

**UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POST-CONSTRUCTION PERFORMANCE
INITIAL EVALUATION REPORT**

**LONG ISLAND DIVISION (GARDNER
DIVISION)
HABITAT REHABILITATION
AND ENHANCEMENT**



July 2003



**US Army Corps
of Engineers**
Rock Island District

POOL 21
MISSISSIPPI RIVER MILES 332.5 – 340.2
ADAMS COUNTY, ILLINOIS



DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING - P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF

June 5, 2003

Planning, Programs, and
Project Management Division

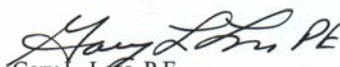
SEE REPORT DISTRIBUTION LIST (APPENDIX H)

The Rock Island District of the U.S. Army Corps of Engineers (Corps) has enclosed for your use the Post-Construction Performance Evaluation Report for Gardner Division (Long Island Division) Habitat Rehabilitation and Enhancement Project (HREP). This report is a product of the first year of post-construction field observations and monitoring data. The next report is scheduled for completion in March 2004.

Performance Evaluation Reports (PERs), both initial and supplemental, are the Corps' primary mechanism for reviewing, documenting, and communicating the effectiveness of HREPs, which are a part of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP). The main purposes of PERs are to summarize project performance, as well as operation and maintenance efforts, based on the project goals/objectives, and to review the monitoring plan and performance criteria to aid in the design of future HREPs.

In April 2003, a draft PER was provided to project sponsors for their review and comment. Those comments received were incorporated into the final PER. If you have any questions regarding this report, please call Ms. Julie Fisher in the Design Branch, Engineering Division, telephone 309/794-5439.

Sincerely,


Gary L. Loss, P.E.
Chief, Planning, Programs, and
Project Management Division

Enclosure

CEMVR

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ENVIRONMENTAL MANAGEMENT PROGRAM
POST-CONSTRUCTION PERFORMANCE
INITIAL EVALUATION REPORT**

**LONG ISLAND DIVISION HABITAT
REHABILITATION AND ENHANCEMENT PROJECT**

**POOL 21, MISSISSIPPI RIVER MILES 332.5 – 340.2
ADAMS COUNTY, ILLINOIS**

July 2003

**Long Island Division Habitat Rehabilitation and Enhancement Project
Performance Evaluation Report
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ACKNOWLEDGMENT

Many individuals of the Rock Island District, United States Army Corps of Engineer, the U.S. Fish and Wildlife Service, and the Illinois Department of Natural Resources contributed to the development of this Post-Construction Performance Evaluation Report for the Long Island Division Habitat Rehabilitation and Enhancement Project. These individuals are listed below:

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**US Army Corps
of Engineers**
Rock Island District



**UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
U.S. ARMY CORPS OF ENGINEERS
ROCK ISLAND DISTRICT**

**UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
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**LONG ISLAND DIVISION
HABITAT REHABILITATION AND
ENHANCEMENT PROJECT**

**CONSTRUCTION SUBSTANTIALLY COMPLETED
2001**

Preface

This project was authorized, designed, and constructed as part of the Upper Mississippi River Environmental Management Program (EMP, PL 99-662). The program, as administered by the U.S. Army Corps of Engineers, authorizes "... the planning, construction and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement..."

Once EMP projects are planned, designed, and constructed, they are operated and maintained by the Project Sponsor in accordance with Project Cooperation Agreements (for Non-Federal Sponsors) or Memorandums of Agreement (for Federal Sponsors).

Post-Construction Project Monitoring was authorized by EMP in efforts to validate project goals and objectives against physical, chemical, and biological aspects of the project. Post-Construction monitoring also provides a systematic basis for project review of planning, design and construction principles; operation and maintenance considerations; and natural resource management viewpoints.

Post-Construction Performance Evaluations are performed each year. Principal Agencies involved include the Sponsor, the U.S. Fish and Wildlife Service, U.S. Geological Survey, Illinois Department of Natural Resources, and the Corps of Engineers. Principal components of the Performance Evaluation Report include inspections and observations; field sampling; and evaluation of data relative to project goals and objectives. Field data is collected according to an established Project Monitoring Plan.

The Post-Construction Performance Evaluation Reports are either published as separate reports or as addendums to previous reports. Addendums are utilized when monitoring / project data do not warrant full evaluations and analyses.

Previous Performance Evaluation Reports, including the Project Monitoring Plan, and other related project documents such as the Definite Project Report (DPR) and the Project Operation and Maintenance Manual with As-Built Construction Drawings are available at: <http://www.mvr.usace.army.mil/EMP/hrep.htm>.

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**LONG ISLAND DIVISION HABITAT REHABILITATION AND
ENHANCEMENT PROJECT**

**POOL 21, UPPER MISSISSIPPI RIVER
RIVER MILES 332.5 THROUGH 340.2
ADAMS COUNTY, ILLINOIS**

EXECUTIVE SUMMARY

1. **General.** As stated in the Definite Project Report (DPR), the Long Island Division project was initiated in response to a decline in backwater areas and side chutes due to siltation and vegetation encroachment. Long Island Division also has one of the last high quality stands of bottomland timber in the middle reaches of the Upper Mississippi River.
2. **Purpose.** The purpose of this report is to provide a summary of the monitoring data and field observations, as well as project operation and maintenance, since the completion of the project in 2001.
3. **Project Goals, Objectives, and Features.** The two goals and associated objectives for the Long Island Division project are as follows:
 - a. **Enhance Aquatic Habitat.**
 - (1) Improve habitat for overwintering fish through channel dredging
 - (2) Reduce sedimentation in side channels by installing a emergent closure structure
 - (3) Increase aquatic habitat diversity through shoreline protection
 - b. **Restore and Protect Wetland and Terrestrial Habitat.**
 - (1) Maintain terrestrial habitat through shoreline protection
 - (2) Increase bottomland hardwood diversity and reduce forest fragmentation through reforestation
4. **Observations and Conclusions.** The objectives to meet each goal had the following observations and conclusions.
 - a. **Enhance Aquatic Habitat.**

Water quality monitoring was performed in O'Dell Chute, upstream from the O'Dell Chute Access dredging, for this current performance evaluation report. All

water quality monitoring grab sample data collected to date are listed in Appendix D.

While little post-project data have been collected, certain trends are apparent. Water velocity in O'Dell Chute is much lower now compared to pre-project. Also, it is possible that suspended solids concentrations are lower now compared to pre-project. These trends may become more definitive when more post-project data have been collected.

Results from the continuous recording data sondes offer a much more complete picture of how water quality varies throughout the day as well as between discrete sampling events. From the data gathered between June 2002 and September 2002, trends in some water quality parameters can be seen that are not apparent from the grab samples. Diurnal variations in water temperature, pH and dissolved oxygen concentrations are most evident. Often these 3 parameters are strongly correlated. With few exceptions, concentrations of important parameters rarely fall outside the acceptable range for most native aquatic organisms. Graphs of sondes data are located in Appendix D.

The dissolved oxygen (DO) levels were monitored to make sure the fish had enough oxygen to keep them alive.

Based on limited post-project data, it appears that the water quality has improved as a result of project construction. The lower water velocities would seem to benefit fish that might over-winter in the side channel being sampled. Also, there appears to be less suspended sediment being transported down this channel.

No sediment transects were performed for this performance evaluation report. Sedimentation transects are scheduled for the 2004 Performance Evaluation Report.

An electrofishing survey on 6 August of 2002 showed at least 18 different fish species and 7 sport species. Observations and surveys for fish diversity and population should be included in the 2004 Performance Evaluation Report to see if the trend continues.

b. Evaluation of Wetland and Terrestrial Habitat.

The shoreline and island protection feature was not monitored for this performance evaluation report.

The contractor is responsible for maintenance of the reforestation feature until all planting is complete and a final inspection finds the work acceptable. After the final inspection approval, there will be no further replanting of trees. Survival and growth of most trees will then be monitored by the U.S. Army Corps of Engineers, Rock Island District through annual inspections of the planting sites. The results of those inspections will be discussed in future performance evaluation reports.

5. Conclusions and Recommendations. Data and observations collected since project completion was limited. Continuing data collection will better define the levels to which the goals and objectives of this project are being met.

In general, project monitoring efforts have been performed according to the Resource Monitoring and Data Collection Summary, Post-Construction Phase (Appendix C) and the Post-Construction Monitoring Plans (Appendix B). The next comprehensive Post-Construction Performance Evaluation will be completed in fiscal year 2004, two years after construction is substantially complete.

There are no operation and maintenance recommendations or conclusions for this PER.

Additional shoreline and island protection is planned as part of a Stage II contract. The protection is tentatively planned for the north end of Long Island, the shoreline of Small Island, and the north end and shoreline of La Grange Island.

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ADAMS COUNTY, ILLINOIS**

TABLE OF CONTENTS

| Section | Page |
|---|-------------|
| 1. INTRODUCTION | 1 |
| a. Purpose | 1 |
| b. Scope | 1 |
| 2. PROJECT BACKGROUND | 1 |
| a. General | 1 |
| b. Goals and Objectives | 2 |
| c. Project Construction | 2 |
| d. Project Operation and Maintenance | 2 |
| e. Previous Performance Evaluation Reports | 2 |
| 3. PROJECT FEATURES | 2 |
| a. Side Channel Dredging | 2 |
| b. Emergent Closure Structure | 3 |
| c. Shoreline and Island Protection | 3 |
| d. Reforestation | 3 |
| 4. PROJECT MONITORING | 3 |
| a. Corps of Engineers | 3 |
| b. U.S. Fish and Wildlife Service | 4 |
| 5. EVALUATION OF AQUATIC REHABILITATION OBJECTIVES | 4 |
| a. Improve Habitat for Overwintering Fish | 4 |
| b. Reduce Sedimentation in Side Channels | 5 |

| | |
|---|----------|
| c. Increase Aquatic Habitat Diversity | 5 |
| 6. EVALUATION OF WETLAND AND TERRESTRIAL HABITAT OBJECTIVES | 5 |
| a. Maintain Terrestrial Habitat | 5 |
| b. Increase Bottomland Hardwood Diversity and Reduce Forest Fragmentation | 5 |
| 7. OPERATION AND MAINTENANCE SUMMARY | 5 |
| a. Operation | 5 |
| b. Maintenance | 5 |
| 8. CONCLUSIONS AND RECOMMENDATIONS | 5 |
| a. Project Goals, Objectives, and Management Plan | 5 |
| b. Post-Construction Evaluation and Monitoring Schedules | 6 |
| c. Project Operation and Maintenance | 6 |
| 9. PROJECT DESIGN ENHANCEMENT CONSIDERATIONS | 6 |

List of Appendices

| |
|--|
| Appendix A. Acronyms |
| Appendix B. Post-Construction Evaluation Plan and Sedimentation Transect Project Objectives evaluation |
| Appendix C. Monitoring and Performance Evaluation Matrix and Resource Monitoring and Data Collection Summary |
| Appendix D. Water Quality Data |
| Appendix E. Fish Survey |
| Appendix F. Project Team Members |
| Appendix G. References |
| Appendix H. Distribution List |
| Appendix I. Plates |

List of Plates

| |
|---|
| Plate 1. Location Plan and Vicinity Map |
| Plate 2. Project Features |
| Plate 3. Monitoring Plan |

List of Figures

| |
|-------------------------------------|
| Figure D-1. Water Temperature |
| Figure D-2. Dissolved Oxygen |
| Figure D-3. pH |
| Figure D-4. Turbidity |
| Figure D-5. Depth |
| Figure D-6. Dissolved Oxygen –Comp. |

List of Tables

| |
|---|
| Table 2.1. Project Goals, Objectives, and Features |
| Table 8.1. Project Goals and Objectives |
| Table B-1. Post-Construction Evaluation Plan |
| Table B-2. Sedimentation Transect Project Objectives Evaluation |
| Table C-1. Monitoring and Performance Evaluation Matrix |
| Table C-2. Resource Monitoring and Data Collection Summary |
| Table D-1. Results of Samples Taken Near the Water Surface |
| Table F-1. Long Island Division Project Team Members |

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**POOL 21, UPPER MISSISSIPPI RIVER
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ADAMS COUNTY, ILLINOIS**

1. INTRODUCTION

a. Purpose. The purposes of this Performance Evaluation Report (PER) for the Long Island Division Habitat Rehabilitation and Enhancement Project (HREP), formerly known as the Gardner Division, are as follows:

- (1) Summarize the performance of the Long Island Division HREP project based on the project goals and objectives
- (2) Review the monitoring plan for possible revision
- (3) Summarize project operation and maintenance efforts to date
- (4) Review engineering performance criteria to aid in the design of future projects

b. Scope. This report summarizes available project monitoring data (Appendix C), inspection records, and observations made by the U.S. Army Corps of Engineers (Corps) and the U.S. Fish and Wildlife Service (USFWS) for 2002 and early 2003 (Appendix B), for one year after construction was substantially complete.

2. PROJECT BACKGROUND

a. General. The 6,300-acre Long Island Division Habitat Rehabilitation and Enhancement Project (HREP) is located in Adams County, Illinois, in Pool 21 on the Mississippi River. It is between Upper Mississippi River miles 332.5 and 340.2 and is about 5 miles north of Quincy, Illinois. The Long Island Division HREP is part of the USFWS Great River National Wildlife Refuge. The project area is comprised of several islands, of which Long, Shandrew, and Flannigan are the largest. The project area also contains a major backwater lake (Long Island Lake) and several important side chutes – Canton, O'Dell, Smoots, and Shandrew. See Plate 2.

b. Goals and Objectives. Goals and objectives, formulated during the project design phase, are summarized in Table 2-1.

| Table 2-1. Project Goals, Objectives, and Features | | |
|---|--|---------------------------------|
| Goals | Objectives | Project Features |
| Enhance Aquatic Habitat | Improve habitat for overwintering fish | Side channel dredging |
| | Reduce sedimentation in side channels | Emergent closure structure |
| | Increase aquatic habitat diversity | Shoreline and island protection |
| Enhance Wetland and Terrestrial Habitat | Maintain terrestrial habitat | Shoreline and island protection |
| | Increase bottomland hardwood diversity and reduce forest fragmentation | Reforestation |

c. Project Construction. The construction contract (contract number DACW25-01-C-0008) was awarded to Magruder Construction Co., Inc. on March 23, 2001. The contract was supervised by the U.S. Army Corps of Engineers, Rock Island District, Construction Division. Construction was substantially complete by the end of 2001 with the exception of the reforestation feature. The reforestation feature is scheduled for completion by April 2004 when tree planting work is finished.

d. Project Operation and Maintenance. Operation and maintenance (O&M) of the Long Island Division HREP is the responsibility of the USFWS in accordance with Section 107 (b) of the Water Resources Development Act of 1992, Public Law 102-580. These functions are further defined in the O&M Manual. The completion of the O & M Manual is schedule for June 2004. The project features were designed and constructed to minimize the operation and maintenance requirements. Project operation and maintenance will generally consist of (1) observe the side channels for evidence of sedimentation; (2) ensure the structural integrity of the closure structure; (3) maintain the shoreline and island protection features; and (4) inspect planting sites and ensure their survival through remedial actions.

e. Previous Performance Evaluation Reports. No previous performance evaluation report (PER) exist for the Long Island Division HREP project since this is the initial performance evaluation report.

3. PROJECT FEATURES

The Long Island Division HREP restores and protects wetland and terrestrial habitat as well as aquatic habitat. Constructed features included side channel dredging, an emergent closure structure, shoreline and island protection, and reforestation.

a. Side Channel Dredging. The downstream end of O'Dell Chute was dredged for approximately 5,000 linear feet. The O'Dell Chute dredge cut had a 50-foot bottom width. Dredging was also conducted for approximately 1,250 linear feet in Canton Chute starting at the confluence of O'Dell Chute and Canton Chute and progressing

downstream. This dredge cut was added during construction to assure access to the O'Dell Chute dredged cut because the flood silted in this area. The Canton Chute dredge cut had a 35-foot bottom width. Both the O'Dell Chute and Canton Chute were dredged 7.5 feet below flat pool to ensure that the 6-foot minimum desired channel depth below flat pool would be maintained throughout the 50-year project life.

b. Emergent Closure Structure. The closure structure spans 271 feet or the entire width of O'Dell Chute just downstream of the closure structure access dredging. On average, approximately 4 feet of the rock structure is emergent, or above the flat pool elevation of 470 feet (MSL). On average, approximately 6 feet of the structure is submerged, or below the flat pool elevation. The closure structure was designed to be emergent 90% of the time. The top of the structure is 14 feet wide. The upstream facing slope measures 2 horizontal : 1 vertical and the downstream slope measure 3 horizontal : 1 vertical. The closure structure is anchored on the upstream side of the structure with a 10-foot wide rock layer extending 3 feet into the bed of O'Dell Chute.

c. Shoreline and Island Protection. Approximately 3,765 linear feet of shoreline were protected with a 2-foot thick riprap layer on top of a 1-foot thick bedding stone layer. Areas protected include the heads of Islands A, B, C, D, and E and Shandrew Island (See Plate 2 in Appendix I). The slope of this protection is 2 horizontal : 1 vertical.

d. Reforestation. Completion of mast tree planting on the 67 acres of Long Island's 184-acre eastern agricultural field with the highest elevation is planned for April 2004. This planting area is where the dredge disposal from O'Dell Chute channel dredging was deposited and incorporated into the soil. Trees specified to be planted included 1005 pin oaks, 670 swamp white oaks, 670 bur oaks, 670 northern pecans, and 536 sycamores for a total of 3,551 trees. The trees are to be planted at 30-foot intervals on berms parallel to O'Dell Chute. The berms are to be 30 feet apart. All trees are to receive weed barrier mats. The size of the trees are to be at least 5/8-inch caliper and five feet in height. As of October 2002, 1,219 trees had been planted. The mast tree planting will continue with completion set for April 2004.

4. PROJECT MONITORING

The Corps and the USFWS will measure the success of the project relative to original project objectives. Appendix B presents the Post-Construction Performance Evaluation Plan. This plan was developed during the design phase and serves as a guide for measuring and documenting project performance. A drawing of the plan is located in Appendix B. Appendix C contains the Resource Monitoring and Data Collection Summary. The Resource Monitoring and Data Collection Summary presents the types and frequency of data needed to meet the requirements of the Post-Construction Performance Monitoring Plan.

a. Corps of Engineers. The Corps has the overall responsibility to document project performance. The Corps is responsible for collecting field data as outlined in the Post-

Construction Monitoring Plan. The Corps also will perform joint inspections with the USFWS. The purpose of these inspections is to assure that adequate maintenance is being performed as presented in the Definite Project Report DPR and O&M Manual. Joint inspections should also occur after any event that causes damage in excess of annual O&M costs.

b. U.S. Fish and Wildlife Service. The UFWFS is responsible for monitoring the project through field observations during inspections. Project inspections should be performed on an annual basis following the guidance presented in the O&M manual. It is recommended that the inspections be conducted in May or June, which is representative of conditions after spring floods. Joint inspections with the Corps and USFWS shall also be conducted as described above. During all inspections, the USFWS should complete the checklist form as provided in the O&M Manual. The form should also include a brief summary of the overall condition of the project and any maintenance work completed since the last inspection. Once completed, a copy of the form shall be sent to the Corps.

5. EVALUATION OF AQUATIC REHABILITATION OBJECTIVES

a. Improve Habitat for Overwintering Fish. Only water quality monitoring was performed for this current performance evaluation report. Observations and surveys for fish habitat should be included in the 2004 Performance Evaluation Report. In order to determine if water quality objectives were met, a single water quality monitoring station designated as W-M336.6S was established in O'Dell Chute upstream from O'Dell Chute access dredging. See Appendix I for location of the water quality monitoring station. Water quality samples were first collected at this location in April 1990. The grab samples from the water quality station were collected approximately every two weeks during the summer and approximately every four weeks during the winter. Sampling was suspended in May 1994. Sampling was resumed in June 2002 and is on going. Since June 2002, continuous recording data sondes are also being used in the summer and winter months. The sondes data was taken from the water quality monitoring station in O'Dell Chute. The data sondes instruments gather information several times per day and store the information until the instruments are retrieved and the data is transferred to computer.

All grab sample data collected to date are listed in Appendix D. While little post-project data have been collected, certain trends are apparent. Water velocity in O'Dell Chute is much lower now compared to pre-project. Also, it is possible that suspended solids concentrations are lower now compared to pre-project. Lastly, the dissolved oxygen concentrations stayed above 5 mg/L. These trends may become more definitive when more post-project data have been collected.

Results from the continuous recording data sondes offer a much more complete picture of how water quality varies throughout the day as well as between discrete sampling events. From the data gathered between June 2002 and September 2002, trends in some water quality parameters can be seen that are not apparent from the grab samples.

Diurnal variations in water temperature, pH and dissolved oxygen concentrations are most evident. Often these 3 parameters are strongly correlated. With few exceptions, concentrations of important parameters rarely fall outside the acceptable range for most native aquatic organisms. However, dissolved oxygen, pH, and water temperature have been shown to change very dramatically within a 24 hour period and given the proper climatic conditions poor water quality conditions could result. Graphs of sondes data are located in Appendix D.

Based on limited post-project data, it appears that the water quality has improved as a result of project construction. The lower water velocities would seem to benefit fish that might over-winter in the side channel being sampled. Also, there appears to be less suspended sediment being transported down this channel.

b. Reduce Sedimentation in Side Channels. No sediment transects were performed for this PER. Since Canton Chute was dredged extra sediment transects were added to the monitoring plan. Sedimentation transects are scheduled for the 2004 PER.

c. Increase Aquatic Habitat Diversity. The aquatic habitat diversity was evaluated. An electrofishing survey was performed on August 6, 2002. The survey collected fish in the upper, middle, and lower sections of O'Dell Chute. None of the optional electrofishing survey areas were surveyed. A summary of the results is located in Appendix E. There were at least 18 different species collected, and 7 sport species. Yearly electrofishing surveys will be coordinated with the IDNR and will be compared to this PER to see the trends.

6. EVALUATION OF WETLAND AND TERRESTRIAL HABITAT OBJECTIVES

a. Maintain Terrestrial Habitat. The shoreline and island protection feature was not monitored for this PER, but should be included in the 2004 PER.

b. Increase Bottomland Hardwood Diversity and Reduce Forest Fragmentation. The contractor is responsible for maintenance of the reforestation feature until all planting is complete and a final inspection finds the work acceptable. After the final inspection approval, there will be no further replanting of trees. Survival and growth of mast trees will then be monitored by the U.S. Army Corps of Engineers, Rock Island District through annual inspections of the planting sites. The results of those inspections will be discussed in future PERs.

7. OPERATION AND MAINTENANCE SUMMARY

a. Operation. According to the O&M manual, there are no operation requirements for the Long Island Division HREP.

b. Maintenance. No inspections have been performed; therefore there are no maintenance issues to address in this PER. An inspection of Long Island Division project will be performed in the summer of 2003.

8. CONCLUSIONS AND RECOMMENDATIONS

- a. **Project Goals, Objectives, and Management Plan.** Data and observations collected since project completion was limited. See Table 8.1. Continued data collection will better define the levels to which these goals and objectives are being met.

| Table 8-1. Project Goals and Objectives | | | |
|---|--|---------------------------------|------------------|
| Goals | Objectives | Project Features | Objective Status |
| Enhance Aquatic Habitat | Improve habitat for overwintering fish | Side channel dredging | Evaluated Once |
| | Reduce sedimentation in side channels | Emergent closure structure | Not evaluated |
| | Increase aquatic habitat diversity | Shoreline and island protection | Not evaluated |
| Enhance Wetland and Terrestrial Habitat | Maintain terrestrial habitat | Shoreline and island protection | Not evaluated |
| | Increase bottomland hardwood diversity and reduce forest fragmentation | Reforestation | Not evaluated |

- b. **Post-Construction Evaluation and Monitoring Schedules.** In general, project monitoring efforts have been performed according to the Resource Monitoring and Data Collection Summary, Post-Construction Phase (Appendix C) and the Post-Construction Monitoring Plans (Appendix B). The next comprehensive Post-Construction PER will be completed in fiscal year 2004, two years after construction is substantially complete.

- c. **Project Operation and Maintenance.** There are no operation and maintenance recommendations or conclusions for this PER.

9. PROJECT DESIGN ENHANCEMENT CONSIDERATIONS

Additional shoreline and island protection is planned as part of a Stage II contract. The protection is tentatively planned for the north end of Long Island, the north end and shoreline of La Grange Island. Funding appropriated for the Environmental Management Program will cover the cost for the protection. The purpose of the protection is to preserve additional existing terrestrial habitat by preventing erosion and to increase aquatic habitat diversity near those areas.

APPENDIX A

ACRONYMS

ACRONYMS

| | |
|-------|---|
| CEMVR | Corps of Engineers, Mississippi Valley Division, Rock Island District |
| DO | Dissolved Oxygen |
| DPR | Definite Project Report |
| EMP | Environmental Management Program |
| ER | Engineer Regulation |
| HREP | Habitat Rehabilitation and Enhancement Project |
| IDNR | Iowa Department of Natural Resources |
| MSL | Mean Sea Level |
| O&M | Operation and Maintenance |
| PER | Performance Evaluation Report |
| RM | River Mile |
| USFWS | United States Fish and Wildlife Service |

APPENDIX B

POST-CONSTRUCTION EVALUATION PLAN AND SEDIMENTATION TRANSECT PROJECT OBJECTIVES EVALUATION

TABLE B-1. Post-Construction Evaluation Plan

| Enhancement Potential | | | | | | | | | |
|--|--|--|---|----------------------------|-------------------------|--------------------------|---------------------------------|---|---|
| Goal | Objective | Enhancement Feature | Unit | Year 0 Without Alternative | Year 1 With Alternative | Year 25 With Alternative | Year 50 Target With Alternative | Feature Measurement | Annual Field Observations by Site Manager |
| Enhance Wetland and Terrestrial Habitat | Increase bottomland hardwood diversity | Establish hardwood trees on suitable sites in existing agricultural fields | Percent survival | NA | 100% | 50% | 20% | Tree count/random sample | Estimate effective acreage and wildlife use |
| | Maintain existing terrestrial habitat | Shoreline protection | Linear feet of riprapped shoreline ¹ | 0 | 7700 | 7700 | 7700 | Surveys/aerial photo interpretation/mapping | Maintenance of bottomland hardwood habitat |
| Enhance Aquatic Habitat ² | Increase habitat for over-wintering fish | Restore/protect O'Dell Chute (closure structure plus dredging) | Acres with depth of 6' or greater | 39 | 39 | 39 | 39 | Fish surveys | Fish presence or absence; reports of kills |
| | Reduce sedimentation in side channels | Rock placement along island tips and shorelines | Depth below flat pool at L/D 21 | Varies | -8 | -7 | -6 | Sediment transects | Observed depths in chute |
| | Increase habitat diversity | | Linear feet of riprapped shoreline | 0 | 7700 | 7700 | 7700 | Fish surveys: presence, species/age composition | Presence of fish, fishing activity |

Table B-1. Post-Construction Evaluation Plan

¹ Linear feet include riprapped shoreline for both EMP and channel maintenance work.

² Currently, water quality improvement objectives are not needed for this project. The purpose of monitoring is to ensure that constructing a closure structure does not degrade water quality in O'Dell Chute.

| Table B-2. Sedimentation Transect Project Objectives Evaluation | | |
|--|---|---------------------------------------|
| Transect | Project Objectives to Be Evaluated | |
| | Increase Overwintering for Fish | Reduce Sedimentation in Chutes |
| S-M336.5S-S-M336.5R | X | X |
| S-M335.0X-S-M336.5W | X | X |

Table B-2. Sedimentation Transect Project Objectives Evaluation

APPENDIX C

MONITORING AND PERFORMANCE EVALUATION MATRIX AND RESOURCE MONITORING AND DATA COLLECTION SUMMARY

| Table C-1. Monitoring and Performance Evaluation Matrix | | | | | | |
|---|-----------------------------------|--|---------------------------|--|-----------------------|---|
| Project Phase | Type of Activity | Purpose | Responsible Agency | Implementing Agency | Funding Source | Remarks |
| Pre-Project | Sedimentation Problem Analysis | Define system-wide problem. Evaluate planning assumptions. | USFWS | USGS ¹ (UMESC ²) | LTRM | -- |
| | Pre-Project Monitoring | Identify and define problems at HREP site. Establish need of proposed project features. | Sponsor | Sponsor | Sponsor | -- |
| | Baseline Monitoring | Establish baselines for performance evaluation. | Corps | Field Station or Sponsor through Cooperative Agreements or Corps | HREP / Sponsor | See Table C-2 for implementation information. |
| Design | Data Collection for Design | Include quantification of project objectives, design of project, and development of performance evaluation plan. | Corps | Corps | HREP | See Table C-2 for implementation information |
| Construction | Construction Monitoring | Assess construction impacts; assure permit conditions are met. | Corps | Corps | HREP | See State Section 401 Stipulations. |
| Post-Construction | Performance Evaluation Monitoring | Determine success of project as related to objectives. | Corps / Sponsor | Sponsor and Corps | HREP / Sponsor | See Tables B-1 the complete monitoring plan. |
| ¹ US Geological Survey ² Upper Mississippi Environmental Sciences Center | | | | | | |

Table C-1. Monitoring and Performance Evaluation Matrix

TABLE C-2. Resource Monitoring and Data Collection Summary ¹

| Type Measurement | Water Quality Data | | | | | | Engineering Data | | | Natural Resource Data | | | Sampling Agency | Remarks |
|--|--------------------|---------|--------------|---------|-------------------|---------|-------------------|--------------|-------------------|-----------------------|--------------|-------------------|-----------------|---------|
| | Pre-Project Phase | | Design Phase | | Post-Const. Phase | | Pre-Project Phase | Design Phase | Post-Const. Phase | Pre-Project Phase | Design Phase | Post-Const. Phase | | |
| | Apr-Sep | Oct-Mar | Apr-Sep | Oct-Mar | Jun-Sep | Dec-Mar | | | | | | | | |
| POINT MEASUREMENTS | | | | | | | | | | | | | | |
| <u>Water Quality Stations</u> ² | | | | | | | | | | | | | | |
| Turbidity | 2W | M | | | 2W | M | | | | | | | Corps | |
| Secchi Disk Transparency | 2W | M | | | 2W | M | | | | | | | Corps | |
| Suspended Solids | 2W | M | | | 2W | M | | | | | | | Corps | |
| Dissolved Oxygen | 2W | M | | | 2W | M | | | | | | | Corps | |
| Specific Conductance | 2W | M | | | 2W | M | | | | | | | Corps | |
| Water Temperature | 2W | M | | | 2W | M | | | | | | | Corps | |
| pH | 2W | M | | | 2W | M | | | | | | | Corps | |
| Total Alkalinity | 2W | M | | | 2W | M | | | | | | | Corps | |
| Chlorophyll | 2W | M | | | 2W | M | | | | | | | Corps | |
| Velocity | 2W | M | | | 2W | M | | | | | | | Corps | |
| Water Depth | 2W | M | | | 2W | M | | | | | | | Corps | |
| Ice Thickness | - | M | | | - | M | | | | | | | Corps | |
| Snow Depth | - | M | | | - | M | | | | | | | Corps | |
| Wind Direction | 2W | M | | | 2W | M | | | | | | | Corps | |
| Wind Velocity | 2W | M | | | 2W | M | | | | | | | Corps | |
| Wave Height | 2W | M | | | 2W | M | | | | | | | Corps | |
| Air Temperature | 2W | M | | | 2W | M | | | | | | | Corps | |
| Percent Cloud Cover | 2W | M | | | 2W | M | | | | | | | Corps | |
| Elutriate Analysis ³ | | 1 | | | | | | | | | | | Corps | |
| <u>Boring Stations</u> ⁴ | | | | | | | | | | | | | | |
| Geotechnical Borings | | | | | | | 1 | | | | | | Corps | |

Table C-2. Resource Monitoring and Data Collection Summary

| Table C-2 (Continued) Resource Monitoring and Data Collection Summary | | | | | | | | | | | | | | |
|--|--------------------|---------|--------------|---------|-------------------|---------|-------------------|--------------|-------------------|-----------------------|--------------|-------------------|-----------------|---------|
| Type Measurement | Water Quality Data | | | | | | Engineering Data | | | Natural Resource Data | | | Sampling Agency | Remarks |
| | Pre-Project Phase | | Design Phase | | Post-Const. Phase | | Pre-Project Phase | Design Phase | Post-Const. Phase | Pre-Project Phase | Design Phase | Post-Const. Phase | | |
| | Apr-Sep | Oct-Mar | Apr-Sep | Oct-Mar | Apr-Sep | Oct-Mar | | | | | | | | |
| TRANSECT MEASUREMENTS | | | | | | | | | | | | | | |
| <i>Sedimentation Transects</i> ⁵ Hydrographic Soundings | | | | | | | 1 | 1 | 5Y | | | | Corps | |
| AREA MEASUREMENTS | | | | | | | | | | | | | | |
| <i>Mast Tree Survey</i> ⁶ | | | | | | | | | | 1 | 1 | 5Y | Corps | |
| <i>Mapping</i> ⁷ | | | | | | | | | | | | | | |
| Aerial Photography/ Remote Sensing | | | | | | | | | | | 1 | | Corps | |

Table C-2 (Continued). Resource Monitoring and Data Collection Summary

LEGEND

W = Weekly

M = Monthly

Y = Yearly

nW = n-Week interval

nY = n-Yearly interval

1,2,3, --- = number of times data is collected within designated project phase

TABLE C-2 (Continued)
Resource Monitoring and Data Collection Summary

¹ See plates 12 and 13 for monitoring sites; plates 10 and 11 for boring locations.

² Water Quality Stations

Pre-Project

W-M336.6S, W-M333.8Q, W-M333.0N, W-M332.7M, W-M333.3K

Post-Project

W-M336.6S

³ Elutriate Analysis

E-M366.1M, E-M334.2N, E-M333.4M

⁴ Corps of Engineers Geotechnical Borings

| Station Code | Geotechnical Boring | Date |
|--------------|-----------------------|--------------------|
| GD-94-1 | Long Island Lake | February 8, 1994 |
| GD-96-1 | O'Dell Chute | September 19, 1996 |
| GD-96-2 | O'Dell Chute | September 19, 1996 |
| GD-96-3 | O'Dell Chute | September 19, 1996 |
| GD-96-4 | O'Dell Chute | September 19, 1996 |
| GD-96-5 | Shandrew Island Chute | September 19, 1996 |
| GD-96-6 | Shandrew Island Chute | September 19, 1996 |
| GD-96-7 | Shandrew Island Chute | September 19, 1996 |
| GD-96-8 | Shandrew Island Chute | September 19, 1996 |
| GD-96-9 | Shandrew Island Chute | September 19, 1996 |
| GD-96-10 | Shandrew Island Chute | September 19, 1996 |
| GD-96-11 | Shandrew Island Chute | September 19, 1996 |

⁵ Sedimentation Transects

Pre-Project Phase

SM337.0U, SM337.0S, SM336.5S, SM336.6K, SM336.6L, SM336.5R, SM336.4F, SM336.4H, SM335.2G, SM335.2F, SM334.1N, SM334.1M, SM332.8L, SM 332.8K

Post-Project Phase

SM336.5S, SM336.5R, SM335.X

⁶ Mast Tree Survey (Post-Construction Phase)

⁷ Mapping (Pre-Construction Phase)

April 1994 Color Aerial Photography

July 1995 Infrared Aerial Photography

November 1995 Black and White Aerial Photography

September 1996 Color Oblique Photography

Brown's photographs and maps for these river miles also were reviewed (dated early 1930's)

APPENDIX D
WATER QUALITY DATA

| Table D-1. Results of Samples Taken Near the Water Surface. | | | | | | |
|---|-------------|-------------------|------------------|---------------|-----------------|------------------|
| Water quality monitoring results from samples collected at site W-M336.6S. | | | | | | |
| DATE | WATER DEPTH | VELOCITY (FT/SEC) | WAVE HEIGHT (CM) | AIR TEMP (°C) | CLOUD COVER (%) | WIND SPEED (MPH) |
| 4/14/1990 | 0.792 | - | 0 | 11 | - | - |
| 5/9/1990 | 1.402 | 1.930 | 0 | 18 | - | - |
| 5/26/1990 | 1.402 | 1.930 | 0 | 18 | - | - |
| 6/9/1990 | 1.966 | 0.649 | 0 | 29 | - | - |
| 8/5/1990 | 3.078 | 2.440 | 3 | 27 | - | - |
| 8/19/1990 | 1.905 | 1.660 | 3 | 31 | - | - |
| 9/16/1990 | 1.539 | 0.968 | 0 | 22 | - | - |
| 9/30/1990 | 0.914 | 0.129 | 3 | 15 | - | - |
| 7/18/1991 | 2.438 | - | - | 28 | 0 | 0 |
| 7/23/1991 | 2.134 | 0.550 | 15 | 34 | 0 | 10 |
| 8/6/1991 | 1.981 | 0.900 | 0 | 29 | 10 | 0 |
| 8/20/1991 | 1.524 | 0.200 | 0 | 27 | 5 | - |
| 9/11/1991 | 1.311 | 0.100 | 0 | 26 | 100 | 0 |
| 9/17/1991 | 1.372 | 0.200 | 9 | 24 | 90 | <5 |
| 9/30/1991 | 0.732 | 0.000 | 0 | 20 | 0 | 0 |
| 10/18/1991 | 1.067 | 0.010 | 24 | 13 | 100 | 10 |
| 10/22/1991 | 1.402 | 0.020 | 18 | 26 | 0 | 10 |
| 11/15/1991 | 1.524 | 0.600 | 6 | 8 | 100 | 10 |
| 12/4/1991 | 1.676 | 0.500 | 0 | -7 | 0 | 0 |
| 4/7/1992 | 1.829 | * | 0 | 14 | 95 | 0 |
| 5/5/1992 | 3.139 | 1.530 | 3 | 14 | 20 | 8 |
| 5/19/1992 | 0.991 | 1.150 | 0 | 27 | 20 | 0 |
| 7/23/1992 | 1.859 | 1.813 | 0 | 26 | 100 | 0 |
| 8/13/1992 | 1.311 | 1.137 | 0 | 18 | 70 | 2 |
| 8/27/1992 | 0.914 | 0.107 | 0 | 21 | 100 | 0 |
| 9/17/1992 | 1.585 | 1.727 | 0 | 23 | 90 | 0 |
| 10/8/1992 | 0.747 | 0.424 | 3 | 9 | 95 | 20 |
| 10/27/1992 | 0.975 | 0.863 | 0 | 12 | 0 | 3 |
| 11/24/1992 | 3.261 | 2.332 | 0 | 4 | 100 | 0 |
| 1/25/1993 | 1.661 | 1.572 | 0 | 1 | 10 | 0 |
| 10/27/1993 | 1.067 | 1.534 | 0 | 12 | 85 | 0 |
| 11/10/1993 | 1.387 | 0.782 | 0 | 5 | 10 | 0 |
| 3/23/1994 | 1.981 | 1.792 | 3 | 17 | 20 | 15 |
| 4/19/1994 | 1.311 | 1.557 | 3 | 21 | 15 | 1 |
| 5/10/1994 | 2.926 | 2.392 | 0 | 24 | 0 | 5 |
| 5/24/1994 | 1.707 | 1.693 | 0 | 28 | 70 | 3 |
| 6/18/2002 | 2.435 | 0.950 | 0 | 28 | 75 | 0 |
| 7/2/2002 | 1.480 | - | 0 | 32 | 80 | 0 |
| 7/18/2002 | 1.340 | 0.000 | 1 | 33 | 35 | 1 |
| 8/1/2002 | 1.110 | - | 1 | 34 | 15 | 4 |
| 8/14/2002 | 0.800 | 0.000 | 1 | 27 | 10 | 1 |
| 8/29/2002 | 1.290 | 0.000 | 1 | 27 | 50 | 0 |
| 9/10/2002 | 0.800 | 0.060 | 0 | 27 | 55 | 2 |
| 9/25/2002 | 0.750 | - | 1 | 21 | 0 | 0 |
| 12/17/2002 | 0.670 | - | - | 8 | 100 | 1 |
| MIN. | 0.670 | 0.000 | 0 | -7 | 0 | 0 |
| MAX. | 3.261 | 2.440 | 24 | 34 | 100 | 20 |
| AVG. | 1.544 | 0.953 | 2 | 20 | 47 | 3 |
| * Meter malfunction ** Not applicable, ice cover *** Too windy to take measurement **** Too dark to measure ***** Field/Laboratory accident | | | | | | |

| Table D-1. continued. | | | | | |
|---|-------------------|--------------------|-------------------------------|---------|--|
| Water quality monitoring results from samples collected at site W-M336.6S. | | | | | |
| DATE | WIND DIRECTION | WATER TEMP (°C) | DISSOLVED OXYGEN (MG/L) | PH (SU) | TOTAL ALKALINITY (MG/L) as CaCO3 |
| 4/14/1990 | - | 9.0 | 15.10 | 8.80 | 144 |
| 5/9/1990 | - | 17.0 | 8.60 | 7.40 | 120 |
| 5/26/1990 | - | 17.0 | 8.60 | 7.40 | 120 |
| 6/9/1990 | - | 21.0 | 7.70 | 7.80 | 140 |
| 8/5/1990 | - | 25.0 | 7.70 | 8.30 | 152 |
| 8/19/1990 | - | 27.0 | 9.00 | 8.60 | 174 |
| 9/16/1990 | - | 23.0 | 8.90 | 8.10 | 162 |
| 9/30/1990 | - | 19.0 | 8.90 | 8.00 | 160 |
| 7/18/1991 | - | 29.5 | 12.10 | 8.13 | 164 |
| 7/23/1991 | NW | 30.0 | 13.00 | 8.22 | 164 |
| 8/6/1991 | - | 25.5 | 10.98 | 7.96 | 154 |
| 8/20/1991 | NW | 25.2 | 9.93 | 7.50 | 158 |
| 9/11/1991 | - | 26.5 | 7.35 | 7.35 | 158 |
| 9/17/1991 | SE | 25.0 | 9.35 | 7.43 | 168 |
| 9/30/1991 | - | 18.0 | 9.83 | 7.07 | 160 |
| 10/18/1991 | NW | 13.0 | 11.00 | 7.22 | 154 |
| 10/22/1991 | SW | 14.9 | 11.89 | 7.40 | 159 |
| 11/15/1991 | NW | 4.0 | 11.20 | * | * |
| 12/4/1991 | - | -0.5 | 12.33 | * | * |
| 4/7/1992 | - | 8.1 | 12.86 | 8.24 | 163 |
| 5/5/1992 | NW | 16.0 | * | 8.32 | 129 |
| 5/19/1992 | - | 22.7 | 11.63 | 8.64 | 159 |
| 7/23/1992 | - | 24.8 | 7.08 | 7.65 | 168 |
| 8/13/1992 | NW | 24.8 | 6.43 | 8.09 | 179 |
| 8/27/1992 | - | 23.6 | 7.91 | 8.30 | 187 |
| 9/17/1992 | - | 21.8 | 6.13 | * | 140 |
| 10/8/1992 | SW | 16.1 | 7.91 | 8.08 | 155 |
| 10/27/1992 | SE | 11.9 | 12.65 | 8.59 | 166 |
| 11/24/1992 | - | 5.3 | * | 8.08 | 164 |
| 1/25/1993 | - | 0.2 | 13.62 | 8.45 | 200 |
| 10/27/1993 | - | 11.7 | 13.60 | 8.90 | 189 |
| 11/10/1993 | - | 7.9 | 17.33 | 9.33 | 175 |
| 3/23/1994 | S | 7.4 | 12.32 | 8.33 | 174 |
| 4/19/1994 | NW | 14.6 | 15.04 | 9.18 | 139 |
| 5/10/1994 | S | 15.9 | 10.29 | 8.02 | 129 |
| 5/24/1994 | S | 23.8 | 11.09 | 8.77 | 164 |
| 6/18/2002 | - | 23.1 | 8.03 | 7.60 | 139 |
| 7/2/2002 | - | 30.0 | 9.23 | 8.10 | 138 |
| 7/18/2002 | SE | 32.6 | 18.90 | 8.90 | 149 |
| 8/1/2002 | S | 33.0 | 17.52 | 8.90 | 182 |
| 8/14/2002 | S | 29.6 | 9.48 | 8.60 | 151 |
| 8/29/2002 | - | 28.5 | 7.07 | 7.60 | 133 |
| 9/10/2002 | NW | 28.8 | 11.60 | 8.50 | 147 |
| 9/25/2002 | - | 21.3 | 12.55 | 8.60 | 154 |
| 12/17/2002 | SE | 4.8 | 22.70 | * | 152 |
| MIN. | - | -0.5 | 6.13 | 7.07 | 120 |
| MAX. | - | 33.0 | 22.70 | 9.33 | 200 |
| AVG. | - | 19.1 | 11.08 | - | 157 |
| * Meter malfunction ** Not applicable, ice cover *** Too windy to take measurement **** Too dark to measure ***** Field/Laboratory accident | | | | | |

| Table D-1. continued. | | | | |
|---|---|---------------------------|--------------------|----------------------------|
| Water quality monitoring results from samples collected at site W-M336.6S. | | | | |
| DATE | SPECIFIC CONDUCTANCE (µMHOS/CM @ 25°C) | SECCHI DISK DEPTH (CM) | TURBIDITY (NTU) | SUSPENDED SOLIDS (MG/L) |
| 4/14/1990 | 391 | 36.6 | 26 | 44.0 |
| 5/9/1990 | 364 | 15.2 | 100 | 150.0 |
| 5/26/1990 | 364 | 15.2 | - | - |
| 6/9/1990 | 413 | 18.3 | 100 | 140.0 |
| 8/5/1990 | 421 | 22.9 | 83 | 140.0 |
| 8/19/1990 | 454 | 41.1 | 40 | 87.0 |
| 9/16/1990 | 444 | 27.4 | 35 | 60.0 |
| 9/30/1990 | 439 | 25.9 | 32 | 53.0 |
| 7/18/1991 | 441 | 48.8 | 35 | 53.0 |
| 7/23/1991 | 445 | 33.5 | 32 | 51.0 |
| 8/6/1991 | 436 | 27.4 | 34 | 43.0 |
| 8/20/1991 | 446 | 30.5 | 46 | 62.0 |
| 9/11/1991 | 452 | 30.5 | 24 | 28.0 |
| 9/17/1991 | 453 | 27.4 | 64 | 60.0 |
| 9/30/1991 | 444 | 30.5 | 68 | 49.0 |
| 10/18/1991 | 439 | 24.4 | 58 | 96.0 |
| 10/22/1991 | 430 | 30.5 | 36 | 53.0 |
| 11/15/1991 | 414 | 18.3 | 84 | 87.0 |
| 12/4/1991 | 126 | 39.6 | 99 | 142.0 |
| 4/7/1992 | 394 | 18.3 | 23 | 68.0 |
| 5/5/1992 | 314 | 39.6 | 47 | 170.0 |
| 5/19/1992 | 415 | 35.1 | 17 | 44.0 |
| 7/23/1992 | 480 | 24.4 | 37 | 102.0 |
| 8/13/1992 | 484 | 42.7 | 17 | 37.8 |
| 8/27/1992 | 475 | 45.7 | 16 | 34.1 |
| 9/17/1992 | 367 | 7.6 | 170 | 307.0 |
| 10/8/1992 | 395 | 41.1 | 17 | 29.3 |
| 10/27/1992 | 377 | 39.6 | 15 | 31.6 |
| 11/24/1992 | 375 | 13.7 | 108 | 309.0 |
| 1/25/1993 | 431 | 32.0 | 15 | 28.8 |
| 10/27/1993 | 427 | 39.6 | 17 | 6.2 |
| 11/10/1993 | 368 | **** | 12 | 22.0 |
| 3/23/1994 | 395 | 35.1 | 18 | 62.0 |
| 4/19/1994 | 362 | 30.5 | 31 | 86.0 |
| 5/10/1994 | 326 | 21.3 | 31 | 130.0 |
| 5/24/1994 | 396 | 36.6 | 19 | 60.0 |
| 6/18/2002 | 416 | 18.0 | 115 | 180.0 |
| 7/2/2002 | 441 | 54.0 | 9 | 7.0 |
| 7/18/2002 | 421 | 53.0 | 6 | 10.0 |
| 8/1/2002 | 401 | 41.0 | 13 | 9.0 |
| 8/14/2002 | 416 | 60.0 | 9 | 10.0 |
| 8/29/2002 | 382 | 31.0 | 30 | 16.0 |
| 9/10/2002 | 382 | 37.5 | 15 | 27.0 |
| 9/25/2002 | 377 | 25.0 | 21 | 35.0 |
| 12/17/2002 | 418 | - | 13 | |
| MIN. | 126 | 7.6 | 6 | 6.2 |
| MAX. | 484 | 60.0 | 170 | 309.0 |
| AVG. | 406 | 31.8 | 42 | 74.9 |
| * Meter malfunction ** Not applicable, ice cover *** Too windy to take measurement **** Too dark to measure ***** Field/Laboratory accident | | | | |

| Table D-1. | | | | |
|---|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| Water quality monitoring results from samples collected at site W-M336.6S. | | | | |
| DATE | CHLOROPHYLL a (MG/M3) | CHLOROPHYLL b (MG/M3) | CHLOROPHYLL c (MG/M3) | PHEOPHYTIN a (MG/M3) |
| 4/14/1990 | 74.0 | <1 | 15.0 | 72.0 |
| 5/9/1990 | 14.0 | <1 | 11.0 | 95.0 |
| 5/26/1990 | - | - | - | - |
| 6/9/1990 | 30.0 | 6.0 | 8.0 | 33.0 |
| 8/5/1990 | 102.0 | 3.0 | 12.0 | 11.0 |
| 8/19/1990 | 111.0 | <1 | 10.0 | 14.0 |
| 9/16/1990 | 38.0 | 5.0 | 8.0 | 21.0 |
| 9/30/1990 | 32.0 | <1 | 11.0 | 35.0 |
| 7/18/1991 | 11.6 | <2 | 1.6 | 5.1 |
| 7/23/1991 | 47.5 | 3.8 | 5.5 | 34.3 |
| 8/6/1991 | 57.2 | 4.2 | 6.0 | 33.4 |
| 8/20/1991 | 38.5 | 2.9 | 1.7 | 2.9 |
| 9/11/1991 | 27.7 | 2.6 | 2.7 | 5.6 |
| 9/17/1991 | 65.2 | 7.0 | 8.5 | 7.8 |
| 9/30/1991 | 16.9 | 2.3 | 4.8 | 13.7 |
| 10/18/1991 | 21.9 | 11.4 | <2 | 8.3 |
| 10/22/1991 | 38.3 | 1.4 | 7.3 | 3.2 |
| 11/15/1991 | 7.4 | <2 | 1.2 | 5.2 |
| 12/4/1991 | 14.2 | 2.0 | 3.2 | <2 |
| 4/7/1992 | 55.0 | <1.3 | 4.8 | 17.0 |
| 5/5/1992 | 33.0 | <1.1 | 3.2 | 2.1 |
| 5/19/1992 | 54.0 | 12.0 | <1.5 | 26.0 |
| 7/23/1992 | 16.0 | <6.9 | 29.0 | 26.0 |
| 8/13/1992 | 11.6 | <6.5 | <7.7 | <9.4 |
| 8/27/1992 | 28.4 | <2.1 | <2.4 | 155.0 |
| 9/17/1992 | 211.0 | <2.2 | 12.8 | 116.0 |
| 10/8/1992 | 13.3 | 16.6 | 22.3 | 78.8 |
| 10/27/1992 | 114.0 | <1.3 | 46.3 | 96.1 |
| 11/24/1992 | 43.3 | 23.7 | 40.5 | 43.0 |
| 1/25/1993 | 22.0 | 6.2 | 25.8 | 37.4 |
| 10/27/1993 | 166.0 | 13.0 | 14.3 | <2.7 |
| 11/10/1993 | 108.0 | 6.8 | 12.3 | <2.7 |
| 3/23/1994 | 25.0 | <1 | <1 | 36.0 |
| 4/19/1994 | 252.0 | <1 | 30.0 | 6.8 |
| 5/10/1994 | 50.0 | <1 | 2.6 | 7.4 |
| 5/24/1994 | 80.0 | 4.2 | 8.5 | 28.0 |
| 6/18/2002 | 12.0 | <1 | <1 | 3.1 |
| 7/2/2002 | 24.0 | <1 | <1 | <1 |
| 7/18/2002 | 73.0 | 4.3 | <1 | 9.1 |
| 8/1/2002 | 84.0 | 9.0 | 2.8 | <1 |
| 8/14/2002 | 40.0 | 2.9 | <1 | 6.2 |
| 8/29/2002 | 12.0 | 1.8 | 1.1 | <1 |
| 9/10/2002 | 45.0 | <1 | <1 | <1 |
| 9/25/2002 | 76.0 | <1 | 3.3 | 6.3 |
| MIN. | 7.4 | 1.4 | 1.1 | 2.1 |
| MAX. | 252.0 | 23.7 | 46.3 | 155.0 |
| AVG. | 55.7 | 6.6 | 11.4 | 31.5 |
| * Meter malfunction ** Not applicable, ice cover *** Too windy to take measurement **** Too dark to measure ***** Field/Laboratory accident | | | | |

Long Island Division W-M 336.6S

August 29 - September 10, 2002

Water Temperature

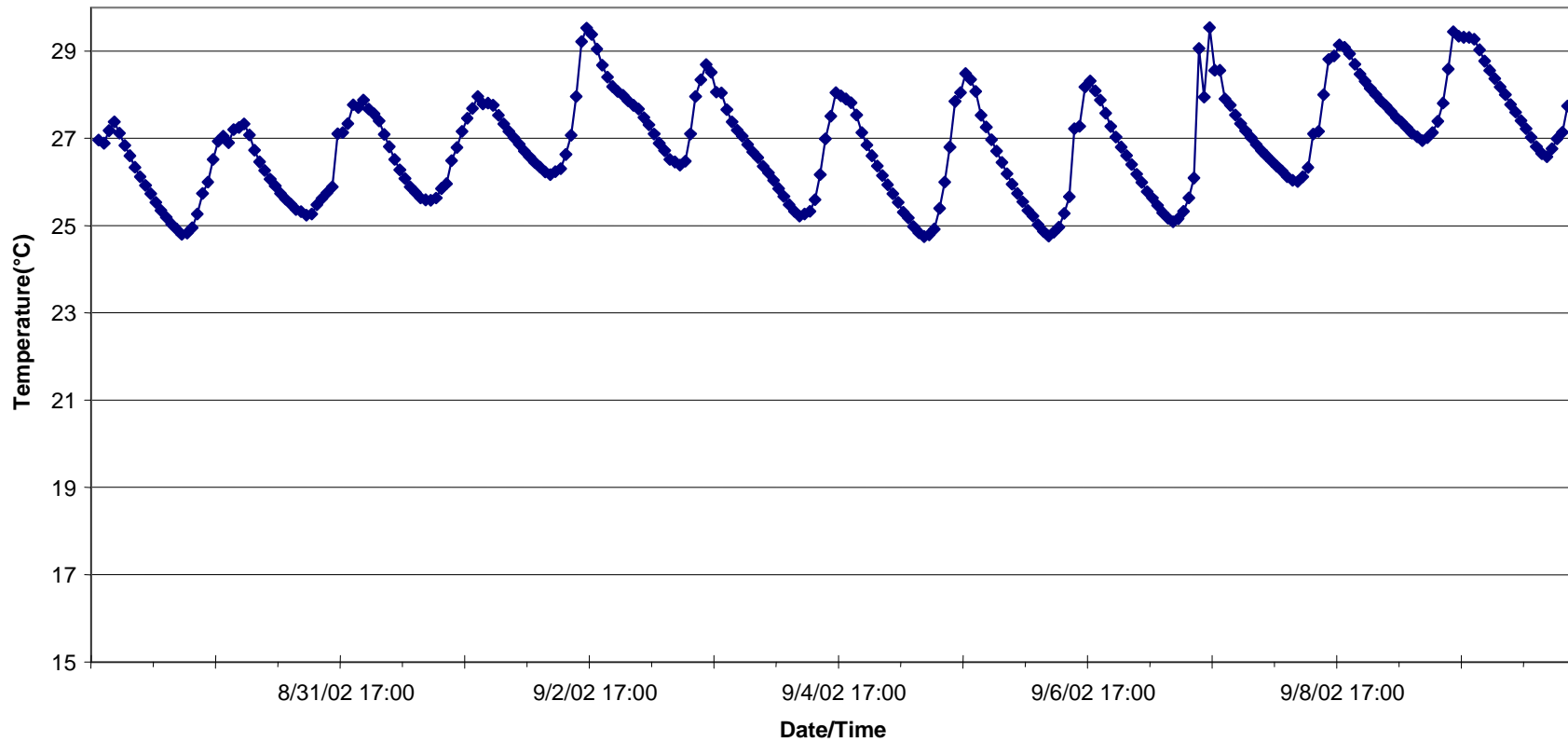


Figure D-1. Water Temperature.

Long Island Division W-M
August 29 - September 10, 2002
Dissolved Oxygen

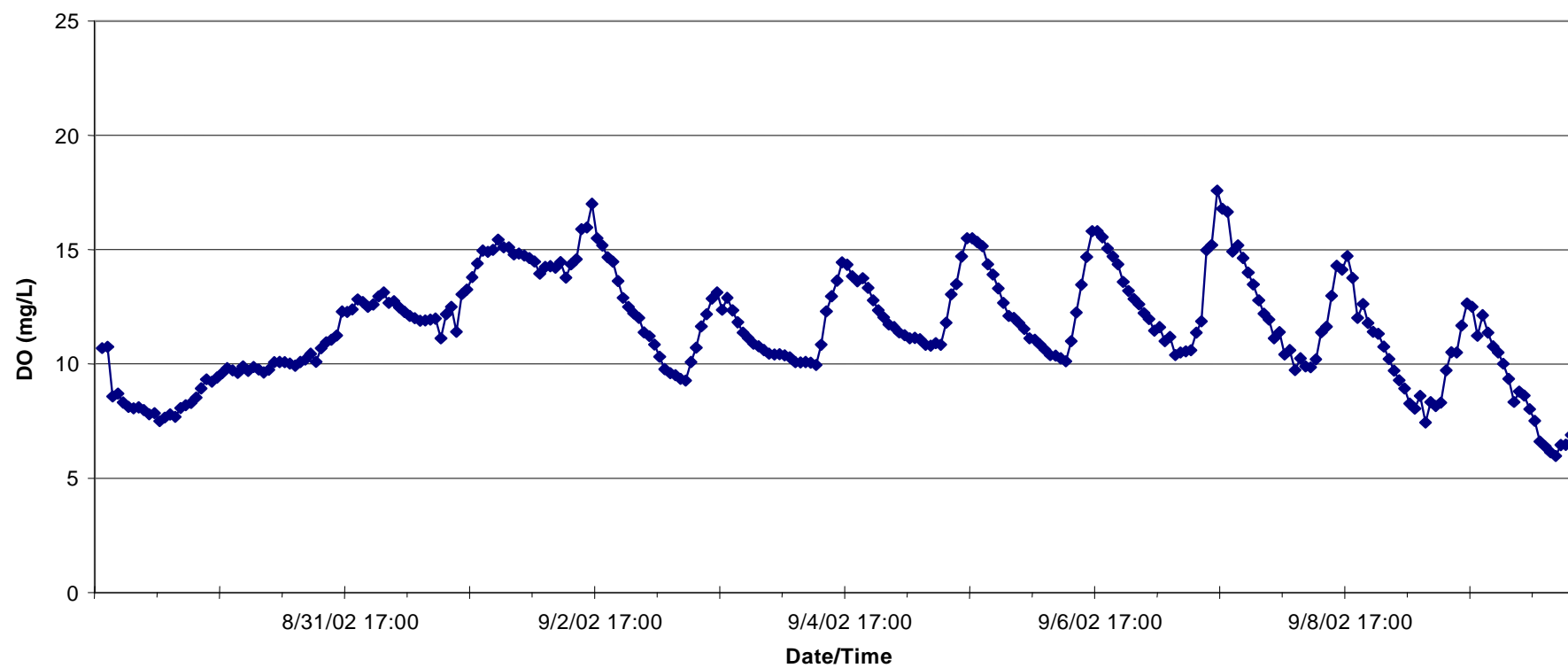


Figure D-2. Dissolved Oxygen.

Long Island Division W-M 336.6S

August 29 - September 10, 2002

pH

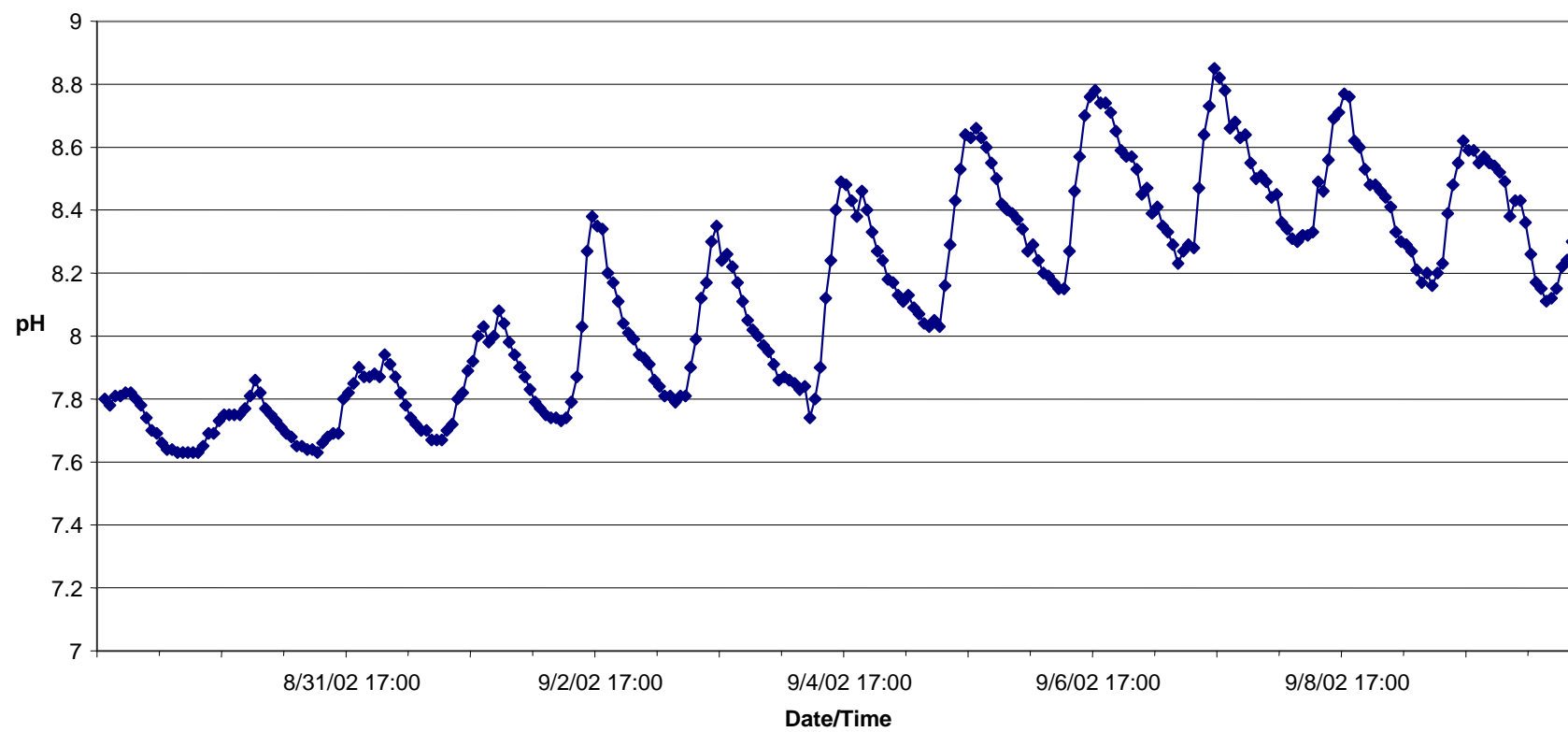


Figure D-3. pH.

Long Island Division W-M 336.6S

August 29 - September 10, 2002

Turbidity

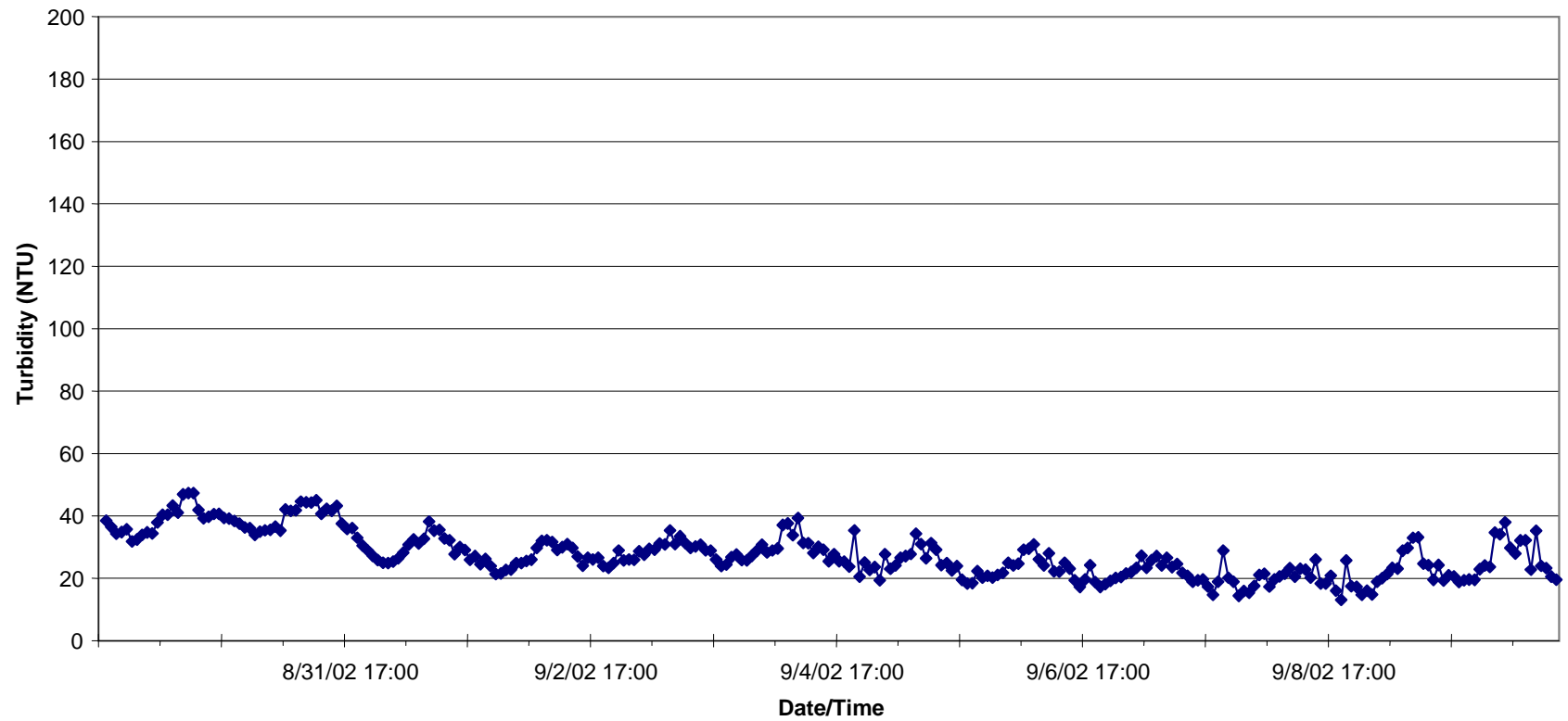


Figure D-4. Turbidity.

Long Island Division W-M 336.6S
Sonde #12
August 29 - September 10, 2002
Paradox Deployment ID
Depth

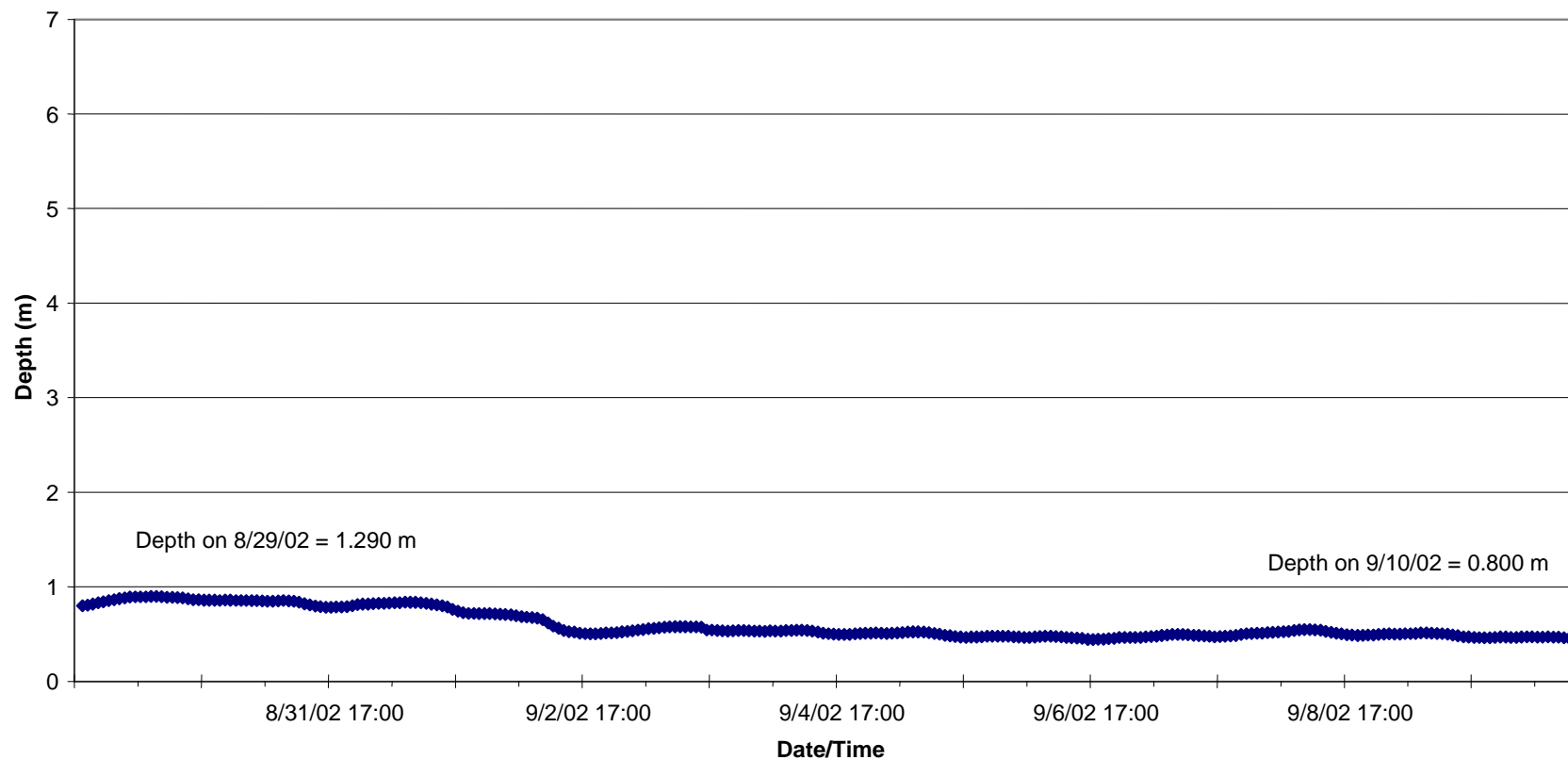


Figure D-5. Depth.

Long Island Division W-M 336.6S
Sonde #12
August 29 - September 10, 2002
Paradox Deployment ID
Dissolved Oxygen - Comp

Offset = -0.975

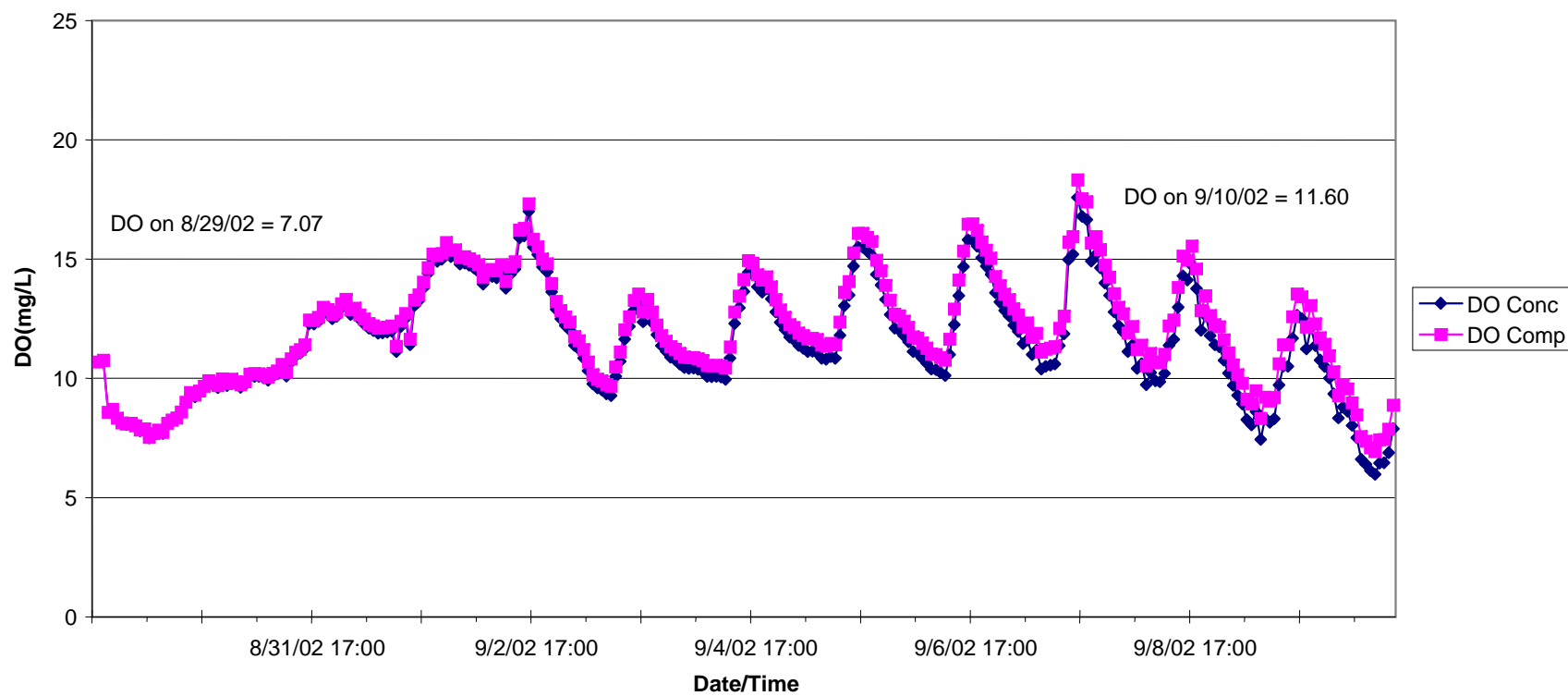


Figure D-6. Dissolved Oxygen – Comp.

APPENDIX E
FISH SURVEY

10/09/02

O'DELL CHUTE

SAMPLED ON 8/06/02

| CODE | STATION | COMMON | NUMBER COLLECTED |
|---------|--------------|-------------------|---------------------|
| 1BED | 20 MINUTES | - Upper | |
| MSR-337 | O'Dell Chute | Bluegill | 5 |
| MSR-337 | O'Dell Chute | Bullhead minnow | 1 |
| MSR-337 | O'Dell Chute | Carp | 6 |
| MSR-337 | O'Dell Chute | Channel catfish | 1 |
| MSR-337 | O'Dell Chute | Gizzard shad | 37 |
| MSR-337 | O'Dell Chute | Largemouth bass | 1 |
| MSR-337 | O'Dell Chute | Orangespotted sun | 1 |
| MSR-337 | O'Dell Chute | River carpsucker | 2 |
| MSR-337 | O'Dell Chute | River shiner | 2 |
| MSR-337 | O'Dell Chute | White bass | 3 |
| 2BED | 20 MINUTES | - middle | |
| MSR-337 | O'Dell Chute | Bluegill | 1 |
| MSR-337 | O'Dell Chute | Carp | 12 |
| MSR-337 | O'Dell Chute | Channel shiner | 2 |
| MSR-337 | O'Dell Chute | Flathead catfish | 1 |
| MSR-337 | O'Dell Chute | Gizzard shad | 24 |
| MSR-337 | O'Dell Chute | Red shiner | 2 |
| MSR-337 | O'Dell Chute | River carpsucker | 2 |
| MSR-337 | O'Dell Chute | Sauger | 1 |
| MSR-337 | O'Dell Chute | Shortnose gar | 1 |
| MSR-337 | O'Dell Chute | Smallmouth buffal | 3 |
| MSR-337 | O'Dell Chute | Spotfin shiner | 1 |
| MSR-337 | O'Dell Chute | White bass | 2 |
| MSR-337 | O'Dell Chute | White crappie | 1 |
| 3BED | 20 MINUTES | - Lower | |
| MSR-337 | O'Dell Chute | Bigmouth buffalo | 1 |
| MSR-337 | O'Dell Chute | Bluegill | 1 |
| MSR-337 | O'Dell Chute | Carp | 6 |
| MSR-337 | O'Dell Chute | Channel catfish | 1 |
| MSR-337 | O'Dell Chute | Flathead catfish | 1 |
| MSR-337 | O'Dell Chute | Gizzard shad | 17 |
| MSR-337 | O'Dell Chute | Largemouth bass | 5 |
| MSR-337 | O'Dell Chute | River carpsucker | 1 |
| MSR-337 | O'Dell Chute | River shiner | 1 |
| MSR-337 | O'Dell Chute | Smallmouth buffal | 1 |
| MSR-337 | O'Dell Chute | White bass | 1 |

APPENDIX F
PROJECT TEAM

| LONG ISLAND DIVISION PROJECT TEAM MEMBERS | | | | | | | | | |
|---|-------------------------|--------|---------------------------------------|-------------|-------|----------|------------------|--------------|--|
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Table F-1. Long Island Division Project Team Members

APPENDIX G

REFERENCES

REFERENCES

Published reports relating to the Long Island Division project or which were used as references in the production of this document are presented below.

(1) Definite Project Report with Integrated Environmental Assessment (R-15F), Gardner Division Habitat Rehabilitation and Enhancement, Upper Mississippi River System Environmental Management Program, Pool 21, Upper Mississippi River, Adam County, Illinois, September 2000. The report marks the conclusion of the planning process and serves as a basis for approval of the preparation of final plans and specifications and subsequent project construction.

(2) Plans and Specifications, Upper Mississippi River System, Environmental Management Program, Pool 21, River Miles 332.5 – 340.2, Gardner Division, Solicitation No. DACW25-01-B-0002. These documents were prepared to provide sufficient detail of project features.

APPENDIX H
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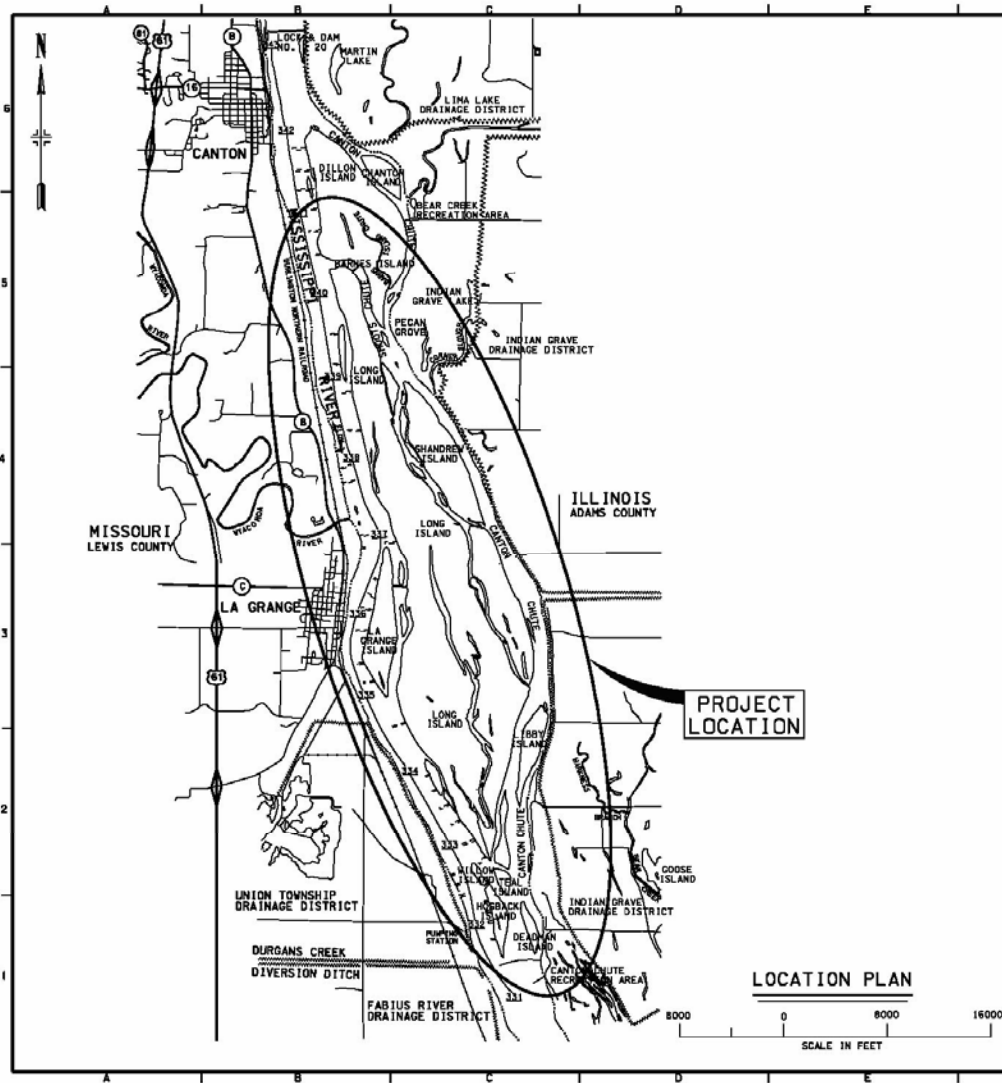
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APPENDIX I

PLATES



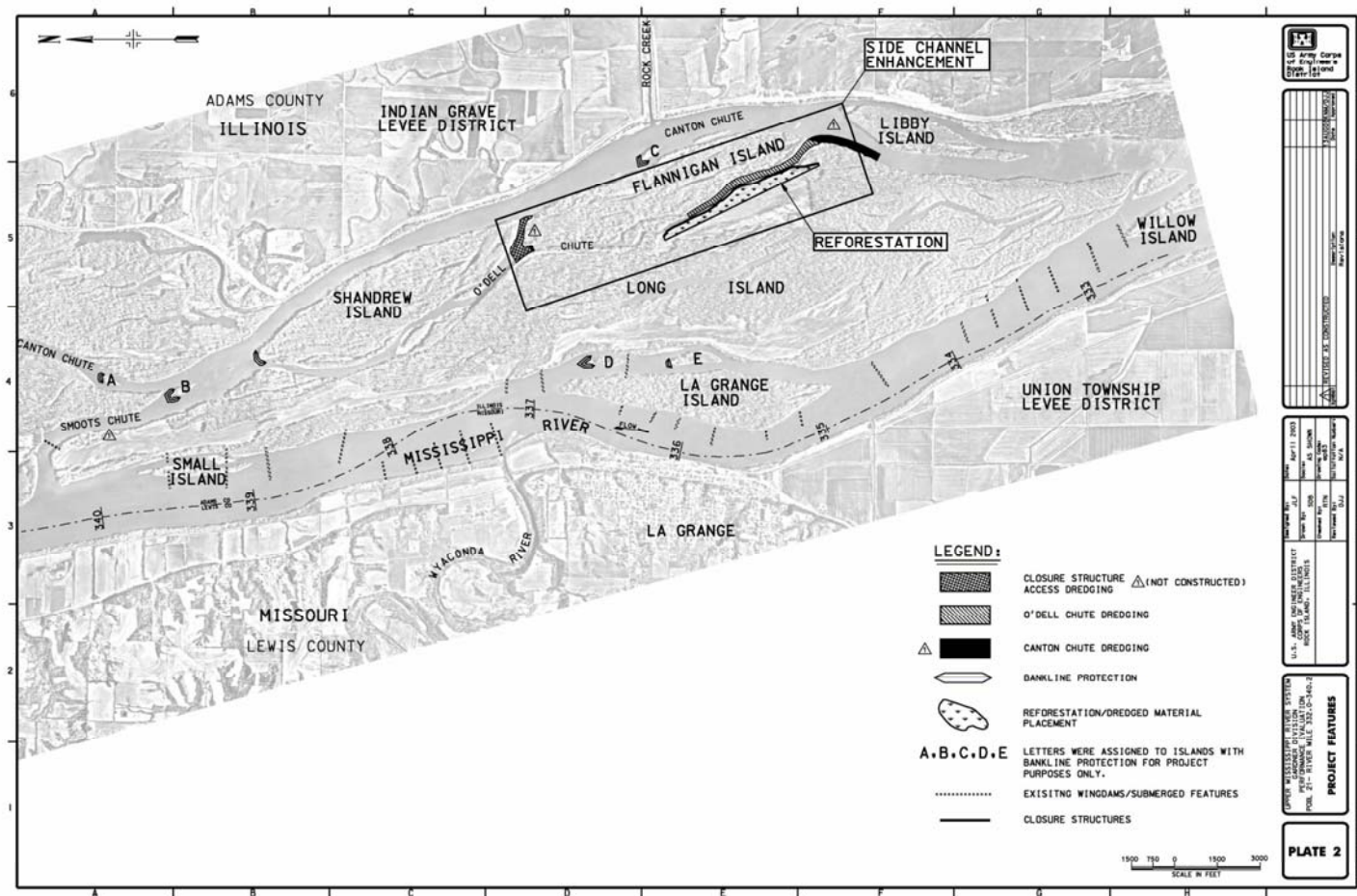
U.S. Army Corps of Engineers
District Office
St. Louis, Missouri

| Project No. | Project Name | Project Location | Project Status |
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PLATE 1



U.S. Army Corps of Engineers
Mississippi River Division
St. Louis, Missouri

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