall hold and save the Department harmless from any and all damages, claims, or liabilities which may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any system authorized by the permit.

6. **Operation and maintenance responsibilities.** The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. **Access Rights.** The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:
(a) Have access to and copy any records that must be kept under conditions of the permit;
(b) Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
(c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

   Reasonable time may depend on the nature of the concern being investigated.

8. **Noncompliance.** If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:
(a) A description of and cause of noncompliance; and
(b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. **Records as evidence.** In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.111, F.S. and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. **Changes in Law.** The permittee agrees to comply with changes in applicable Department rules and applicable Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida law.

11. **Transferability.** This permit is transferable only upon Department approval in accordance with Rules 62-4.120 and 62-343.130, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. **Permit at work site.** This permit or a copy thereof shall be kept at the work site of the permitted activity. For the purposes of this permit the work site shall be defined as *[South Florida Water Management District Headquarters located at 3301 Gun Club Road in West Palm Beach, Florida]*.

13. **Records retention.** The permittee shall comply with the following:
(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department;
(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least five years from the date of the sample, measurement, report, and application unless otherwise specified by Department rule; and
(c) Records of monitoring information shall include:
    1. the date, exact place, and time of sampling or measurements;
    2. the person responsible for performing the sampling or measurements;
    3. the dates analyses were performed or the appropriate code as required by Chapter 62-160, F.A.C.;
    4. the person responsible for performing the analyses;
    5. the analytical techniques or methods used, including but not limited to MDL; and
    6. the results of such analyses, including identification of potential outlier values.

14. **Requests for information.** When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

15. **External Agency Requirements.** Should any other regulatory agency require changes to the permitted system, the permittee shall notify the Department in writing of the changes prior to implementation so that a determination can be made whether a permit modification is required.

16. **Sovereign Lands.** The permittee is hereby advised that Florida law states: No person shall commence any excavation, construction, or other activity involving the use of sovereign or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund or the Department of Environmental Protection under Chapter 253, until such person has received from the Board of Trustees of the Internal Improvement Trust Fund the required lease, license, easement, or other form of consent authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on sovereignty lands or other state-owned lands.

17. **Artifacts.** If historic or archaeological artifacts such as, but not limited to, Indian canoes, arrow heads, pottery or physical remains, are discovered at any time on the project site, the permittee shall immediately stop all activities which disturb the soil and notify the Department and the State Historic Preservation Officer.

SPECIFIC CONDITIONS:

1. **Addresses.** Reports and notices submitted to the Department in accordance with this permit, unless otherwise specified, shall be submitted to the Department's Division of Environmental Assessment and Restoration, Restoration Planning and Permitting Section, 2600 Blair Stone Road, MS 3560, Tallahassee, Florida 32399-2400, telephone number (850) 245-8316. Electronic copies and notices required by this permit shall also be sent to RPPS_Comp@dep.state.fl.us.

2. **Threatened and Endangered Species.** The District shall avoid any actions that are likely to result in a take of any species listed by Fish and Wildlife Conservation Commission (FWC) in Chapter 68A-27, F.A.C or U.S. Fish and Wildlife Service, Department of the Interior (USFWS) in 50 CFR 17.11 or 50 CFR 17.12. The permittee shall coordinate with both the Florida Fish and Wildlife Conservation Commission (FWC) and the U.S. Fish and Wildlife Service (FWS) for appropriate guidance, recommendations, and/or necessary authorizations to avoid, minimize, or mitigate impacts to listed species. In the event that either the Department or the District determines that the proposed activities will result in a take of a listed species, the District shall cease operations affecting the populations and closely coordinate with the FWC and the USFWS to obtain any necessary incidental take permits. Operations may continue if take authorization was granted for the affected species and all conditions accompanying that take are satisfied. If the District makes the above determination, it shall notify the Department at the address and telephone number in Specific Condition 1 within 24 hours of the date of such determination. Prior to construction activities taking place, the permittee shall submit the final hard copy of the FWS Biological Opinion (BO) to the addresses identified in Specific Condition No. 1 for review and determination of consistency with applicable Department rules and statutes.

3. **Contaminated Sites and Residual Agrichemicals.** The Permittee shall address all contaminated sites within the project footprint in accordance with all applicable Department statutes and rules including but not limited to Chapters 62-770, 62-780, and 62-785, F.A.C. The Permittee shall address any agricultural chemical residuals in the project footprint in accordance with the "Protocol For Assessment, Remediation And Post-Remediation Monitoring For Environmental Contaminants On Everglades Restoration Projects" (Protocol) dated March 14, 2008 so that risk to the environment is minimized based upon the projected use of the property. Regardless of any remedial action plan, the Chapter 62-777, F.A.C. cleanup target levels, or the Protocol, the Permittee shall address all contamination within the project footprint, to minimize to the maximum extent practicable any detrimental impacts to Threatened or Endangered species. As a corrective action, the Department may require limitations on property access or use as part of the Permittee's Land Management Plan for the project area. All corrective actions must be completed prior to initial operation or use of the project. Documentation of completion of corrective actions must be submitted to the Department no later than 90 days prior to the initial operation or use of the completed project, unless the Department approves an alternative schedule. The Permittee shall secure written concurrence from the Department that the corrective actions have been completed based upon applicable protocols and the projected land use, prior to initial operation of the completed project. If contamination is discovered after initial operations, the Permittee shall send to the Department at the address listed in Specific Condition No. 1 an assessment and remedial action plan for Department approval. Upon the Department's approval, the Permittee shall implement the assessment and remedial action plan and provide quarterly reports to the Department on the progress of the remediation until the cleanup is completed to the Department's satisfaction.

4. **Wetland Impact and Restoration.** This project is expected to result in permanent and temporary impacts to wetlands within the construction limits with a total impacted area of less than 213 acres.

At this time, the Department does not require any mitigation to offset the functional loss of wetland areas. Upon commencement of operations, if routine operations do not move forward as outlined in the final Project Operations Manual in order to meet the goals and objectives of the project, then the District shall coordinate with the Department to determine whether mitigation or restoration of impacted wetlands to their original condition is required to offset impacts.

5. **Real Estate.** Prior to initiation of construction or operational activities, copies of all real estate authorizations (i.e., right-of-way(s), leases, easements, land certifications or other legal agreements that authorize the applicant to perform the activities described herein) shall be provided to the Department, if not already provided under document 12 of the project reasonable assurances, at the address listed in Specific Condition No. 1. All real estate information should include the tract numbers, folio numbers, section/township/range, and the status of the tracts. Construction activities shall not be permitted to commence on properties where real estate authorizations have not been received.

Construction

6. **Authorized Construction.** This permit allows for the construction of the C-111 SC Phase 1 Project as submitted to the Department and described in the Final (100%) Plans and technical specifications for the C-111 SC Phase 1 Project and the Pre-final (90%) Plans and technical specifications for the S-198 Structure. Permittee shall submit Final Plans for the S-198 Structure for consistency review at least 60 days prior to initiating construction activities. Upon review of the submitted plans and specifications, the Department will determine whether a permit modification will be required.

7. **Instructions to Contractors.** The permittee shall ensure that the permit conditions are explained to all construction personnel working on the project component and shall give a copy of this permit to each contractor and subcontractor before the authorized work begins. Prior to construction of each contract, the permittee shall schedule a pre-construction meeting for attendance by the contractor(s), and representatives from the District, the Department, and other environmental regulatory agencies. The Department shall receive at least two weeks' notice of the meeting. The proposed construction schedule and any modified schedules shall be provided to the Department at the earliest possible date.

8. **Site Inspections and Construction Meetings.** Throughout each of the construction phases of the C-111 SC Phase 1 Project, the Department intends to conduct periodic site inspections to ensure permit compliance and to monitor progress. Upon, or prior to, receipt of the written statement of completion and certification, the Department shall conduct substantial and final inspections as defined in the Technical Specifications for the project. It is anticipated that this activity may be completed in conjunction with other regulatory agencies and may be accomplished in stages as the project progresses.

9. **Quality Control Inspections.** For quality control purposes, a Professional Engineer registered in the State of Florida, or a personal representative under his or her direct supervision, shall conduct quality control inspections during all phases of construction including, but not limited to (as applicable):

   A. Excavation, placement, and backfill for inlet/outlet pipes within the embankment;

   B. Installation of water control structure foundations and spillways;

C. Removal of unsuitable foundation materials and replacement with approved fill;

D. Blanket/toe drain installation including review of off-site material sources;

E. Construction and testing of embankment foundation materials;

F. Construction and testing of soil-cement interior protection layer; and,

G. Installation and quality control of any other appurtenances or structures.

10. **Construction Best Management Practices (BMPs).** At all times during construction, the District shall use best management techniques for erosion and sedimentation control. All graded areas shall be stabilized and vegetated immediately after construction to prevent erosion with the exception of the bottom of the FPDA cells and unlined channels, which shall be vegetated through natural recruitment. Prior to commencement of construction activities for each feature, the District shall submit a BMP plan, which details the use of sediment controls to minimize the suspension and transport of soils, levee materials, and roadway materials into waters adjacent to or downstream of the construction site to the Department for review and approval. Once installation of the erosion controls identified through the BMP plan have been completed, the District shall contact the Department at the address listed in Specific Condition No. 1 to determine whether inspections of the installed controls are necessary.

11. **Adjacent Wetlands and Preserve Areas.** Wetlands and preserve areas adjacent to construction activities shall be staked and fenced off with construction fencing or other effective physical barriers to prevent encroachment into these wetlands prior to the commencement of construction. All areas of exposed soils shall be isolated from wetlands, preserves and surface waters to prevent erosion and deposition of sediments into these wetlands during permitted construction activities. All excavated or dredged material shall be placed strategically to prevent the transport of any material into wetlands and surface waters both during and after completion of the construction. Upon completion of the barrier installation, the District shall contact the Department at the address listed in Specific Condition No. 1 to determine whether inspections of the installed controls are necessary. The barriers shall remain in place until all adjacent construction activities are complete.

12. **Vegetation Removal and Temporary Wetland Impacts.** Limits and extent of clearing and grubbing associated with construction activities shall consider minimizing or avoiding impacts to native vegetation, either within or immediately adjacent to the project area. Prior to commencement of clearing activities within the Aerojet berm segments and near the FPDA tree island preserve area; the contractor shall contact the Department for a site visit to discuss the specific requirements associated with these sites. Exotic vegetation within the FPDA tree island preserve area shall be removed as part of this project.

13. **Water Quantity, Water Quality, and Flooding Impacts.** The District shall be responsible for ensuring that each of the project features is constructed and operated so as not to adversely affect adjacent lands outside the C-111 SC Phase 1 Project boundary with regards to water quantity, water quality, and/or flooding. Should adverse effects be determined at any point during operation of the project, the District shall alter operations to avoid such effects and develop a schedule and strategy to mitigate for such effects. Operating schedules and mitigating strategies developed by the District shall be submitted to the Department for review and approval prior to resuming such operations. The District shall hold and save the Department harmless from any and all damages, claims or liabilities, which may arise from water quantity, water quality, and/or flooding impacts resulting from construction and operation of this project.

14. **NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities.** The issuance of this Permit does not constitute coverage under the National Pollutant Discharge Elimination System (NPDES) Generic Permit for Stormwater Discharges from Large and Small Construction Activities (CGP) pursuant to Rule 62-621.300(4)(a), F.A.C. Prior to the commencement of any construction, permittee is advised to contact the Department's NPDES Stormwater Program at (850) 245-7522 or toll free at (866) 336-6312 or to download application information at http://www.dep.state.fl.us/water/stormwater/npdes/construction3.htm#permit.

15. **NPDES General Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity.** The issuance of this Permit does not constitute coverage under the NPDES General Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity pursuant to Rule 62-621.300(2), F.A.C. If any offsite discharges will occur due to construction dewatering activities, then coverage under the aforementioned General Permit may be required and the permittee is advised to review Rule 62-621.300(2), F.A.C. Before discharge of produced ground water can occur, analytical tests on samples of the proposed discharge water shall be performed to determine if contamination exists. If the analytical results comply with applicable criteria for use of the General Permit, then a short summary of the proposed activity and copy of the analytical tests shall be sent to the addresses in Specific Condition No. 1 within one week after discharge begins, and the permittee may proceed with the project component while abiding by all conditions of the General Permit.

16. **Dewatering.** For construction dewatering activities that are anticipated to occur, the permittee shall submit site-specific dewatering information for determination of consistency with Department's Rules and Statutes at least 30 days prior to commencement of dewatering activities. The information submitted to the Department shall meet the requirements of Rules 40E-2 and 40E-20, F.A.C., for on-site and offsite dewatering activities. Prior to dewatering, the District will provide the following information along with the Staff Report from the Water Use Division:
    - Site plan of the project component with the location of the proposed discharge point(s) and their associated water quality monitoring locations;
    - The location and type of turbidity control devices and methods necessary to ensure state water quality standards shall be met;
    - Calculations estimating the area of influence of dewatering; the depth of dewatering, pumpage rates, duration and volumes, and a demonstration that the requested allocations represent reasonable dewatering needs;
    - Provide reasonable assurance that the dewatering water will remain onsite. If it is not technically feasible to retain dewatering water onsite, then the plan shall also include:
        a) Demonstration and documentation that the permittee is authorized to discharge to the receiving water body and/or adjacent lands;
        b) Operational plan, which demonstrates that the discharge to the receiving water body shall meet all applicable State Water Quality standards prior to discharge, and also contains the proposed sampling locations and daily turbidity measurements; and,
        c) A contingency plan, which includes procedures for ceasing dewatering operations and correcting the situation until water quality standards are met.

17. **Manatee Protection During Construction:** The District shall comply with the following conditions intended to protect manatees from direct project effects:

A. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with, and injury to manatees. The District shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

B. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

C. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

D. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

E. Any collision with or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-232-2580) for north Florida or Vero Beach (1-561-562-3909) for south Florida.

F. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the District upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used. One sign measuring at least 3 ft. by 4 ft. which reads *Caution: Manatee Area* must be posted. A second sign measuring at least 81/2" by 11" explaining the requirements for "Idle Speed/No Wake" and the shutdown of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

G. To reduce the risk of entrapment of and drowning of manatees, grating shall be installed to restrict manatee access to pipes and/or culverts. Any submerged or partially submerged pipes and/or culverts accessible to manatees shall have a grating with bars no more than eight inches apart constructed across the mouth of the pipes or culverts.

18. **Blasting Activities.** Prior to commencing blasting activities, the permittee shall coordinate with the Florida Fish and Wildlife Conservation Commission (FWC) to eliminate the potential for harmful effects on protected species from the use of explosives within the project area. Any substantial modifications to the construction plan, such as, but not limited to, blasting, must be submitted for review and approval to the Department prior to construction and operation of such modifications. Substantial modifications shall be determined on a case-by-case basis by the Department in consultation with the District.

19. **Water Quality Standards.** Under no circumstances shall the construction or operations of the C-111 SC Phase 1 Project cause or contribute to violation of state water quality standards. The permittee shall comply with all applicable state water quality standards described in Chapter 62-302, F.A.C.

20. **Turbidity Monitoring.** Effective means of turbidity control, such as, but not limited to, turbidity curtains shall be employed during all construction activities that may create turbidity so that turbidity shall not exceed 0 NTU above background in receiving waters that are classified as OFW, unless authorized by Specific Condition No. 19 and 29 NTUs above background in other Class III receiving waters. Turbidity controls shall be maintained around the work area to confine turbidity generated by the construction within the work area. All turbidity control devices and/or preventive operation procedures shall remain in place until all turbidity has subsided and the turbidity level at the construction zone meets state standards.

    Turbidity monitoring equipment and personnel trained to use it shall be available on site at all times during construction activities that could result in project-generated turbidity levels beyond the work area that have the potential to be discharged to the receiving water body. During construction, the District shall monitor turbidity levels at least once every four hours, as follows:

    a. Monitoring samples shall be taken at the following locations:
        1. Background Sample(s): One background sample station, at least 150 meters upstream of the work area, in each adjacent canal, outside any visible plume generated by the construction; and
        2. Compliance Sample(s): Monitoring station located in each canal adjacent to the work area, no more than 150 meters down current from the work area within the densest portion of any visible plume.
    b. Turbidity monitoring results shall be summarized quarterly (every three calendar months) by project component, beginning with the first calendar month in which construction or maintenance projects occur that could generate turbidity in receiving waters and continuing until all construction, dredging, and/or excavation is completed. Monitoring data with supporting documents shall be submitted to the Department quarterly during the period of actual construction. If no construction occurs that could generate turbidity during the quarterly monitoring period, the report shall be so noted. The reports shall clearly identify the following information:

        - Permit number;
        - Dates and time of sampling and analysis;
        - A statement describing the methods used in collection, handling, storage and analysis of the samples;
        - A clear description of project component activities taking place at the time of sampling;
        - A map indicating the sampling locations;
        - Name of individual collecting samples; and,
        - A statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, limits of detection and accuracy of the data.

        Monitoring reports shall also include the following information for each sample that is taken:

        - Water depth;

- Depth of sample;
- Weather conditions;
- Water level stage in the canal; and,
- In the event that project-generated turbidity levels exceed zero NTU above background in downstream waters that are classified as Outstanding Florida Water (OFW), or 29 NTUs above background in any receiving waters (see 62-302 F.A.C.), project activities contributing to elevated turbidity shall immediately cease and the Department shall be notified within 24 hours. Work shall not resume until the work can be conducted in compliance with these turbidity limits or an accompanying variance, where applicable.

21. **Future Phases.** This permit does not authorize any construction or operational activities associated with future portions of the C-111 SC Phase 1 Project. Future phases, including operations, shall require separate review and approval by the Department. Permanent changes to operation of structures will require a separate approval.

<u>Operations</u>

22. **Project Operation Plan.** The District shall submit the final version of the Project Operating Plan to the Department for review and approval within a reasonable timeframe prior to initiation of operations. In addition to the proposed operations, the operations plan should work in conjunction with the water quality and hydro-meteorological monitoring plans to identify the location of surface water and groundwater monitoring sites that will be used to provide a framework around which operational decisions shall be made, including temporary operational changes, to ensure that adverse impacts to adjacent landowners do not occur. The District shall operate and maintain the C-111 SC Phase 1 Project consistent with the design documents and the conditions of this permit.

23. **Project Water Quality Compliance, Hydrometeorological and Ecological Monitoring Plans.** After one year of operations for each project component, and annually thereafter, the permittee shall schedule a meeting with an interagency team to review the data collected for the project and provide recommendations regarding future operations and monitoring. Over the operational phase of this project, data from these plans shall be evaluated on an ongoing basis and shall be incorporated into the operational decision framework. Modifications to these plans shall be submitted to the Department for review and approval.

24. **Pump Testing and Maintenance.** In order to ensure operational readiness, testing and maintenance operations may be required by the construction contractor and/or permittee for the pumps authorized by this permit. Operational readiness requirements of the pump stations include operation of the pumps for approximately 2 to 4 hours per month, as necessary, to maintain their mechanical integrity. Therefore, temporary operation of the pump stations for testing and maintenance purposes is allowed and is not subject to the discharge criteria of the specific conditions of this permits. However, the permittee shall include all such discharge flows and loads as a part of the monitoring requirements of this permit.

25. **Emergency Discharge Frog Pond Detention Area.** There shall be no pumped surface water discharges from the FPDA. Discharge from the FPDA is allowed in the event of accumulation of storm water above the crest elevation (5.5 ft NAVD88) of the three emergency overflow weirs. When an emergency discharge from the FPDA is anticipated, the permittee shall notify the Department of the anticipated event and report this event in the annual report.

26. **Public Health, Safety, and Welfare.** Pursuant to 373.1502, F.S., discharges from the C-111 SC Phase 1 Project component shall not pose a serious danger to public health, safety, or welfare.

Monitoring

27. **Water Quality Monitoring.** Within 30 days following the issuance of the final permit, the permittee shall submit a final Water Quality Compliance Plan for Department review and approval. The permittee shall collect and analyze surface water quality monitoring data in accordance with the Water Quality Plan (Document No. 15) using the parameters and frequencies identified in Table 1 at the sites shown on Figure 2. Any modifications to the Water Quality Compliance Plan shall be submitted to the Department for review and approval. Within 180 days prior to commencement of operation of the S-198 structure, the District shall submit a revised Water Quality Compliance Plan for Department review and approval to incorporate water quality sampling associated with the operation of the S-198 structure.

    A. Quality Assurance and Quality Control. Sampling and monitoring data shall be collected, analyzed, reported and retained in accordance with Chapter 62-160, F.A.C. Any laboratory test required by this permit shall be performed by a laboratory that has been NELAP-accredited (primary or secondary) with the Florida Department of Health (DOH) under Chapter 64E-1, F.A.C., where such certification is required by Rule 62-160.300, F.A.C. The laboratory must be certified for all specific method/analyte combinations that are used to comply with this permit. The analytical method used shall be appropriate so as to determine if the sample complies with Class III surface water quality standards as specified in Chapter 62-302, F.A.C. All field activities including on-site tests and sample collection, whether performed by a laboratory or another organization, must follow all applicable procedures described in DEP-SOP-001/01 (March 31, 2008). Alternate field procedures and laboratory methods may be used if they have been approved according to the requirements of Rules 62-160.220, and 62-160.330, F.A.C.

    B. Method Detection Limits. The sample collection, analytical test methods and method detection limits (MDLs) applicable to this permit shall be performed and reported in accordance with Rule 62-4.246, F.A.C. A list of Department established analytical methods, and corresponding MDLs and PQLs (practical quantification limits), which is titled "Florida Department of Environmental Protection Table as Required By Rule 62-4.246(4) Testing Methods for Discharges to Surface Water" dated April 25, 2006, is available from the Department on request. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. More stringent MDLs and PQLs may be necessary for specific parameters. If required, these will be identified in the permit monitoring table.

28. **Start-up Monitoring for Frog Pond Detention Area (FPDA).** Two sampling events shall be conducted in the FPDA Cell 3: 1) one upon commencement of operations at the initial discharge in the cell, and 2) one at the end of a complete wet season in the cell, in order to verify the adequacy of soil remediation activities outlined in the Soil Management Plan, and ensure that leaching does not occur upon inundation of the FPDA. Grab samples and IN SITU samples shall be collected in the FPDA Cell 3 for the parameters listed in Table 1 with the exception of the fish tissue sampling. A summary report with the results and data shall be submitted to the Department within a reasonable

amount of time not to exceed 90 days following the sampling events. The District shall coordinate with the Department to determine if further action is required in accordance with Specific Condition 3.

29. **Mercury and Pesticide Monitoring.** The permittee shall submit a revised mercury and pesticide monitoring plan for Department review and approval, 30 days following the issuance of the final permit. Mercury and pesticide monitoring will be conducted in accordance with Table 1 and Table 2.

30. **Removal of Monitoring Requirements.** Upon demonstration that a specific parameter(s) is not present or is found consistently in compliance with Class III Water Quality Standards or Outstanding Florida Waters (OFW), the permittee may request a modification to the monitoring program as appropriate. A minimum of one year's worth of data, for those parameters being sampled quarterly or more frequently, will be required prior to the Department approving any modification to the monitoring program. The Department may approve a reduction of the monitoring frequency or waive the monitoring requirement for parameters that consistently are reported as in compliance with state water quality standards.

31. **Addition of Monitoring Requirements.** If the Department has reason to believe that additional monitoring may be required or parameters exist that may cause or contribute to water quality violations or degradation of receiving waters, additional monitoring or parameters shall be added to the monitoring section of this permit through a permit modification.

<u>Reports and Notices</u>

32. **Facility Inspection Plan and Reports.** The permittee shall submit annual inspection reports to the Department evaluating the integrity and functionality of the above-ground levees and structures, including pump stations. Annual inspection reports shall be prepared buy field staff trained by a Professional Engineer and reviewed by the designated superintendent of the area prior to submittal to the Department. The cover letter of the inspection report should summarize site conditions and work that was completed in response to inadequacies that may have been found during regular inspections. Every five years, at a minimum, each permitted facility shall have an inspection by a Professional Engineer registered in the State of Florida, and the subsequent inspection report shall be signed and sealed by that Professional Engineer and submitted to the Department. A Professional Engineer or the District's Dam Safety Officer shall review and approve major repair plans or remedial work associated with inadequacies identified during routine and formal inspections. All reporting shall be submitted to the Department to the address listed in Specific Condition 1.

33. **Construction Status Reports.** Construction Status Reports or Construction Meeting Minutes for each project feature shall be provided to the Department upon request and such reports shall continue to be available throughout the construction activities until all disturbed areas are successfully stabilized. These Reports may be requested through the Project Manager, Construction Manager, or obtained at the construction meetings.

34. **As-Built Certification and Record Drawings.** Within 90 days after the completion of construction for each of the project features, the District shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law. The statement of completion and certification shall be based on on-site observation of construction or review of as-built drawings for the purpose of determining whether or not the work was completed in compliance with permitted plans and specifications. Additionally, if deviation

from the approved drawings is discovered during the certification process, the certification must be accompanied by a copy of the approved permit drawings with deviations noted. Both the original and revised specifications must be clearly shown. Plans submitted to the Department must be clearly labeled as "as-built" or "record" drawings with electronic copies provided in pdf format. A registered surveyor shall certify all surveyed dimensions and elevations.

35. **Annual Reports.** The permittee shall submit an "Annual Report" to the Department detailing the construction activities / operations of each of the features for the C-111 SC Phase 1 Project during the annual reporting period. In addition to the permit number and name of the permit administrator, the Annual Reports shall contain, at a minimum the following information: the project component name, permit number, a summary of monitoring results from the work conducted under Specific Condition 20 and 27 an evaluation of the success of the project component in achieving its objectives, problems encountered during the period covered, actions taken to address problems encountered, and the information listed below. The annual reporting requirements under this permit shall be incorporated into the South Florida Environmental Report (SFER) and submitted to the Department no later than March 1st of each year. If additional reporting modifications are required, the permittee may request a modification of the annual report submission date and upon approval by the Department, the permittee may modify the Annual Report submission date to coincide with other reporting requirements and time periods needed for data acquisition and analysis. The reports shall be submitted on an annual basis for a period of 5 years after the completion of construction. At that time, the permittee and Department shall coordinate to determine if further reporting is required.

a. **Construction/ Operations.** A construction and/or operations summary shall include, at a minimum:
   i. Construction/Inspections/Maintenance progress report;
   ii. Summary of the operational record, including deviations from normal operations;
   iii. Annual Ecological Monitoring Summary Report;
   iv. Annual Water Quality Monitoring Summary Report;
   v. Annual Hydrometeorological Monitoring Report;
   vi. Annual Facility Inspection Report; and

b. **Surface Water Quality Data.** Records of monitoring information, where applicable, shall include:
   i. Date, location, and time of sampling or measurements;
   ii. Person responsible for performing the sampling or measurements;
   iii. Dates analyses were performed or the appropriate code as required by Chapter 62-160, F.A.C.;
   iv. Person responsible for performing the analyses;
   v. Analytical techniques or methods used, including method detection limit (MDL);
   vi. Results of such analyses, including appropriate data qualifiers;
   vii. Depth of samples;
   viii. Flow conditions and weather conditions at time of sampling; and,
   ix. Monthly flow volumes.

c. **Implementation Schedules.** When appropriate, the District shall include information on:
   i. C-111 SC Phase 1 Project and Comprehensive Everglades Restoration Plan implementation;
   ii. Project adaptive management;
   iii. Project design modifications; and,

iv. Implementation of remedial measures in the event of noncompliance with permit conditions.

Factors Impacting Compliance

36. **Emergency Suspension of Sampling.** Under hurricane, tropical storm warnings, or other extreme weather conditions, the District's normal sampling schedule may be suspended if necessary. The District shall notify the Department's Restoration Planning and Permitting Section at the address and telephone number listed in Specific Condition No. 1, of any suspension of sampling associated with hurricanes, tropical storms, or other extreme weather events that may require deviation from the normal sampling schedule. Within 14 days following the cessation of emergency conditions, the District shall notify the Department of when normal sampling is expected to resume.

37. **Factors Outside the Permittee's Control.** In the event that non-compliance or failure to achieve performance objectives occurs for any reason other than those listed below, the District shall take appropriate remedial measures.

A. Natural Background. Deviations from water quality standards may occur as a result of natural background conditions, in accordance with Section 403.021(11), F.S.

B. Random Variation. The District shall report any statistical uncertainty in the methodology using acceptable scientific methods.

C. Other Factors. Unavoidable legal barriers or restraints, including those arising from actions or regulations not under the control of the District.

Renewals and Modifications

38. **Permit Modifications.** The permittee shall submit proposed permit modifications of the C-111 SC Phase 1 Project to the Department, prior to implementation of the modification, for review and approval by the Department.

39. **Permit Renewal.** At least 60 days prior to the expiration of this permit, the permittee shall apply for renewal of this permit. Renewal may be for a period of up to five years in accordance with Subsection (3)(g) of the CERPRA.

40. **Department Review and Approval.** Where conditions in this permit require Department review of remedial actions or plan modifications to be implemented pursuant to this permit, the Department shall consult with the permittee to ascertain whether mutual agreement can be reached. If mutual agreement on the remedial actions or plan modifications cannot be reached, the action of the Department shall be deemed final agency action and shall be subject to judicial or administrative review, as appropriate.

Table 1. Interim Operations Monitoring Plan C-111 Spreader Canal Phase 1Project

PARAMETER	UNITS	SAMPLE TYPE	SAMPLING FREQUENCY	SAMPLING LOCATION
Temperature	Deg C	IN SITU	Weekly if flowing, otherwise monthly	S-177[1], S-200, AJ Canal
Specific Conductance	µmhos	IN SITU	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Turbidity	NTU	G	Quarterly	S-177
pH	SU	IN SITU	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Dissolved Oxygen (DO)	mg/l	IN SITU	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Total Suspended Solids (TSS)	mg/l	G	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Ammonia (NH_4)	µg /l	G	Weekly if flowing, otherwise monthly	S-177
Total Kjeldahl Nitrogen (TKN)	mg/l	G	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Nitrate + Nitrite (NO_X)	mg/l	G	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Ortho-Phosphate (OPO_4)	mg/l	G	Weekly if flowing, otherwise monthly	S-177, S-200, AJ Canal
Total Phosphorus (TP)	mg/l	G	Weekly if flowing, otherwise monthly	S-177, S-200, S-18C, AJ Canal
Calcium (Ca)	mg/l	G	Quarterly	FPDA Header, AJ Canal
Magnesium (Mg)	mg/l	G	Quarterly	FPDA Header, AJ Canal
Sulfate (SO_4)	mg/l	G	Quarterly	S-332DX[2], S-177
Zinc (Zn)	µg /l	G	Quarterly	FPDA Header*, AJ Canal
Copper (Cu)	µg /l	G	Quarterly	FPDA Header*, AJ Canal
Pesticides[3]	µg /l	G	Quarterly	S-332DX[2], S-177
Stage	ft	Stage recorder	Daily	FPDA Header, AJ Canal, CSSS Units 2 + 3, S-199, S-18C, S-197
Flow	CFS	PR/ CAL	DAV	S-177, S-18C, S-197, S-200, AJ Canal
Rainfall	inches	RG	DAC	S-177
Total Mercury (THg)	ng/l	G	Quarterly	S-332DX
Methylmercury (MeHg)	ng/l	G	Quarterly	S-332DX

[1]Due to its proximity S-177 is used to monitor S-199 water quality. S-177 is currently sampled under the Non-Everglades Construction Project (Non-ECP) permit (Permit No. 0237803). These data are to be submitted or referenced as part of the Annual Report for this permit.
[2] S-332DX is currently sampled under the Final Emergency Order No.9 to operate the S-332B, S-332C, and S-332D pump stations and appurtenant structures (OGC Case Nos. 00-0889 and 99-2242). These data are to be submitted or referenced as part of the Annual Report for this permit.
[3]See Table 2 for a list of pesticides and other toxicants to be monitored.

Mercury (Mosquitofish)	mg/kg	FT	Quarterly	FPDA Header*, AJ Canal
Pesticides[3] (Mosquitofish)	ug/Kg	FT	Quarterly	FPDA Header*, AJ Canal
Large-bodied Fish (sunfish, largemouth bass)	mg/kg	FT	Annually	FPDA Header*, AJ Canal

* Quarterly when sufficient depth (at least 10 cm) exists at FPDA Header (403,700N 796,800E)

Key for Table 1

Monitoring locations:

AJ Canal: In the Aerojet Canal downstream of the S-201 culvert (381,680N 799,450E)
FPDA Header: At the north end of the unlined section of the header canal

Units:

µmhos	Micromhos
NTU	Nephelometric Turbidity Unit
SU	Standard Units (pH)
mg/l	Milligrams per liter
µg/l	Micrograms per liter
µg /g	Micrograms per gram
Deg C	Degrees Celsius
ng/l	nanograms per liter
mg/kg	milligrams per kilogram

Sample Type:

IN SITU	In Situ Field Sample
G	surface water grab
PR	Pump record
CAL	Calculated parameter
RG	Rain Gage
FT	Fish Tissue
S	Sediment

Frequency:

DAV	Daily averages of continues sampling
DAC	Daily accumulation of continuous sampling

Table 2. Pesticide and other toxicant parameters for surface water and fish.

Parameter	Surface Water	Fish
chlordane	X	-
cis-chlordane	-	X
trans-chlordane	-	X
o,p'-DDD	-	X
p,p'-DDD	X	X
o,p'-DDE	-	X
p,p'-DDE	X	X
o,p'-DDT	-	X
p,p'-DDT	X	X
alpha endosulfan	X	X
beta endosulfan	X	X
endosulfan sulfate	X	X
toxaphene	X	X
cis-nonachlor	-	X
trans-nonachlor	-	X
copper	X	X
zinc	X	X

[-] = Parameter is not analyzed

Executed in Tallahassee, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

10/8/09

Greg Knecht, Director — Date
Office of Ecosystem Projects

GK/swf/af

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52 F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk — Date 10/8/09

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Permittee: South Florida Water Management District
Project: C-111 Spreader Canal Phase 1 (Western) Project
File No.: 293559-001
Page 25 of 27

Figure 1. C-111 Spreader Canal Phase 1 Project components.

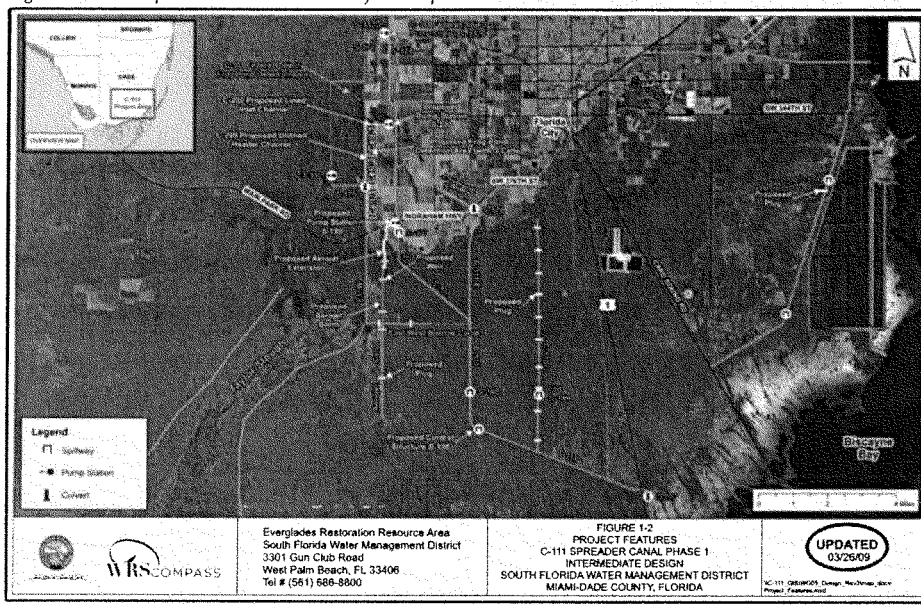
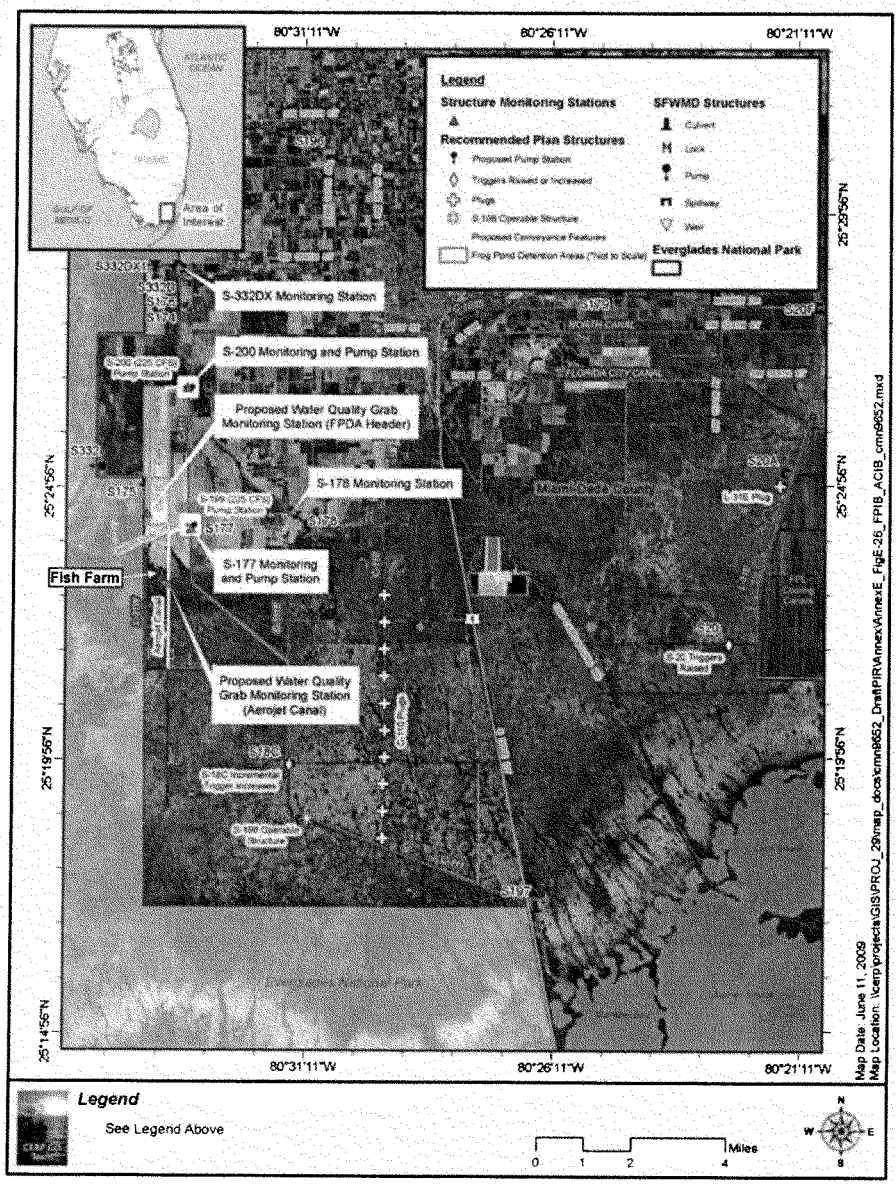


Figure 2. C-111 Spreader Canal Phase 1 Project monitoring locations.



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FOR CONTINUATION OF HOUSE DOCUMENT 112-132

CENTRAL AND SOUTHERN FLORIDA PROJECT:
COMPREHENSIVE EVERGLADES RESTORATION PLAN C-111
SPREADER CANAL WESTERN PROJECT

SEE VOLUME 5