

UPPER MISSISSIPPI RIVER RESTORATION
ENVIRONMENTAL MANAGEMENT PROGRAM
DEFINITE PROJECT REPORT WITH
INTEGRATED ENVIRONMENTAL ASSESSMENT

**EMIQUON EAST
HABITAT REHABILITATION
AND ENHANCEMENT PROJECT**



NOVEMBER 2014

FINAL



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

LAGRANGE POOL
ILLINOIS WATERWAY
RIVER MILES 121.0 THROUGH 126.0
FULTON COUNTY, ILLINOIS

**UPPER MISSISSIPPI RIVER RESTORATION
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EXECUTIVE SUMMARY

The 5,800 acre *Emiquon East Habitat Rehabilitation and Enhancement Project* (Project) is a Feasibility level study at a site located on the right descending bank of the Illinois River/Illinois Waterway (IWW) between river miles 121 and 126, near Havana, Illinois. The Project is located in Fulton County, IL, approximately 40 miles southwest of Peoria, IL. The Project area encompasses the land and water areas that comprise The Nature Conservancy's Emiquon Preserve within the Thompson Levee and Drainage District. The non-Federal Sponsor (NFS) is The Nature Conservancy (TNC) which owns and operates the property in cooperation with the Thompson Drainage and Levee District (TDLD). This Project is authorized by Section 1103 of the Water Resources Development Act (WRDA) of 1986 (as amended).

The IWW is a large part of the Upper Mississippi River System (UMRS), which represents the largest riverine ecosystem in North America and the third largest in the world. This significant resource encompasses over 2.6 million acres of aquatic, wetland, forest, grassland, and agricultural habitats, supporting more than 300 species of birds; 57 species of mammals; 45 species of amphibians and reptiles; 150 species of fish; and nearly 50 species of mussels. More than 40 percent of North America's migratory waterfowl and shorebirds depend on the food resources and other life requisites (shelter, nesting habitats, etc.) that the UMRS provides. The importance of these resources was recognized by Congress in the Water Resources Development Act of 1986 by its declaration of the UMRS as a "nationally significant ecosystem". Institutional recognition of the significance of this resource was further recognized by Congress' initial and continued authorization of the Environmental Management Program (EMP) for the planning, construction, and evaluation of measures for rehabilitation and enhancement of fish and wildlife habitat in the UMRS.

The IWW historically functioned as a significant resting and foraging area for waterfowl during spring and fall migration. The shallow floodplain lakes provided abundant aquatic and emergent vegetation utilized as food and cover by diverse species of fish, water birds, and other animals. The wide floodplain also supported extensive bottomland forests with a substantial number of pin oaks, pecan, and hickories. This rich and diverse combination of food and cover supported large populations of waterfowl, fishes, and other wildlife. For these reasons, the IWW was once considered one of the most productive riverine systems for fish and wildlife in North America.

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Over the past century, increased human activity within the IWW basin, floodplain, and channel has altered the hydrology, topography, and biotic communities originally present in the Project area. These alterations have reduced native plant and animal populations, degraded the quality of remaining natural resources and plant communities, impaired ecosystem functions, and threaten the future sustainability of the river-floodplain ecosystem.

In 1923, the TDL completed construction on an agricultural levee, thus ending the Emiquon backwater's important biological interrelationship with the Illinois River. Historically, the Project area served as a significant biomass production area of fish, plants, and zoo plankton for the Illinois River system (Havera, et al, 2003). It was an important migratory bird staging area in the Mississippi Flyway (Stafford, 2010), a major food source for local Native Americans, and later was a large commercial inland fishery and waterfowl hunting area prior to its conversion to farmland.

In 2000, TNC announced they had purchased the Project area along with additional adjacent lands. The Project area continued to be farmed while a restoration plan was being developed. In 2006, TNC signed into a Wetland Reserve Program (WRP) agreement with the USDA-Natural Resources Conservation Service (NRCS).

In 2007, in cooperation with the WRP agreement, TNC halted pumping and the water levels began to rise, restoring fishery and wetland habitat in this backwater area. Restoration efforts associated with the WRP easement have yielded a healthy fishery and migratory bird resting and forage area. Although current restoration efforts look promising, scientists found similar restoration efforts at the Illinois River's Hennepin and Hopper Lakes initially demonstrated promising results and then experienced dwindling habitat values due to the inability to manage water levels. Without the ability to effectively manage water levels Hennepin and Hopper Lakes experienced adverse ecological impacts in part due to growing numbers of carp fishes. Common carp and grass carp fish concentrations dramatically increased, which resulted in increased turbidity and loss of vegetation. The TNC has identified that without a reliable way to manage water levels in the Emiquon backwater, and, thereby promoting vegetation growth, and control of nuisance fish species, the ecosystem will substantially degrade over time similar to that experienced at Hennepin and Hopper Lakes.

The Emiquon preserve has been managed for fish, migratory birds and other wetland dwelling species since TNC purchased the Project area. Site management by TNC includes removal of invasive species, planting of native species and intermittent operation of a pump station to support fishery health and to provide reliable food production for migrating waterfowl. The opportunity exists to increase overall preferred habitat quality and quantity by simulating a more natural hydrologic river-floodplain ecosystem. This would include responding to and adaptively managing the ecosystem needs by drawing down water levels to compact sediments and grow aquatic vegetation and increasing water levels to flood invasive woody vegetation and improve fishery habitat.

The goals, objectives, and potential project features to achieve the objectives are shown in table ES-1.

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Table ES-1. Goals, Objectives and Potential Features of the Emiquon East
Habitat Rehabilitation and Enhancement Project

GOAL	OBJECTIVES	POTENTIAL FEATURES
<ul style="list-style-type: none"> • Restore, to the extent practical, quality, functional, floodplain habitat and ecological processes in an Illinois River backwater area • Restore floodplain connectivity from the Illinois River to a productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river 	<ul style="list-style-type: none"> • Restore the natural hydrograph of the Emiquon Preserve/ Illinois River backwater to approximate pre-settlement conditions • Restore native aquatic habitat and ecological processes • Increase the presence of a reliable food source and quality habitat for migratory waterfowl, shorebirds, and other breeding birds • Improve processing of nutrients and sediments by reducing sediment resuspension • Restore river floodplain connectivity to provide habitat and function similar to pre-settlement conditions • Increase connectivity to fish nursery and spawning habitats 	<ul style="list-style-type: none"> • Levee Removal • Water Control Structure / Fish passage structure • Pump Station • Reinforced Levee Spillway • Levee Improvements • Berms/Islands

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For each potential project feature a number of measures were identified that would help achieve an objective. Measures are the specific action component of a Project feature (sometimes thought of as construction actions). Measures are considered the building blocks of project alternatives. The measures associated with the Project features are as follows:

Levee Removal

- LR0: No Action
- LR1: Complete removal
- LR2: Notch levee below flat pool (429 NGVD)
- LR3: Notch levee above avg yearly WSE (437.5 NGVD, median WSE for high spring flows)

Water Control Structure

- W0: No Action
- W1: 7' wide - single gate
- W2: 21' wide – triple gate
- W3: 42' wide – multiple gates
- W4: 175' wide – maximum gates

Pump Station

- P0: No Action
- P1: 45,000 gpm of pumping capacity
- P2: 60,000 gpm of pumping capacity
- P3: 60,000/45,000 gpm of pumping capacity

Reinforced Levee Spillway

- S0: No Action. Leave existing levee at lower elevation
- S1: Articulated concrete mattress and riprap – 1,020-foot width
- S2: Articulated concrete mattress and riprap – 2,190-foot width
- S3: Articulated concrete mattress and riprap – 3,100-foot width
- S4: Reinforced Turf Mat – 1,020-foot width
- S5: Reinforced Turf Mat – 2,190-foot width
- S6: Reinforced Turf Mat – 3,100-foot width
- S7: Reinforced Turf Mat – maximum width (~3,600)
- S8: Fill Spillway to Maximum Levee height
- S9: Partially Fill Spillway with Erodible Sand Material

Levee Rehabilitation

- L0: No Action.
- L1: Restore levee cross-section with rock protection
- L2: Restore levee cross-section by placing material on landward side of levee.
- L3: Restore levee cross-section to accepted design standards
- L4: Install Bioengineering measures to restore riverside toe of levee.

Islands

- I0: No Action
- I1: Construct 5 islands in critical areas
- I2: Construct 10 islands in critical areas

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Evaluation of the Project features and measures was accomplished through application of the Wildlife Habitat Appraisal Guide (WHAG) and Aquatic Habitat Appraisal Guide (AHAG) habitat models. Since the Project features had aquatic and wetland benefits/impacts, the WHAG and AHAG results were combined to produce the final results. The WHAG and AHAG evaluation methodology quantifies annualized habitat output in the form of habitat units that are used in conjunction with Project cost data and functional project life expectancy to compare the construction options of the proposed enhancement features. This incremental analysis identifies which combination of enhancement features would be cost efficient and cost effective. The analysis also shows the changes in cost for increasing levels of environmental output. The Recommended Plan provides 47,322 net Average Annual Habitat Units of habitat.

The Recommended Plan (shown on figure ES-1) includes:

- Constructing a single gate 7-foot wide Water Control Structure with a sill depth of 428ft to facilitate water and fish passage during all probable river stages.
- Construct a 60,000 gallon-per-minute Pumping System to drawdown the Emiquon Preserve during times the river is too high to gravity drain.
- Construct 10 Interior Earthen Islands to reduce resuspension of sediment associated with wind fetch.

Implementation of the Recommended Plan would provide increased water management flexibility and the capability to optimize the quality and quantity of aquatic, wetland, and floodplain habitat at this location.

The Project outputs meet TNC's site management goals and objectives and support the overall goals and objectives of the UMRS-EMP. Per section 107(b) of the 1992 WRDA, the Project's Operation, Maintenance, Repair, Rehabilitation, and Replacement, at an estimated average annual cost of \$67,556, would be accomplished by TNC, the non-Federal Sponsor.

In accordance with the 1999 WRDA, a 35 percent non-Federal cost share will be required for general design and construction costs. The NFS has indicated that they will utilize a combination of land credits and work-in-kind in order to meet their required 35% cost share. A Project Partnership Agreement will be executed consistent with this requirement.

The Corps, Rock Island District, District Engineer (DE), has reviewed the Project outputs, a gain of 47,322 average annual habitat units, and determined that the implementation of the Recommended Plan is in the Federal interest. Therefore, the DE recommends construction approval for the Emiquon East HREP. The estimated total Project cost, including general design and construction management, is \$18,626,000. The estimated total Federal cost is \$12,106,000. The total non-Federal cost share is estimated at \$6,520,000 and will be met by using land credits and work in-kind associated with construction of the pump station and water control structure.

An item of significance worth noting is that this Project is one of the first projects to demonstrate application of the principles highlighted in the Corps/NRCS Memorandum of Understanding as well as those in the Corps/TNC Memorandum of Understanding.

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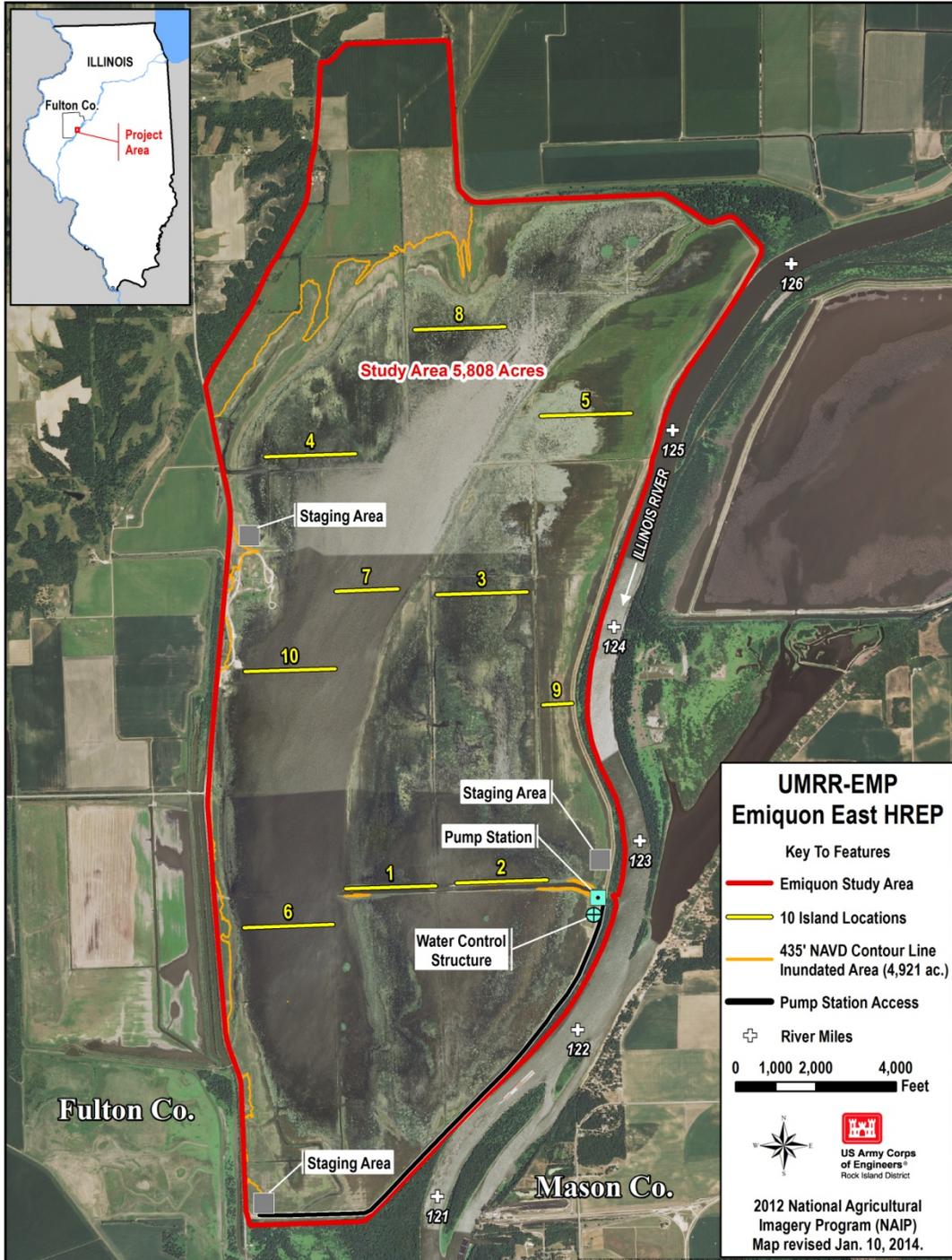


Figure ES-1. Recommended Plan

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ACRONYMS

AFB – Alternative Formulation Briefing
AHAG – Aquatic Habitat Appraisal Guide
AM – Adaptive Management
AMP – Adaptive Management/Monitoring Plan
AMT – Adaptive Management Team
APE – Area of Potential Effect
ATR – Agency Technical Review
CAP – Continuing Authorities Program
CE-ICA – Cost Effectiveness – Incremental Cost Analysis
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CORPS/USACE – United States Army Corps of Engineers
CWA – Clean Water Act
CDE – Constant Dollar Estimate
CU – CUA
DO – Dissolved Oxygen
DPR – Definite Project Report
DQCR – District Quality Control Review
EA – Environmental Assessment
EMP – Environmental Management Program
EO – Executive Order
ER – Engineering Regulation
FFE – Fully Funded Estimate
FONSI – Finding of No Significant Impact
FWOP – Future Without-Project
GPM – Gallons per Minute
HREP – Habitat Rehabilitation and Enhancement Project
HTRW – Hazardous, Toxic and Radioactive Waste
IEPA – Illinois Environmental Protection Agency
IHPA – Illinois Historic Preservation Agency
ILDNR – Illinois Department of Natural Resources
ILDOT – Illinois Department of Transportation
ISWS – Illinois State Water Survey
IWW – Illinois Waterway
LERRD – Lands, Easements, Right-of-ways, Relocations and Disposal
LTRMP – Long Term Resource Monitoring Program

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MCC – Motor Control Center
NEPA – National Environmental Policy Act
NER – National Ecosystem Restoration Plan
NESP – Navigation and Ecosystem Sustainability Program
NFR – No Further Remediation
NFS – Non-Federal Sponsor
NGVD – National Geodetic Vertical Datum
NPDES – National Pollutant Discharge Elimination System
NWR - National Wildlife Refuge
OMRR&R – Operation, Maintenance, Repair, Rehabilitation and Replacement
P&G – *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*
P&S – Plans and Specifications
PDT – Product Delivery Team
PED – Planning, Engineering and Design
PPA – Project Partnership Agreement
REC – Recognized Environmental Condition
SHPO – Illinois State Historic Preservation Office
TDLD – Thompson Drainage and Levee District
TNC – The Nature Conservancy
TWI – The Wetland Initiative
UMRR – Upper Mississippi River Restoration
UMRS – Upper Mississippi River System
USDA-NRCS – United States Department of Agriculture – Natural Resources Conservation Service
USFWS – United States Fish and Wildlife Service
VE – Value Engineering
WLMP – Water Level Management Plan
WHAG – Wildlife Habitat Appraisal Guide
WRDA – Water Resources Development Act
WRP – Wetland Reserve Program
WSE – Water Surface Elevation

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FINDING OF NO SIGNIFICANT IMPACT

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I. INTRODUCTION

A. Location and Stakeholders. The Emiquon East Habitat Rehabilitation and Enhancement Project (HREP) (Project) area is located within the Thompson Drainage and Levee District (TDLD), located in the La Grange Pool immediately northwest of Havana (in Fulton County), Illinois and approximately 40 miles southwest of Peoria, Illinois. The Project area is located on the right descending bank of the Illinois River between river miles (RM) 121 and 126, and between the Illinois River and Highways 78 and 97. Sister Creek flows into the Illinois River immediately upstream of the Project site, and Spoon River enters the Illinois River downstream of the Project site, located approximately 40 river miles upstream from the LaGrange Lock and Dam (figures 1 and 2).

The majority of the land that constitutes the TDLD is a part of The Nature Conservancy's (TNC) larger Emiquon Preserve, consisting of the approximately 6,300 acre TDLD and approximately 500 acres of the 1,200 acre Globe Drainage and Levee District and adjacent areas for a total of approximately 7,134 acres. The U.S. Fish and Wildlife Service (USFWS) manages the Emiquon National Wildlife Refuge [(NWR) approximately 2,200 acres] immediately southwest of the Project area. The USFWS also manages the Chautauqua NWR (approximately 4,500-acre) immediately across the river to the east. In addition, the Illinois Department of Natural Resources (ILDNR) manages approximately 200 acres in the area, encompassing the Dickson Mounds Museum, a National Historic Site. The actual Project area is limited to the approximately 5,800 floodplain acres in the TDLD and would focus on restoring and improving habitat on the approximately 5,000 acres below elevation 435 feet NGVD (figure 2). For the purposes of this Report, all elevation data will be reported in "feet" and will be referenced to vertical datum NGVD 29. NGVD 1929 minus 0.3 ft converts to NAVD 88.

The Project lands are part of the congressionally designated area that may be acquired as part of the USFWS Emiquon NWR area but are currently owned by TNC. Responsibility for operation, maintenance and repair of the lands is with TNC. The Nature Conservancy, a nonprofit non-governmental organization would partner as the non-Federal Sponsor (NFS). In accordance with Section 210 of the Water Resources Development Act (WRDA) 1999, a non-Federal interest may include a nonprofit entity, with the consent of the affected local government. The Nature Conservancy has provided a letter of support from Fulton County who was identified by the Rock Island District as the affected local government requiring consent. This letter of consent is provided in Appendix A, *Correspondence*.

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This Project would be cost-shared in accordance with Section 1103 of the WRDA of 1986 (as amended).

In accordance with Section 1103 of WRDA 1986 (as amended) the NFS share of HREP projects is 35 percent of the total project cost. The NFS must provide all lands required for the restoration Project and is responsible for 100 percent of the operation and maintenance of the completed Project.

The proposed NFS for this Project is The Nature Conservancy. Stakeholders for the Project include:

- Natural Resources Conservation Service
- Thompson Drainage and Levee District
- Illinois Department of Natural Resources
- Illinois Natural History Survey
- Illinois State Water Survey
- United States Fish and Wildlife Service
- Ducks Unlimited
- Illinois Department of Transportation
- University of Illinois – Springfield
- Fulton County
- Mason County
- Havana, IL
- Lewistown, IL
- Fulton County Trails Coalition
- National Scenic Byway Board – Illinois River Road
- Emiquon Community Advisory Council
- Emiquon Science Advisory Council
- Dickson Mounds State Museum
- Illinois State Historic Preservation Office
- Illinois Historic Preservation Agency
- The Nature Conservancy’s Illinois Chapter Science Advisory Committee

B. Purpose & Need. The purpose of this Definite Project Report (DPR) is to present a detailed proposal for the rehabilitation and enhancement of the Emiquon East Preserve. This report provides planning, engineering, and sufficient construction details of the Recommended Plan to allow final design and construction to proceed subsequent to approval of this document.

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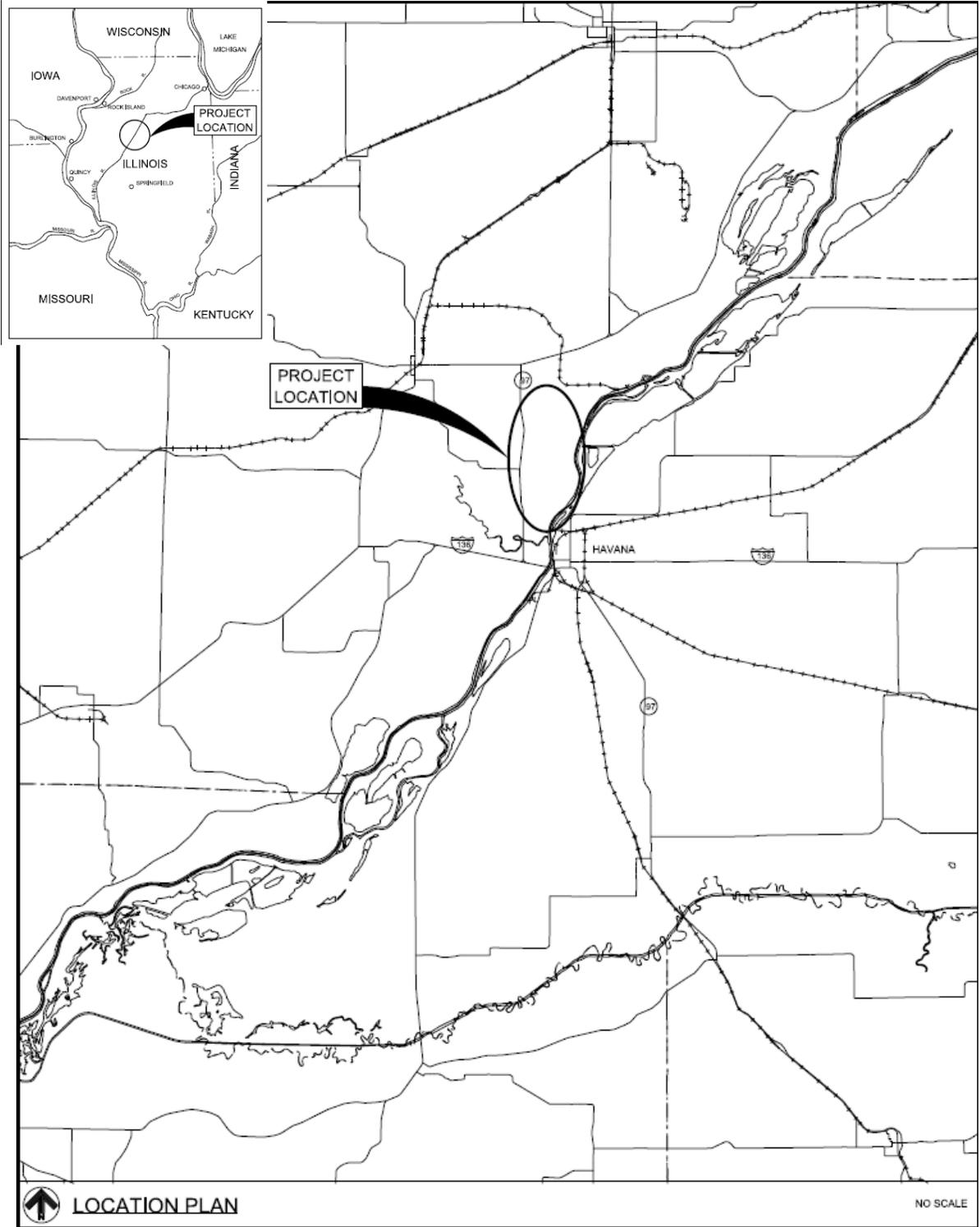


Figure 1. Location and Vicinity Map

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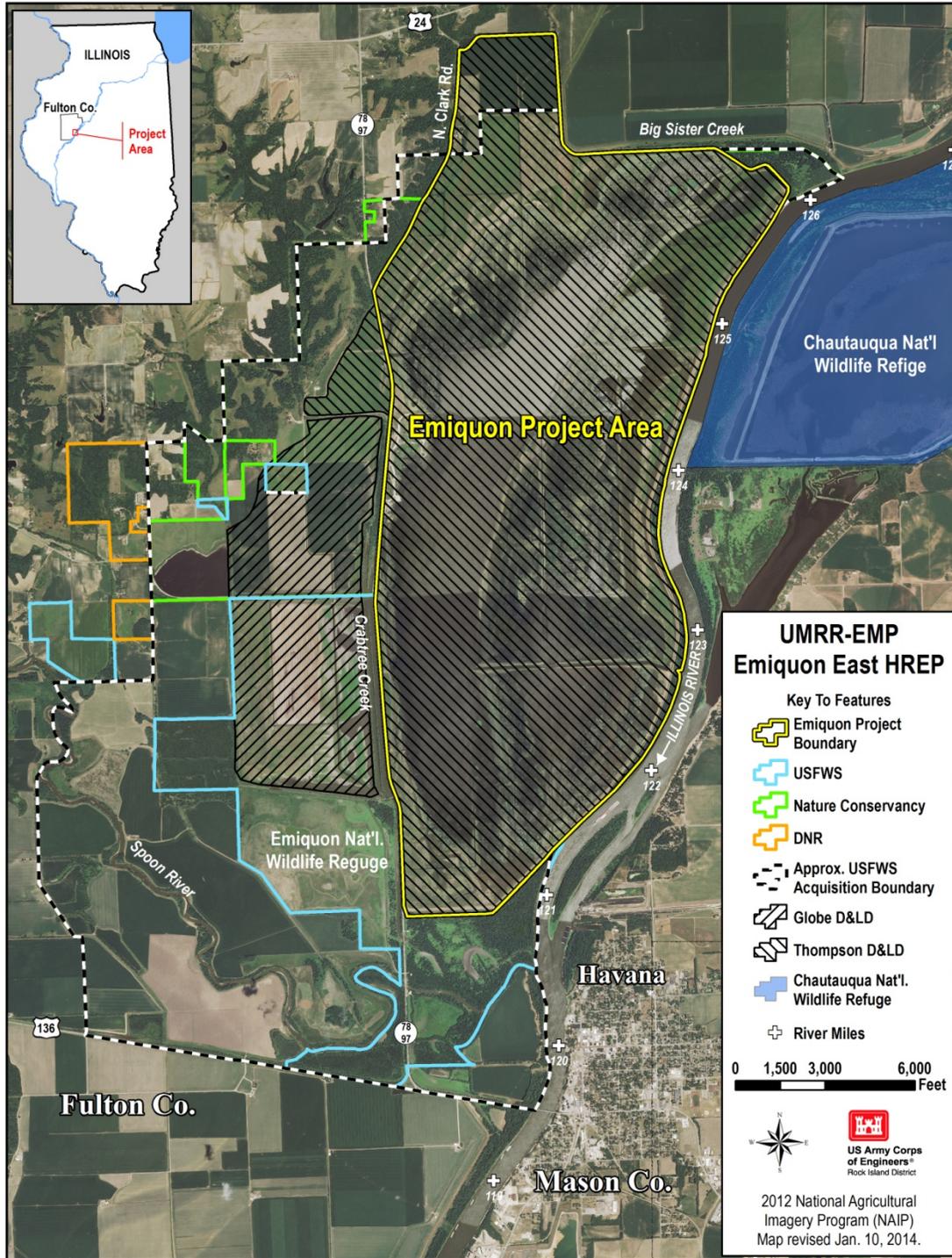


Figure 2. Site Map

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C. Resource Problems and Opportunities. Emiquon East has historically been an excellent fishery and provided valuable mid-migration waterfowl habitat, but conversion of Illinois River floodplain (aquatic, wetland, forest, and prairie) habitat to agricultural uses and loss of ecological connections between the floodplain and the Illinois River have reduced the quality and quantity of habitat available to resident and migratory wildlife and fish species. The loss of floodplain connectivity has eliminated natural flood pulses and has prevented native species from using the floodplain during various life stages and times of the year. Loss of connectivity and ecosystem degradation has also resulted in absent or minimized wetland functions such as: nutrient and sediment processing; carbon sequestration; establishment and maintenance of high-quality wetland habitats; delivery of primary and secondary production to the river; moderation of unnatural hydrology; and increased frequency of unnatural fluctuations.

The primary opportunity is to restore aquatic backwater habitat that has been inaccessible to native river species for nearly 100 years. In addition to the opportunity for connectivity this Project offers the opportunity to enhance wetland health over a long-term period of time through varying water levels to support life stage requirements for migratory birds, wildlife, and fish species in the existing backwaters of the Emiquon East Preserve. This Project also provides an opportunity to be a demonstration project for other levee insulated locations on the Illinois and Mississippi Rivers. Problems and opportunities are further described in Section III. B.

D. Project Selection. Initially, Emiquon East was developed as a project under the Section 206 Continuing Authority Program (WRDA 1996). When estimated costs exceeded the Federal cost share limit for a Section 206 project (\$5 million regularly; \$7.5 million per WRDA 2007 for Emiquon), another program was sought to complete the Project. In July 2013, with the Corps' Mississippi Valley Division (MVD) consent, Emiquon East was migrated into the Environmental Management Program (EMP) to fill a priority slot set aside for the Illinois Waterway (IWW) in 2008 when a list of new projects was developed for future EMP HREPs. The Illinois Department of Natural Resources (ILDNR) concurred with this decision in an email dated September 26, 2013 (see Appendix A). The Environmental Management Program-Coordinating Committee also concurred with this decision at the November 2013 quarterly meeting. The Fish and Wildlife Interagency Committee (FWIC) was briefed on this issue at their August 2013 meeting and the River Resources Coordinating Team will be presented with this plan at their next regular meeting.

E. Scope of Study. The scope of this study focuses on proposed project features that would improve aquatic, and floodplain habitat and enhance overall resource values. The Project is consistent with agency and TNC management goals and was planned for the benefit of resident and migratory birds, fish, and other wildlife.

Field surveys and inventories, aerial photography, Light Detection and Ranging (LiDAR), bathymetry, hydraulic modeling, and habitat quantification procedures were completed to support the planning and assessment of proposed Project alternatives. Soil borings were taken to determine sediment types. Baseline water quality monitoring was performed to define present water quality conditions.

The TNC has made wildlife and resident fish observations within the Project area. These observations, along with future studies and monitoring, will assist in evaluating project performance.

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F. Discussion of Prior Studies, Reports, and Existing Water Projects. The following is a summary of significant related studies and restoration efforts.

Wetland Reserve Program (WRP). In June 2006, TNC enrolled a total of nearly 6,300 acres of the Emiquon Preserve lands into a 30-year conservation easement with the US Department of Agriculture (USDA) through their WRP. The Nature Conservancy, working with the USDA Natural Resources Conservation Service (NRCS), developed a restoration plan for the site. The plan serves as part of the agreement between NRCS and TNC on the management of the site.

Key Attributes and Indicators for Illinois River Conservation Targets at The Nature Conservancy's Emiquon Preserve, TNC, Peoria, IL, April 2006. This document highlights key ecological attributes and sets measurable objectives for these attributes. The Nature Conservancy currently has a number of ongoing monitoring activities, including: plant surveys, water quality, zoo plankton, aquatic insects, and fish. This data is utilized in this feasibility document.

Quiver Island Dredged Material Management Plan. The District was working with TNC on the Quiver Island Dredged Material Management Plan that would result in placement of material along a portion of the existing TDL D levee. The District planned to acquire real estate interests to a total of 71.1 acres, mostly in the southeast corner of the site, to place dredged material from the Quiver Island dredge cut. At this time this site is not planned to be used by the District due to its conversion to a wetland in 2007.

Emiquon East Habitat Restoration Project Preliminary Restoration Plan, Fulton County, IL, Section 206 Preliminary Restoration Plan, Rock Island District, March 2006

Other Corps of Engineers studies along the Illinois River include the ***Illinois River Basin Restoration Comprehensive Plan*** (Section 519 of WRDA 2000) March 2007; the ***Upper Mississippi River – Environmental Management Program***; the ***Upper Mississippi River – Illinois Waterway System Navigation Study*** (including Environmental Objectives Planning Workshops, also known as ENV NAV 50 study); the ***Upper Mississippi River System Flow Frequency Study***; the ***Navigation and Ecosystem Sustainability Program-Emiquon West Project***; and the ***Upper Mississippi River Comprehensive Plan***. The Project is consistent with all of these planning efforts.

An excellent site history is provided by Stephen P. Havera, Katie E. Roat, and Lynn L. Anderson in ***The Thompson Lake/Emiquon Story: The Biology, Drainage, and Restoration of an Illinois River Bottomland Lake***, Illinois Natural History Survey, Special Publication Oct 25, 2003.

A summary of the Illinois State Water Survey's (ISWS) hydrologic data and hydrologic and hydraulic models, which were used to assess existing conditions and evaluate different management alternatives that could be used during the Emiquon restoration was compiled by Misganaw Demmisie, Allen Wehrman, Yanqing Lian, Geremew G. Amenu, Stephen Burch, and William Bogner, in the paper ***Hydrologic and Hydraulic Considerations for the Ecological Restoration of the Emiquon along the Illinois River***, 2005 World Water and Environmental Resources Congress, Anchorage, Alaska. May 2005.

A recent publication, ***Historical and Contemporary Characteristics and Waterfowl Use of Illinois River Valley Wetlands***. Stafford et al, 2010, from the INHS compares the historical and current land characteristics for waterfowl use in the Illinois River Valley.

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The ***Lake Chautauqua Rehabilitation and Enhancement Project located in LaGrange Pool, Illinois Water River Miles 124 through 128***, Mason County, Illinois was constructed across the river from the Project Area. Resources reviewed included the Definite Project Report (June 1991); the 1996 Flood Repair Report (1997); the Performance Evaluation Report (2003); and the O&M Manual (2005). Features constructed in this report were reviewed for applicability to the Project.

The ***Lake Odessa Rehabilitation and Enhancement Project Located in Pools 17 and 18, Upper Mississippi River Miles 435 through 444***, Louisa County, Iowa an ongoing environmental restoration project with similarities to the Project. Feature designs from Lake Odessa were used in the analysis of Emiquon features. Resources reviewed included the Definite Project Report (April 2005) as well as construction drawings from various construction stages of this Project.

The most recent description of groundwater conditions at the Project site was completed by Wehrmann and Burch (2009) in ***Assessment of Groundwater Conditions at the Emiquon Project Area, Fulton County, Illinois***.

The ***Illinois River Basin Restoration Comprehensive Plan with Integrated Environmental Assessment*** identified numerous potential projects in the Illinois River Basin system that have a high restoration potential as defined by their six goals. The Project area is identified as a site with high restoration potential under Goal 3: *Floodplain, Riparian and Aquatic Restoration*.

A River That Works and a Working River. A Strategy for the Natural Resources of the Upper Mississippi River System. The Upper Mississippi River (UMR) Conservation Committee, Rock Island, IL, 2000. This report describes the critical elements of a strategy for the operation and maintenance of the natural resources of the UMR and its tributaries including the setting of restoration goals and objectives.

Upper Mississippi River System Habitat Needs Assessment. Summary Report 2000. Corps, St. Louis District, St. Louis, MO, 2000. The summary report and its supporting technical report were the result of a system-wide analysis of historical, existing, and forecasted habitat conditions. The information in the report was developed to help guide future habitat projects on the Upper Mississippi River System (UMRS).

UMRR-EMP Environmental Design Handbook. Corps, Rock Island District, Rock Island, IL, December 2012. This Design Handbook of the UMRR-EMP evaluates project features and incorporates lessons learned throughout the lifetime of the program. This also discusses ecosystem objectives and how various features can meet these objectives.

Upper Mississippi River Environmental Design Handbook. Corps, Rock Island District, Rock Island, IL, August 2012. This Design Handbook of the UMRR-EMP evaluates project features and incorporates lessons learned throughout the lifetime of the program.

2004 Report to Congress, Upper Mississippi River System Environmental Management Program. Corps, Rock Island District, Rock Island, IL. This report is the first formal evaluation of the UMRR-EMP. This report evaluates the program; describes its accomplishments, including development of a systemic habitat needs assessment; and identifies certain program adjustments.

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2010 Report to Congress, Upper Mississippi River Restoration Environmental Management Program. Corps, Rock Island District, Rock Island, IL. This report is the most recent formal evaluation of the UMRR-EMP that evaluates the program; describes its accomplishments, including development of a systemic habitat needs assessment; and identifies certain program adjustments.

Upper Mississippi River-Illinois Waterway System Navigation Feasibility Study, Feasibility Report 2004. Corps, Rock Island, St. Paul, and St. Louis Districts. This feasibility study examines multiple navigation and environmental restoration alternatives, and contains the preferred integrated plan as a framework for modifications and operational changes to the UMR and the IWW System to provide for navigation efficiency and environmental sustainability.

Environmental Science Panel Report. Establishing System-wide Goals and Objectives for the Upper Mississippi River System. D. Galat, J. Barko, S. Bartell, M. Davis, B. Johnson, K. Lubinski, J. Nestler, and D. Wilcox, UMRS Navigation and Ecosystem Sustainability Program, NESP ENV Report 6, Rock Island, IL 2007. The report presents suggested refinements to system-wide ecosystem goals and objectives and proposed steps to take in the further development of objectives for the system.

Upper Mississippi River Restoration Ecosystem Restoration Objectives, Corps, 2009. This report is the final product of a planning process initiated in 2008 for the purpose of identifying areas for new restoration projects and identifying knowledge gaps at a system scale. The Report serves as a backdrop for the formulation of specific restoration projects and their adaptive ecosystem management components.

G. Authority The UMRR-EMP's original authorizing legislation was the WRDA of 1986 (P.L. 99-662), Section 1103. The UMRR-EMP was originally comprised of five elements: HREPs; Long-Term Resource Monitoring Program (LTRMP); Recreation Projects; Economic Impacts of Recreation; and Navigation Monitoring. Currently, the UMRR-EMP is comprised of two elements: (1) plan, construct, and evaluate measures for fish and wildlife habitat improvement through HREPs; and (2) monitor the natural resources of the river system through the LTRMP. The other UMRR-EMP elements have either been successfully completed or are now carried out under other authorities.

The original authorizing legislation has been amended three times since its enactment. The 1990 WRDA, Section 405, extended the original UMRR-EMP authorization an additional five years to fiscal year 2002, which allowed for ramping up of the program. The 1992 WRDA, Section 107, amended the original authorization by allowing limited flexibility in how funds are allocated between the HREP program and the LTRMP program. The 1992 WRDA also assigned sole responsibility for operation and maintenance (O&M) of habitat Projects to the agency that manages the lands on which the Project is located. The 1999 WRDA, Section 509, and its implementation guidance, amended Section 1103 by (1) adding applied research, (2) establishing an independent technical advisory committee, (3) extending the program life indefinitely, (4) requiring a program evaluation every six years, (5) raising funding limits, (6) requiring a 35 percent non-Federal cost share for projects that require cost sharing, (7) establishing a deadline for completing the habitat needs assessment, (8) requiring the latest habitat needs assessment to be submitted with each program evaluation, and (9) removing funding limits on recreation needs assessments.

The text of the original authorization is as follows:

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Environmental Management Program Authorization

Section 1103 of the Water Resources Development Act of 1986 (P.L. 99-662) as amended by Section 405 of the Water Resources Development Act of 1990 (P.L. 101-640), Section 107 of the Water Resources Development Act of 1992 (P.L. 102-580), Section 509 of the Water Resources Development Act of 1999 (P.L. 106-53), and Section 2 of the Water Resources Development Technical Corrections of 1999 (P.L. 106-109).

WATER RESOURCES DEVELOPMENT ACT OF 1986 P.L. 99-662

SEC. 1103. UPPER MISSISSIPPI RIVER PLAN.

(a)(1) This section may be cited as the "Upper Mississippi River Management Act of 1986".

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system. Congress further recognizes that the system provides a diversity of opportunities and experiences. The system shall be administered and regulated in recognition of its several purposes.

(b) For purposes of this section --

(1) the terms "Upper Mississippi River system" and "system" mean those river reaches having commercial navigation channels on the Mississippi River main stem north of Cairo, Illinois; the Minnesota River, Minnesota; Black River, Wisconsin; Saint Croix River, Minnesota and Wisconsin; Illinois River and Waterway, Illinois; and Kaskaskia River, Illinois;

(2) the term "Master Plan" means the comprehensive master plan for the management of the Upper Mississippi River system, dated January 1, 1982, prepared by the Upper Mississippi River Basin Commission and submitted to Congress pursuant to Public Law 95-502;

(3) the term "GREAT I, GREAT II, and GRRM studies" means the studies entitled "GREAT Environmental Action Team--GREAT I--A Study of the Upper Mississippi River", dated September 1980, "GREAT River Environmental Action Team--GREAT II--A Study of the Upper Mississippi River", dated December 1980, and "GREAT River Resource Management Study", dated September 1982; and

(4) the term "Upper Mississippi River Basin Association" means an association of the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, formed for the purposes of cooperative effort and united assistance in the comprehensive planning for the use, protection, growth, and development of the Upper Mississippi River System.

(c)(1) Congress hereby approves the Master Plan as a guide for future water policy on the Upper Mississippi River system. Such approval shall not constitute authorization of any recommendation contained in the Master Plan.

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(2) Section 101 of Public Law 95-502 is amended by striking out the last two sentences of subsection (b), striking out subsection (i), striking out the final sentence of subsection (j), and redesignating subsection "(j)" as subsection "(i)".

(d)(1) The consent of the Congress is hereby given to the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, or any two or more of such States, to enter into negotiations for agreements, not in conflict with any law of the United States, for cooperative effort and mutual assistance in the comprehensive planning for the use, protection, growth, and development of the Upper Mississippi River system, and to establish such agencies, joint or otherwise, or designate an existing multi-State entity, as they may deem desirable for making effective such agreements. To the extent required by Article I, section 10 of the Constitution, such agreements shall become final only after ratification by an Act of Congress.

(2) The Secretary is authorized to enter into cooperative agreements with the Upper Mississippi River Basin Association or any other agency established under paragraph (1) of this subsection to promote and facilitate active State government participation in the river system management, development, and protection.

(3) For the purpose of ensuring the coordinated planning and implementation of programs authorized in subsections (e) and (h)(2) of this section, the Secretary shall enter into an interagency agreement with the Secretary of the Interior to provide for the direct participation of, and transfer of funds to, the Fish and Wildlife Service and any other agency or bureau of the Department of the Interior for the planning, design, implementation, and evaluation of such programs.

(4) The Upper Mississippi River Basin Association or any other agency established under paragraph (1) of this subsection is hereby designated by Congress as the caretaker of the master plan. Any changes to the master plan recommended by the Secretary shall be submitted to such association or agency for review. Such association or agency may make such comments with respect to such recommendations and offer other recommended changes to the master plan as such association or agency deems appropriate and shall transmit such comments and other recommended changes to the Secretary. The Secretary shall transmit such recommendations along with the comments and other recommended changes of such association or agency to the Congress for approval within 90 days of the receipt of such comments or recommended changes.

(e) Program Authority

(1) Authority

(A) In general. The Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, may undertake, as identified in the master plan

- (i) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement; and
- (ii) implementation of a long-term resource monitoring, computerized data inventory and analysis, and applied research program.

(B) Advisory committee. In carrying out subparagraph (A)(i), the Secretary shall establish an independent technical advisory committee to review projects, monitoring plans, and habitat and natural resource needs assessments.

(2) REPORTS. — Not later than December 31, 2004, and not later than December 31 of every sixth year thereafter, the Secretary, in consultation with the

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Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, shall submit to Congress a report that —

- (A) contains an evaluation of the programs described in paragraph (1);
- (B) describes the accomplishments of each of the programs;
- (C) provides updates of a systemic habitat needs assessment; and
- (D) identifies any needed adjustments in the authorization of the programs.

(3) For purposes of carrying out paragraph (1)(A)(i) of this subsection, there is authorized to be appropriated to the Secretary \$22,750,000 for fiscal year 1999 and each fiscal year thereafter.

(4) For purposes of carrying out paragraph (1)(A)(ii) of this subsection, there is authorized to be appropriated to the Secretary \$10,420,000 for fiscal year 1999 and each fiscal year thereafter.

(5) Authorization of appropriations.—There is authorized to be appropriated to carry out paragraph (1)(B) \$350,000 for each of fiscal years 1999 through 2009.

(6) Transfer of amounts.—For fiscal year 1999 and each fiscal year thereafter, the Secretary, in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, may transfer not to exceed 20 percent of the amounts appropriated to carry out clause (i) or (ii) of paragraph (1)(A) to the amounts appropriated to carry out the other of those clauses.

(7)(A) Notwithstanding the provisions of subsection (a)(2) of this section, the costs of each project carried out pursuant to paragraph (1)(A)(i) of this subsection shall be allocated between the Secretary and the appropriate non-Federal sponsor in accordance with the provisions of section 906(e) of this Act; except that the costs of operation and maintenance of projects located on Federal lands or lands owned or operated by a State or local government shall be borne by the Federal, State, or local agency that is responsible for management activities for fish and wildlife on such lands and, in the case of any project requiring non-Federal cost sharing, the non-Federal share of the cost of the project shall be 35 percent.

(B) Notwithstanding the provisions of subsection (a)(2) of this section, the cost of implementing the activities authorized by paragraph (1)(A)(ii) of this subsection shall be allocated in accordance with the provisions of section 906 of this Act, as if such activity was required to mitigate losses to fish and wildlife.

(8) None of the funds appropriated pursuant to any authorization contained in this subsection shall be considered to be chargeable to navigation.

(f) (1) The Secretary, in consultation with any agency established under subsection (d)(1) of this section, is authorized to implement a program of recreational projects for the system substantially in accordance with the recommendations of the GREAT I, GREAT II, and GRRM studies and the master plan reports. In addition, the Secretary, in consultation with any such agency, shall, at Federal expense, conduct an assessment of the economic benefits generated by recreational activities in the system. The cost of each such project shall be allocated between the Secretary and the appropriate non-Federal sponsor in accordance with title I of this Act.

(2) For purposes of carrying out the program of recreational projects authorized in paragraph (1) of this subsection, there is authorized to be appropriated to the Secretary not to exceed \$500,000 per fiscal year for each of the first 15 fiscal years beginning after the effective date of this section.

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(g) The Secretary shall, in his budget request, identify those measures developed by the Secretary, in consultation with the Secretary of Transportation and any agency established under subsection (d)(1) of this section, to be undertaken to increase the capacity of specific locks throughout the system by employing nonstructural measures and making minor structural improvements.

(h)(1) The Secretary, in consultation with any agency established under subsection (d)(1) of this section, shall monitor traffic movements on the system for the purpose of verifying lock capacity, updating traffic projections, and refining the economic evaluation so as to verify the need for future capacity expansion of the system.

(2) Determination.

(A) In general. The Secretary in consultation with the Secretary of the Interior and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, shall determine the need for river rehabilitation and environmental enhancement and protection based on the condition of the environment, project developments, and projected environmental impacts from implementing any proposals resulting from recommendations made under subsection (g) and paragraph (1) of this subsection.

(B) Requirements. The Secretary shall

(i) complete the ongoing habitat needs assessment conducted under this paragraph not later than September 30, 2000; and

(ii) include in each report under subsection (e)(2) the most recent habitat needs assessment conducted under this paragraph.

(3) There is authorized to be appropriated to the Secretary such sums as may be necessary to carry out this subsection.

(i) (1) The Secretary shall, as he determines feasible, dispose of dredged material from the system pursuant to the recommendations of the GREAT I, GREAT II, and GRRM studies.

(2) The Secretary shall establish and request appropriate Federal funding for a program to facilitate productive uses of dredged material. The Secretary shall work with the States which have, within their boundaries, any part of the system to identify potential users of dredged material.

(j) The Secretary is authorized to provide for the engineering, design, and construction of a second lock at locks and dam 26, Mississippi River, Alton, Illinois and Missouri, at a total cost of \$220,000,000, with a first Federal cost of \$220,000,000. Such second lock shall be constructed at or in the vicinity of the location of the replacement lock authorized by section 102 of Public Law 95-502. Section 102 of this Act shall apply to the project authorized by this subsection.

II. AFFECTED ENVIRONMENT

Resources that are discussed for the Project area within the scope of the Project authority include: land use and infrastructure, hydrologic and hydraulic conditions, natural resources (wetland resources, aquatic resources, migratory birds, state and federally-listed threatened or endangered species, and invasive species), socioeconomic resources, cultural resources, water quality, and hazardous, toxic, and radioactive waste (HTRW).

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A. Resource History of the Study Area. The IWW historically functioned as a significant resting and foraging area for waterfowl during spring and fall migration. The shallow floodplain lakes provided abundant aquatic and emergent vegetation utilized as food and cover by diverse species of fish, water birds, and other animals. The wide floodplain also supported extensive bottomland forests with a substantial number of pin oaks, pecan, and hickories. This rich and diverse combination of food and cover supported large populations of waterfowl, fishes, and other wildlife. For these reasons, the IWW was once considered one of the most productive riverine systems for fish and wildlife in North America.

The Project area was one of the largest and most recognized bottomland areas in the Illinois River Valley. The most notable historic features of the site are Thompson Lake and Flag Lake, which were created through a complex series of geological events in the Illinois River floodplain. Flag Lake was the shallower of the two lakes and had a large wetland complex associated with it. Thompson Lake was a deeper lake, and both lakes provided rich habitat for fish, waterfowl, and other native species. Small channels connected the two lakes to each other and to the Illinois River.

Thompson Lake was reported to be approximately 1,740 acres in size in an 1842 survey of the site (Havera, 2003 referenced Submerged and Shore Lands Legislative Investigative Committee 1911). Figure 3 shows a Government Land Office map of the Project area in 1871 and notes the diversity of habitats including Thompson Lake, sloughs connecting to the Illinois River, and swamps and forested areas.

From 1900 to 1907, a diversion was constructed in the Chicago area to route water from Lake Michigan into the Illinois River, causing the water levels in the lake to increase an average of 3.6 feet, and as a result the summer expanse of the lake averaged 1,943 acres before 1900, and 5,072 acres afterward. Figure 4 shows a 1912 map of the Project area, and clearly shows an increase in the size of open water in Thompson and Flag Lakes. The increase in the size of the lake further improved the aquatic resources, and Thompson Lake soon became known as “the most famous and useful breeding ground for the various fish that abound in the Illinois River, and also a wonderful feeding ground for ducks while pursuing their migratory flights...” (Havera 2003, referenced Submerged and Shore Lands Legislative Investigative Committee 1911). According to historic records from the INHS, Thompson Lake produced about 300 pounds per acre per year of fish and spawned enough young fish to stock all the surrounding waters (Havera 2003).

Although Thompson Lake was a prized fishery and waterfowl hunting area for the local community near Havana, other people saw an opportunity for economic development and agricultural crop production. After extensive legal battles between the general public and private landowners, the State of Illinois Supreme Court ruled in 1917 that Thompson Lake was private property and was subject to drainage. In 1919, efforts to drain Thompson Lake and construct a 13.5 mile long levee around the district were initiated. On April 13, 1923, the *Mason County Democrat* (Havera 2003) reported, “Take your last look at Thompson Lake. Soon it will be a large area of farm land. For several years they have been working on the levee. The lake will not be there very long.”

Upon completion of the levee in 1923, the site was dewatered and planted for crop production. The first cultivation occurred in 1924 (Havera 2003, referenced from Oswalt 1972, Thompson 1989) and the Project area remained in agricultural crop production for over 80 years. The once productive ecological resource became productive and fertile farmland. On May 1, 2000, TNC announced that

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they had purchased 6,661 acres of the historic Thompson and Flag Lake area. After being purchased by TNC in 2000, the area remained in agricultural production while they developed a comprehensive restoration plan. In 2006, TNC and USDA-NRCS signed a WRP agreement to convert the Emiquon area back to a wetland. In 2007, pumping was halted and the water levels began to rise, which has already started to reestablish native vegetation. As restoration efforts continue, the lakes and surrounding area will be restored to provide much of the highly productive habits that historically existed.

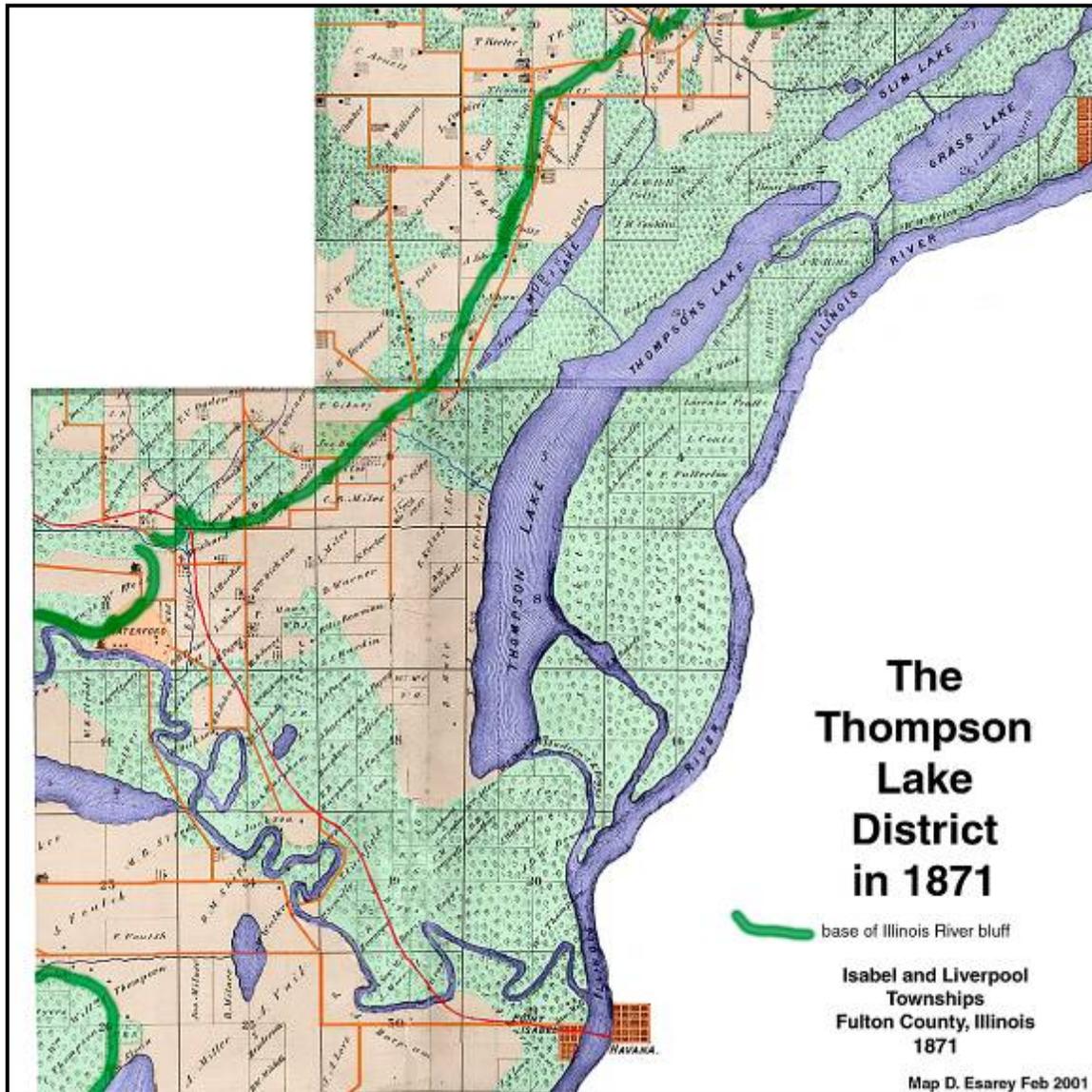


Figure 3. 1871 Government Land Office Map of the Project Area

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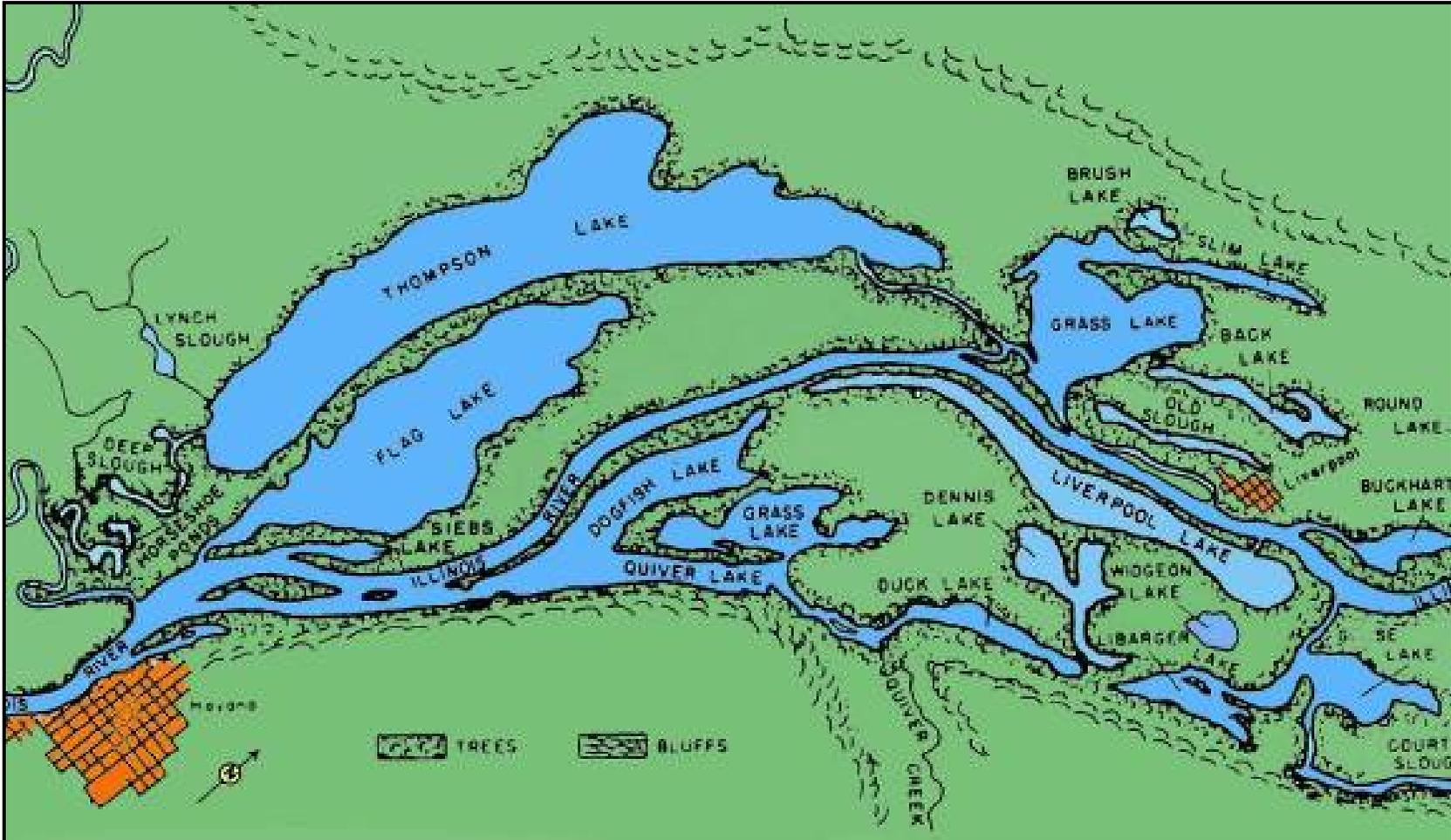


Figure 4. 1912 Map of Emiquon Area

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B. Description of Project Area and Current Management. In 2007, TNC converted the land use from agriculture (corn, soybeans, and wheat production) to an open water wetland. The adjacent lands are either agricultural lands or managed as wildlife habitat by the USFWS.

The Project area is generally surrounded by the TDL D levee, essentially cutting off connectivity to the Illinois River for approximately 5,800 floodplain acres. This drainage levee system was constructed between 1919 and 1923, as a non-Federal project. The levee lies on the right bank of the Illinois River approximately between RM 120.9 and 125.9. The levee is approximately 64,950 feet long and ties into high ground on the northern and southern ends. The levee has a top elevation of 455-456 feet NGVD 1929. However, approximately 3,600 feet along the southern end of the levee is lower than the rest of the levee, allowing it to act as a spillway. The lowest elevation along this southern end is approximately 452 feet. This elevation is 0.3 ft lower than the 2.0 percent chance exceedance flood (50-year) elevation. The levee consists of silty clay, clay, silt, clayey sand, silty sand, and sand according to the 1995 TDL D O&M Manual. Recent borings identified primarily fat clay soils with trace sands within the levee as are shown on the plates in Appendix Q and described in Appendix G, *Geotechnical Considerations*.

During the last PL84-99 eligibility inspection report, the levee had erosion along the river side slope; unwanted riverside levee growth; substandard sod on the riverside slope; encroachments including scattered light to heavy woody debris on the riverside slopes; ruts in the levee crown; and unused capped culverts in the levee crown. Many of these conditions are still present.

The TDL D has one pumping station. The pump station has three pumps. Two are exterior located Couch vertical pumps and one is a horizontal flat belt diesel driven pump. The horizontal pump is located within the pump station building. An additional horizontal pump and diesel engine is located in the building and is used only for parts. The building associated with the pump station has stucco/concrete walls and a metal framed structure with a concrete foundation. The roof of the pump station is a pitched metal roof. In 1997, following a pump station inspection conducted as part of a Corps annual levee inspection, the overall rating for the pump station was Unacceptable.

The following information was provided in the 1997 Corps Annual Levee Inspection Report:

Thompson Pump Station (3 Pumps Total; 2 exterior & 1 interior)

Pump	Motor/Driver	Motor RPM	Reduction	Pump RPM	Flow Rate GDMTDH (ft)
Exterior 30" N&S	Siemens-Allis	710	1:1	710	30,000@30.8
Couch Pump Co:	Model/Type: Unknown				
Vertical Pump:	350 HP, 460 Volts, 60 Cy, 476 Amps, 3 Ph				
Stages: 2:	S/N: 7-5117-17559-1-1				
S/N:5598/5599:	7-5117-17559-1-2				
Pump Hours:	30" North – 8200hrs; 30" South – 13,900 hrs				

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Pump	Motor/Driver	Motor RPM	Reduction	Pump RPM	Flow Rate GDMTDH (ft)
Interior 24" Horizontal	Fairbanks Morse	300	Unknown	Unknown	Approx. 24,000 @ 15-20
Unknown: Type/Model: 32E14					
Horizontal Volute: 225 HP, Belt: Length 76', Width 15 1/4"					
S/N: 823361					
Pump Hours: 24" horizontal – unknown					

Higher water levels may result in significant damage to the pump's electric motors. The pump house which houses the electrical controls for the pumps would be inundated at about 434 feet NGVD.

The TDLD experienced damage or breaching from significant floods in 1945-1958, 1973, 1979, 1982, and 1994. In 1990, the District considered the TDLD eligible to be enrolled in the PL84-99 rehabilitation and inspection program. However, a 2000 flood control works inspection report determined maintenance of the flood control works was unacceptable and no longer eligible for federal assistance under Public Law 84-99. The District's subsequent December 2002 eligibility inspection determined that the Flood Control Works continued to be inactive and ineligible for repair assistance under the PL 84-99 Program.

The Illinois Department of Transportation (ILDOT) maintains State Highway 78/97, a two-lane highway along the western portion of the Project. An underground gas line also runs throughout the Project.

Other existing infrastructure in the Project site includes power lines that serve the pump station. Ameren-CILCO's above ground power poles were inundated following the conversion of land use in the area. Since no improvements to these poles had occurred, in 2009, the power poles running to the pump station began to lean and fail. Power was cut to the pump station until spring of 2010 when TNC hired a contractor to direct bury a power line into the southern half of the levee. The power line was direct buried 3 feet below grade.

C. Hydrologic and Hydraulic Conditions. The Project site is located within the LaGrange Pool and lies approximately 40 river miles upstream of the LaGrange Lock and Dam. The TDLD is located on the right descending bank of the Illinois River between river miles 120.9 and 125.9 and is bordered to the north by Big Sister Creek and to the south by the Spoon River. The west side of the site is bordered by the Highway 78/97 elevated road embankment, limiting the off-site area that contributes runoff to the site to less than 700 acres. Therefore, the greatest component of the hydrologic budget is precipitation falling directly within the TDLD itself.

On the southern end of the levee the elevation drops significantly, allowing this portion of the levee to act as a spillway. The lowest point on the levee is approximately 452 feet and is located along the southern end. This spillway elevation is 0.3 ft lower than the 2.0 percent chance exceedance flood (50-year) elevation. The levee has not been overtopped to date, however flood fighting during past events has been reported. The probability an overtopping event will occur one or more times during the 50-year design life is approximately 73 percent.

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Over 2,000 acres of Emiquon's interior are below elevation 429 feet NGVD and therefore are below the Illinois River flat pool (429.27 feet at RM 123.4). As a result, agricultural production within the TDLR required pumping during the growing season. Prior to 2007, pumping during the growing season maintained the water surface elevation (WSE) between 416-420 feet. By maintaining those elevations, water was confined to the drainage ditches. After harvest, pumping would cease or decline and during fall, water levels were allowed to rise to 422 to 425 feet. Pumping would then resume during the spring to allow for planting. During this period of agricultural production no observations of seepage through the levee were documented.

On April 1, 2007 pumping was ceased, resulting in a post-pumping WSE of approximately 425 feet. During more recent years the site has seen significant rainfall producing higher interior WSEs. The highest WSE the interior has reached since agricultural pumping stopped is 434.4 ft, which occurred in 2010 when power was being restored to the pump station. At that time, the pumps were thought to be nonoperational due to inundation of the motor housing but they were turned on and operated adequately to prevent permanent damage to the pump motors and controls due to flooding of the pump station. Understanding the interaction between surface water and groundwater at Emiquon will help to predict how interior WSEs will respond to a transition from agricultural pumping to management for ecosystem restoration. A study completed by the ISWS in 2009 suggests groundwater from an underlying sand aquifer is preferentially seeping through a confining clay layer in a few locations within the drainage ditches where the clay was penetrated during ditch construction or maintenance. Although there remains some uncertainty as to exactly how much groundwater will contribute to Emiquon's interior water levels, the ISWS study concluded the amount of interior filling at Emiquon as a result of groundwater flow relative to contributions from precipitation is considered to be minor. The study predicts interior water levels will rise to between 432 and 435 feet as a result of groundwater and average rainfall assuming no pumping occurs in the interior.

In the late 1800s, prior to its connection with Lake Michigan, the Illinois River's median annual maximum and minimum WSEs upstream of the pump station (RM 123.4) were 438.3 ft NGVD and 427.6 ft, respectively. The absolute maximum and minimum values at this location were 442.6 ft and 426.1 ft NGVD, respectively. Construction of the LaGrange Lock and Dam around 1940 in addition to levee construction efforts that took place on the Illinois River floodplain from 1900 to 1930 increased the average annual minimum and maximum WSEs at RM 123.4 by almost 2.5 feet and by 4.5 feet, respectively

During the gage period of record there are three distinct hydrologic periods: 1) prior to the diversion of water from Lake Michigan (1878 to 1899); 2) following a court ordered restriction of flow from Lake Michigan (1930) and after the construction of LaGrange Lock and Dam in 1940 (until present); and 3) the time between these two events (1900 - 1930).

Median stage elevations at RM 123.4 for 7 years prior to 1900; from 1900 to 1930; and from 1940 to 2004 are shown in figure 5 to illustrate these differences. During the pre-development hydrologic regime water levels receded during the summer which compacted sediments and allowed moist soil plants to grow. The cumulative effects of land use changes, diversions, dam construction and isolation from the floodplain have resulted in increased water levels during the summer growing period which has ultimately limited wetland and aquatic habitat in the Illinois River and its floodplain. Under an altered hydrologic regime such as the Illinois River's, success in restoring aquatic habitat cannot be achieved by simply notching the levee and allowing water levels to fluctuate with the river itself.

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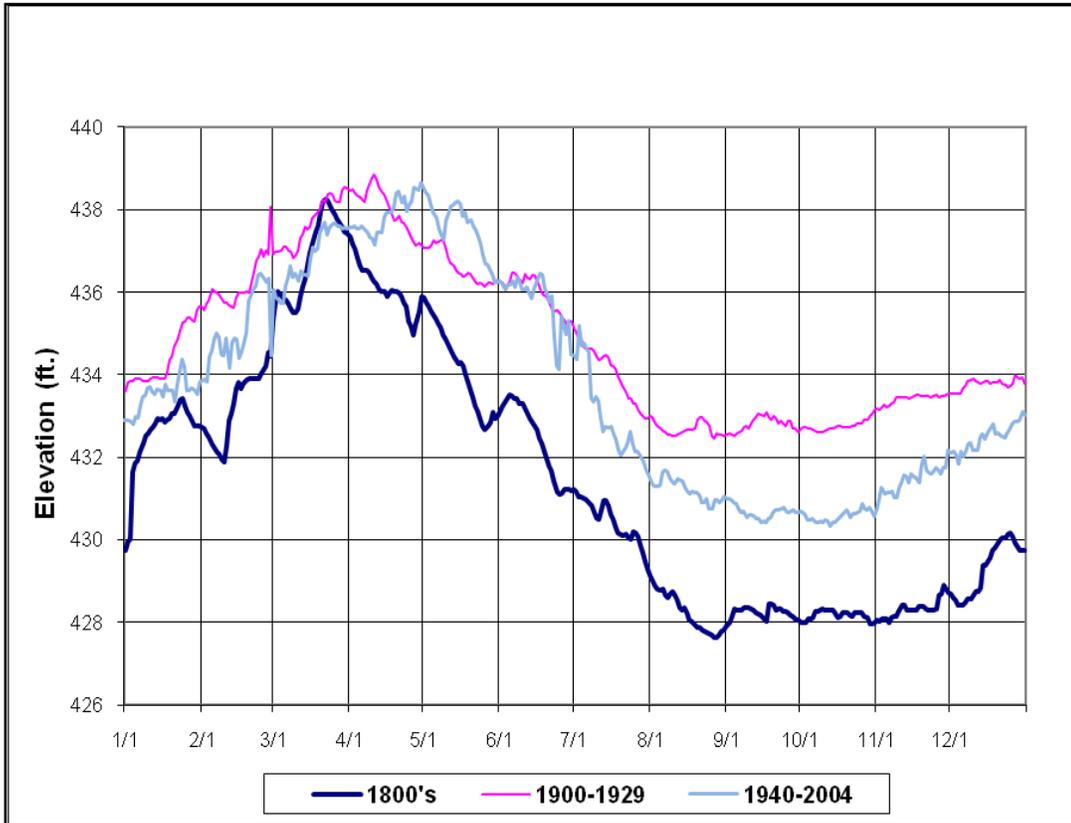


Figure 5. Median Illinois River Water Levels at RM 123.4 for: 1) 7 years in the late 1800s; 2) the period following the diversion from Lake Michigan and prior to LaGrange Dam construction (1900-1929); and 3) during current operations (1940-2004).

D. Wetland Resources. In June 2006, TNC partnered with the USDA-NRCS through their WRP, authorized by the Farm Bill. As part of their partnership in the WRP program, TNC accepted a 30-year conservation easement over approximately 6,300 acres of their property. In 2007, TNC began their wetland restoration efforts. The NRCS Restoration Plan includes planting 1,400 acres of bottomland forest, tall grass prairie, wet prairie, upland forest and wetland. The first step included the planting of 180,000 tree seedlings and the planting of 8,000 pounds of seed. By fall 2007, TNC planted an additional 90,000 upland shrubs and trees. The established trees in the Preserve are being fortified in a timber stand improvement project. These WRP planting and activities are all located above elevation 435 feet. The TNC's restoration activities associated with the NRCS WRP easement are shown in figure 6 and include wet sedge meadow; timber stand improvement, upland hardwood and bottomland hardwood trees; and tall grass prairie.

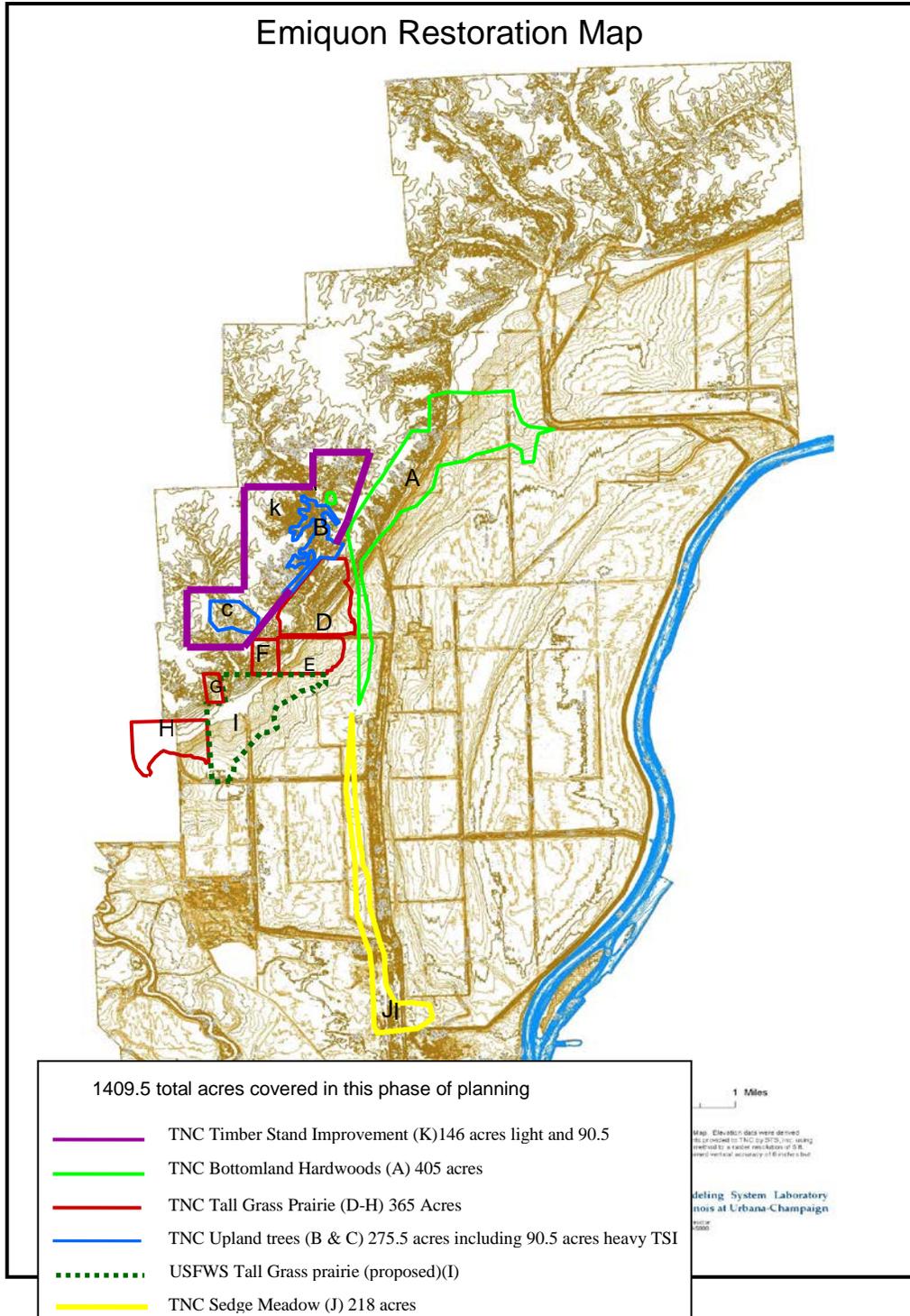


Figure 6. Wetland Reserve Program Restoration Map

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- **Wet Sedge Meadow.** 218 acres were planted on the western edge of site. Forbs include angelica, milkweed, flattopped aster, purple stem beggartick, Joe-pie weed, plus many more. Grasses and sedges include American slough grass, hop sedge, riverbank rye, prairie cordgrass, rice cutgrass plus many more.
- **Timber Stand Improvement, Upland Hardwood and Bottomland Hardwood Trees.** 421 acres of upland area were planted on the western bluff down to the 405 acres of bottomland hardwood planted on northern edge of site above elevation 435 feet. In total, 310,000 bare root tree seedlings were planted. The species planted in the upland include chinquapin oak, white oak, black walnut, and others. Shrubs include grey dogwood, persimmon, hazelnut and others. The species planted in the bottom land include pecan, burr oak, swamp white oak and sycamore.
- **Tall Grass Prairie.** 400 acres planted, including the entire area of the TDLD west of Highway 97. Species planted include 6 types of grasses and 89 forbs. The forbs include knodding wild onion, partridge pea, rough blazing star, and prairie cone flower. Grasses include rough drop seed, big bluestem, Indian grass plus others.

In addition to the vegetative plantings, water levels are being allowed to naturally rise within the site due to inputs from precipitation and groundwater. Water levels in the 425 feet NGVD range, result in a Thompson Lake surface area of roughly 600 acres. Natural succession will be allowed to occur on areas under 435 feet NGVD.

E. Aquatic Resources

1. Vegetation. The INHS monitored aquatic vegetation monthly April-October, 2008, and showed a community composition of 14 species dominated by coontail *Ceratophyllum demersum*. Other successful aquatic plants at Emiquon are sedges (*Carex* sp.), cattails (*Typha* sp.), pondweed (*Potamogeton* sp.), and duckweed (*Lemna* sp.).

2. Fishery Resources. As of summer 2007, 17 species of native fish have been re-introduced including: largemouth bass, black and white crappie, bluegill, channel catfish, brown bullhead, pumpkinseed sunfish, orange spotted sunfish, warmouth sunfish, grass pickerel, bowfin, walleye, brook silver-sides, black-striped topminnow, lake chubsucker, pirate perch, and spotted gar.

Since 2007, TNC has stocked the preserve with 31 different types of fish species, and recent surveys are tracking their growth. Survey results from 2009 showed native fish including large-mouth bass, black crappie, bluegill and pumpkinseed make up greater than 90 percent of the fish population at Emiquon. The remaining percentage primarily includes native fish species such as warmouth sunfish, green sunfish, black bullhead catfish, brown bullhead catfish, bowfin, longnose gar, spotted gar and lake chubsuckers. Additional populations of another 18 native species are likely present in numbers too small to be representative in the 2009 survey. In the 2009 results, native fish species made up 99.4 percent of all species caught in the fisheries survey.

In April, 2010 TNC released 200 of the state-threatened red-spotted sunfish into Thompson Lake at Emiquon. This release will add more diversity to the overall population in future surveys. Non-native fish such as common carp were also found at Emiquon in 2009. Even though common carp can cause

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ecological issues, large populations of native, predatory fish like bass, bowfin and gar are currently keeping the carp's population in check.

What is lacking at Emiquon are the river fish historically making this backwater their home. For example, since there is no connection with the Illinois River, there are no northern pike taking advantage of spring flooded grasses to lay their eggs; or, there is no opportunity for fish like the smallmouth buffalo, or walleye to use Emiquon's deep slack water for overwintering habitat. Historically, backwater areas like Thompson and Flag lakes were winter oasis for these types of river fish.

F. Migratory Birds. Emiquon offers two important life requisites for wetland birds—a migratory stop in the spring and fall and excellent nesting opportunities for bird species preferring Central Illinois summers to raise their young.

The staff of INHS Forbes Biological Station monitors waterbirds and wetland habitat at Emiquon. Monitoring includes spring and fall waterfowl inventories and behavior observations, waterbird brood counts, aquatic invertebrate and moist-soil plant seed sampling, and wetland habitat mapping. The INHS conducted migratory waterfowl inventories and behavioral observations between February 19 and April 14, 2008 and again between September 2 and December 8, 2008. Waterfowl abundance peaked at 64,228 ducks on March 10, 2008 during spring, and at 34,855 ducks on October 10, 2008 during fall.

During six passive summer brood observations, the INHS encountered 111 waterbird broods consisting of 8 species. Additionally, they counted 62 broods consisting of 7 species during 2 active brood flush surveys. The INHS collected 20 net-sweeps in shallow water 3 times during spring and summer to estimate abundance of aquatic invertebrates that breeding waterbirds consume.

G. Threatened and Endangered Species. Federally-listed, threatened, and, endangered species for Fulton County, Illinois are discussed as follows and shown in table 1.

1. Indiana bat. The Indiana bat (*Myotis sodalis*) is a federally-endangered species listed as potentially occurring in Fulton County, though there are no records of the species occurrence within the county. However, the species may potentially roost and forage in floodplain forests during spring and summer months where suitable habitat exists within the Emiquon Preserve. Suitable summer habitat in Illinois is considered to have the following characteristics within a ½ mile radius of a Project site: forest cover of 15 percent or greater; permanent water; and potential roost trees with 10 percent or more peeling or loose bark.

2. Decurrent false aster. The decurrent false aster (*Boltonia decurrens*) is a federally-threatened plant species historically found in the Illinois River floodplain and in the Mississippi River floodplain below the confluence with the Illinois River. Decurrent false aster is an early-successional floodplain species requiring full sunlight and is intolerant of shading or closed-canopy conditions. Periodic flooding is important for the continued growth of *B. decurrens* due to the deposition of seeds by receding floodwaters and by the floodwaters acting as a control for competing upland plants. Without periodic disturbance of a flood pulse, populations disappear within 3 to 5 years of establishment. The altered flood regime of the Illinois River and loss of floodplain habitat have substantially reduced the size and number of populations along the river (Mettler-Cherry and Smith, 2009).

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There is an ongoing university study looking at an experimental *B. decurrens* population at Emiquon with the goal of using this population as a test for other management areas as a source population for seed dispersal when conditions are favorable.

3. Eastern prairie fringed orchid. The eastern prairie fringed orchid (*Platanathera leucocephalus*) is a federally-threatened plant species found in wet grassland habitats in Illinois and other Midwestern states. Suitable habitat for this species does not currently exist within the Project area and the species has not previously been recorded within the Emiquon Preserve.

Table 1. Federally-listed, Threatened, and Endangered Species for Fulton County, Illinois

Species	Status	Habitat
Indiana bat (<i>Myotis sodalis</i>)	Endangered	Caves, mines (hibernacula); small stream corridors with well developed riparian woods; upland forests (foraging)
Decurrent false aster (<i>Boltonia decurrens</i>)	Threatened	Disturbed alluvial soils
Eastern prairie fringed orchid (<i>Platanthera leucophaea</i>)	Threatened	Mesic to wet prairies

US Fish and Wildlife Service, June, 2013

In addition to the species discussed above, the sheepsnose (*Plethobasus cyphus*) is a mussel species proposed as a candidate for listing as federally endangered. This species historically occurred in large rivers, including the Illinois River in Fulton County. The sheepsnose mussel is primarily a larger-stream species occurring mainly in shallow shoal habitats with moderate to swift currents over coarse sand and gravel but includes mud, cobble, and boulders as well. This type of aquatic habitat is not present within the Emiquon Preserve backwater lakes. There are no recent records of the species occurring in the Illinois River adjacent to the Project area.

While no longer listed as endangered or threatened, the bald eagle (*Haliaeetus leucocephalus*) is a federally-protected species utilizing large trees for roosting within along the perimeter of the Emiquon Preserve during the winter months. There is one active eagle nest just outside the levee along the northern edge of the preserve.

The Illinois Endangered Species Protection Board determines which plant and animal species are threatened or endangered in the state and advises the ILDNR on means of conserving those species. The ILDNR maintains the current state list of threatened and endangered species. In an email dated March 8, 2011, the Board provided those species listed for Fulton County, Illinois (table 2).

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Table 2. State-listed, Threatened, and Endangered Species for Fulton County, Illinois

Species	Status	Habitat
Smooth Softshell (turtle) (<i>Apalone mutica</i>)	Endangered	Rivers and streams
Upland Sandpiper (bird) (<i>Bartramia longicauda</i>)	Endangered	Upland native grass and hay fields
Decurrent False Aster (plant) (<i>Boltonia decurrens</i>)	Threatened	Disturbed alluvial soils
American Bittern (bird) (<i>Botaurus lentiginosus</i>)	Endangered	Emergent wetlands and wet meadows
Starhead topminnow (fish) (<i>Fundulus dispar</i>)	Threatened	Streams
Least Bittern (bird) (<i>Ixobrychus exilis</i>)	Threatened	Emergent wetlands
Redspotted Sunfish (fish) (<i>Lepomis miniatus</i>)	Endangered	Ponds and lakes
Blazing Star (plant) (<i>Liatris scariosa</i> var. <i>nieuwlandii</i>)	Threatened	Prairies
Indiana Bat (<i>Myotis sodalis</i>)	Endangered	Forest
Black-crowned Night-Heron (bird) (<i>Nycticorax nycticorax</i>)	Endangered	Emergent wetlands
Osprey (bird) (<i>Pandion haliaetus</i>)	Endangered	Bottomland hardwoods
Wolf's Bluegrass (plant) (<i>Poa wolfii</i>)	Endangered	Woods along streams, rocky wooded slopes, and prairie patches
King Rail (bird) (<i>Rallus elegans</i>)	Endangered	Emergent wetlands
Buffalo Clover (plant) (<i>Trifolium reflexum</i>)	Threatened	Rocky open woods and prairies; usually in acidic soil

Natural Heritage Database, March, 2011

H. Invasive Species. While in agricultural production, the site supported a limited fishery within the drainage ditches. In April 2007 in preparation of the restoration, TNC and ILDNR performed a fish kill to remove rough fish (particularly grass carp and common carp). Following the fish kill, the ILDNR restocked the site. Since then, fish surveys have collected common carp, but have yet to see exponential population growth.

Common carp are present in Emiquon, but have had no detectable negative effect on aquatic plants, water quality, or native fishes so far. Water drawdown and application of rotenone (a fish toxicant) has had to be used three times in attempts to eliminate Common carp from the Dixon Waterfowl Refuge at Hennepin and Hopper Lakes, which is completely isolated from the Illinois River with a high levee. Isolation alone is apparently no guarantee of permanent freedom from Common Carp. Bighead and Silver Carp need current to spawn and to keep their eggs and young suspended in the water column so it is not expected they will reproduce successfully in the ponded waters of Emiquon; nevertheless, TNC is monitoring their populations.

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The levees at TNC's second floodplain restoration project, downstream at Spunky Bottoms, were overtopped at first, but then broke open, so the river rushed in until water levels on both sides of the broken levee equalized. Water levels at Illinois River gages upstream and downstream of Spunky Bottoms declined in response to the breach, corroborating previous hydraulic simulations. These simulations showed flood crests could be reduced during damaging floods if some levee districts were allowed to flood in order to protect others. After the flood receded, the Illinois Natural History Survey collected a record 37 species of fish, 34 native species and 3 species of carp: Common, Bighead and Silver. Despite the uncontrolled flooding and the open access to the river through the levee, native species dominated the samples in Spunky, which were taken by electrofishing and four types of net sets.

Results to date indicate the flooding may have benefitted Emiquon fish populations. In 2013, the Natural History Survey reported that some of the catches of native species (Bowfin, Shortnose Gar, Gizzard Shad, and Black Crappie) were the highest ever, and native species remained dominant. Ninety-two Common Carp were captured in 2013, higher than the 62 caught in 2012, but less than the record high of 146 in 2011.

I. Socioeconomic Resources. The Emiquon Preserve, formally the Walker Farm, has a rich history of human occupation, agriculture production, and now, natural resources management and recreation. It is situated in a rural area of Illinois, approximately 1 mile from Havana, Illinois (population 3,476). The TNC's primary focus for the area is to preserve this Illinois backwater lake and restore its natural relationship to the Illinois River. Ancillary benefits include bird watching, non-motorized boating, fishing, and waterfowl hunting.

J. Historic and Cultural Resources. To meet District requirements promulgated under Section 106 of the National Historic Preservation Act (NHPA), of 1966, as amended and the implementing regulations 36 CFR Part 800: "Protection of Historic Properties," the District conducted research and investigations for reported and unreported historic properties within the Project's Area of Potential Effect (APE) to determine effects to sites eligible for, or listed on, the National Register of Historic Places (NRHP). The Corps queried the most recent version of the Illinois Site File Database and there are at least 81 sites or isolated finds located within the Project APE. The following references were also reviewed for data pertinent to the Emiquon Project: Hajic, Edwin R, 2000, 2006; Roberts, Timothy E. et al (1999a); Roberts, Timothy E. et al (1999b); Wiant, Michael D. (2001), and Harn, Alan, D. et al (2012). See Section XV, *Literature Cited*.

Directly associated with the Emiquon Preserve restoration initiative, the USDA-NRCS and TNC initiated a WRP easement. During consultation or coordination promulgated under the easement compliance with the NHPA, The TNC, NRCS, District, and Illinois State Historic Preservation Officer (SHPO) executed the *Programmatic Agreement Between the Nature Conservancy and the Natural Resources Conservation Service the Illinois State Preservation Office Regarding Emiquon Project Fulton County, Illinois (PA)* dated 2004 (March 26, 2013 correspondence, Appendix A). Under the purview of TNC, the inundation of Emiquon began in 2007 and within a few years exhibited successful fishery and waterfowl habitats.

During the consultation process promulgated under Section 106 of the NHPA by TNC and the NRCS, the referenced Harn and McClure Phase I report was accepted by the Illinois Historic Preservation Agency (IHPA) in 2012. Of the known sites within the APE, the NRCS identified three sites (11F675, 11F679, and 11F2381) as having potential for listing on the NRHP. The NRCS correspondence stated

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that a Phase II evaluation of the aforementioned three sites would occur as soon as conditions permitted. This NRCS proposal received concurrence from the IHPA for the Phase II investigations on December 19, 2012, (March 26, 2013 correspondence, enclosure 5, Appendix A). As a signatory to the PA, the District concurs that these sites have the potential for adverse effects from the previous inundation from either lakeshore wave erosion or inundation. Also, the District concurs with these determinations and the proposal for a Phase II NRCS evaluation of all three sites.

District research and investigations to identify reported and unreported historic properties within the Project's APE resulted in a determination of ***No Adverse Effect*** to sites eligible for, or listed on, the NRHP. This determination was based on the existing flooded condition of the Emiquon reserve and all potential project-related alternatives, features/measures avoid existing sites within the APE. The three NRCS identified sites (11F675, 11F679, and 11F2381) having potential for listing on the NRHP are required to undergo Phase II evaluation as soon as conditions allow. Phase II actions required to be taken by the NRCS per the PA cover the range of the potential inundation extents presented in this Project; therefore, the Project was determined to have ***No Adverse Effect*** to sites eligible for, or listed on, the NRHP.

Promulgated under Section 106 of the NHPA of 1966, the District provided a letter to the IHPA in Springfield, Illinois (March 26, 2013 correspondence, Appendix A). The Corps described the undertaking with an attached Project Location and Fact Sheet (enclosures 1 and 2), identified historic properties within the APE (enclosure 3), included a copy of the aforementioned PA (enclosure 4), the Illinois SHPO concurrence with the proposed Phase II testing of three prehistoric sites by the NRCS (enclosure 5) and developed an Interested and Consulting Parties Distribution List (Distribution List) (enclosure 6). The IHPA was asked to comment on the District's determination of ***No Adverse Effect*** and those on the Interested and Consulting Parties distribution list and were invited to participate in the consultation process and provide any comment on the Project APE and effects to historic properties.

Allowing for tribal and other consulting parties review and comment on the Project and proposal for a Phase I survey and investigations contributes to fulfilling Corps obligations as set forth in the NHPA (PL 89-665), as amended; the NEPA of 1969 (PL 91-190); Executive Order (EO) 11593 for the "Protection and Enhancement of the Cultural Environment" (Federal Register, May 13, 1971); the Archaeological and Historical Preservation Act of 1974 (PL 93-291); the Advisory Council on Historic Preservation "Regulations for the Protection of Historic and Cultural Properties" (36 CFR, Part 800); and the applicable National Park Service and Corps' regulations.

K. Water Quality

1. General. The water quality of the Project area is a result of several factors including source of water input, historical and current land use within and surrounding the Project site, wind fetch across the water surface, and the Project location in the Illinois River floodplain.

The area is protected from direct surface water influence of the Illinois and Spoon Rivers and a major portion of upstream drainage area by a levee and the elevated Illinois 97 roadway. Only a small section, fewer than 700 acres, of area outside the Project provides surface runoff input. Historically, the land draining to the Project was used for agricultural production, so surface runoff that entered the site was pumped into the Illinois River. Because the land surface elevation for a large portion of the

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site is below the flat pool of the Illinois River and with the pumps currently not draining overland flows, groundwater and surface water both have an influence on the water quality of this Project.

2. Nutrients. Although data has not been collected at the Project site to specify the exact nutrients present or their concentrations, historic and present land use around and in the Project area allow for assumptions to be made. The Emiquon East site was used historically for row crop agricultural purposes, as was the surrounding areas within the watershed. The Project site has been converted to wetland and agricultural practices have ceased, yet the surrounding land is still used primarily for row crops and will continue to influence the nutrients found in the water within the Project. Based on typical row crop practices, the surface water is likely carrying a high amount of nutrients into the Project area, primarily comprised of: nitrates/nitrites, phosphates, ammonia, pesticides, and herbicides.

Based on a Phase I HTRW survey identifying both above and below ground fuel storage tanks (see Appendix E of this Report for further detail) hydrocarbons such as benzene, toluene and ethyl benzene were thought to potentially be found in the water. To reduce potential impacts to water quality, TNC cleaned up the sites and performed remediation. On November 23 and November 24, 2010 TNC received No Further Remediation (NFR) letters from the IEPA which addressed these potential water quality issues.

3. Turbidity. Turbidity is typically caused by suspended solids, including algae. This is likely true for the Project. Typical of the Illinois River floodplain, the Project site substrate is fine grains and rich organic material. Due to substrate grain size, the substrate is easily re-suspended by wave action and tends to stay suspended. Due to the Project orientation and the predominant wind directions, wind fetch and correlated wave action contribute to sediment re-suspension, with amplified effects in the shallow areas commonly found within the Project area.

4. Dissolved Oxygen. Available data does not allow conclusions to be drawn regarding dissolved oxygen concentrations.

5. Impaired Waters. The Clean Water Act, Section 303(d) defines waterbodies are deemed impaired for specific chemical constituents and consequently additional loadings (i.e., discharges) of those constituents may be restricted. In addition to possible restrictions on future loadings to these listed waterbodies, waters identified in accordance with Section 303(d) are subject to the development of Total Maximum Daily Loads (TMDLs). The TMDLs in Illinois may take the form of a watershed study in which the chemical constituent causing impairment to that waterbody is evaluated. A TMDL is the sum of the allowable amount of a single pollutant a waterbody can receive from all contributing sources and still meet water quality standards or designated uses.

Within the Emiquon Preserve there are no designated 303(d) waters. The Illinois River (Water ID D-31) has a 66.58 mile river segment with 303(d) designation. This river segment has 303(d) designation resulting from unacceptable mercury, PCBs and fecal coliform levels. Under these conditions humans should not eat fish and have primary contact from recreation.

L. Hazardous, Toxic, and Radioactive Waste. In February 2010, a Phase I Hazardous, Toxic and Radioactive Waste (HTRW) Environmental Site Assessment for the Project was completed in accordance with ER 1165-2-132, ER 405-1-12, ASTM E 1527-05, and ASTM E 1528-06. Deviations

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from the ASTM included not reviewing real estate records. This assessment revealed one recognized environmental condition (REC) at the Project area and no evidence of RECs at surrounding properties that could potentially affect the Project area. An REC in the form of soil contamination from leaking tanks incidents was discovered, but was being remediated by TNC in cooperation with the IEPA at the time of the Phase I assessment. On November 23 and November 24, 2010 TNC (sponsor and SRP responsible party) received NFR letters from the IEPA which addressed these concerns. These designations correlate to the areas of concern in the Phase I ESA. In addition the NFR designations do not require any land use or administrative restrictions on the Project Area. The submittal of the NFR letters addresses the concern of the 2010 Phase I ESA, and it is recommended that no further HTRW assessments be conducted for this Project.

ER 1165-2-132 requires the NFS to supply contaminant-free land to the Federal Government. Based on the Phase I ESA and the documentation received in the NFR letters, it was determined that this land is not an HTRW site.

III. DEVELOPMENT OF PROJECT OBJECTIVES

A. Future Without-Project (No Action). The future without-project (FWOP) conditions will include continued backwater isolation from the Illinois River, and further growth and succession of WRP restoration plantings and natural succession of other areas. The site will continue to experience growth and maturation of forest, prairie, and sedge meadow. However, without proper capabilities to manage water levels, invasive fish and vegetative species over large areas of the site will be a constant challenge.

Wetland restoration will continue to occur through natural vegetative succession, but habitat quality may reach a point where it begins to decline due to the lack of soil structure and magnitude of invasive woody species. Compaction of sediment during periods of drought (low water elevation) is critical in supporting emergent and submergent vegetation as well as other wetland plants when the water levels rise. Similarly, periods of flooding (high water elevation) are necessary to control invasive woody species. If the water elevation remains high the rough fish will have adequate area to avoid native fish predators and due to their rate of molting may dominate the fish community. Without a Project, this area is limited to water level management with the existing pump station. The existing pump station remains operational, but was rated as unacceptable during a 1997 Corps Annual Levee Inspection and is not considered to be reliable.

1. Hydrologic and Hydraulic Conditions. The largest component of the Emiquon hydrologic budget is precipitation falling directly on the site. Surface runoff from less than 700 acres that drain to the Project site is the second largest component and groundwater is the smallest component. As a result of decades of agricultural pumping within the Project site, the underlying groundwater potentiometric surface has been lowered. As the groundwater system recovers from pumping and contributes to interior WSEs, the steady state interior WSE that will result has been estimated. The ISWS's report (Wehrmann and Burch, 2009) suggests that once the groundwater system has recovered water levels are expected to stabilize between 432 and 435 feet. Since agricultural pumping was ceased in 2007, the highest interior WSE reached was 434.4 feet in 2010. At that time, TNC reestablished electrical power to the motors and were able to turn the pumps on to prevent permanent damage to the pump motors and motor controls due to flooding in the pump house (motor damage

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should occur at 434). The FWOP condition is assumed that the NFS will continue to operate this pump station and make repairs as necessary, potentially resulting in periods of an inability to maintain or drawdown interior water levels.

The FWOP hydrologic conditions are expected to be characterized by sustained high WSEs (432 to 435 feet) with seasonal fluctuations due primarily to seasonal variations in precipitation and evapotranspiration. Sustained high interior WSEs across the Project area will result in more frequent high wave depths as well as longer fetch lengths. Fetch lengths of up to nearly 5 miles are expected. Wave run-up and wave wash increases with both increased wave depth and fetch length; therefore erosion due to wind-driven wave wash is expected to result in benching along the interior of the levee. Without a project, the unreliability of the pumps are likely to result in periods of time where the interior water levels cannot be drawn down thereby preventing recruitment of emergent aquatic vegetation. This vegetation not only provides habitat benefits but also works to dissipate wave energy and reduce erosion and sediment resuspension. Resuspension results in increased turbidity and degraded aquatic habitat. The degraded conditions that will occur without a Project will not support native fish populations. The lack of reliable water level management without the Project will also prohibit the control of rough fish using drawdown measures.

2. Vegetative Habitat Conditions. Without a Project, TNC would have limited ability to manage for native plants and combat invasive species on the roughly 1,900 acres between elevations 430 feet NGVD and 435 feet NGVD. Species of concern would include invasion by reed canary grass, phragmites (common reed), purple loosestrife, willow, cottonwood, and silver maple. Depending on the FWOP water levels and in particular the groundwater inputs, this area is likely to lack historic water level fluctuations and could end up being either too wet or too dry without additional management features.

Without a Project, TNC is subject to the reliability of an unacceptable pump station for achieving water levels between 425 to 430 feet NGVD. This range of elevations is important for the health of the submergent and emergent vegetation at the Emiquon preserve. The ability to drawdown water in order to compact sediments is paramount to vegetative health of emergent vegetation and general health of the other wetland plants. In addition, wind fetch and associated sediment resuspension due to wind driven waves may be a problem, especially in Flag Lake, where shallow water and long wind fetch lengths may cause significant waves to develop. These waves may also damage the existing levees, the ridge between Thompson and Flag Lakes, and berms adjacent to drainage ditches. The inability to compact suspended sediments poses a threat to the habitat value and the aquatic life that depends on it.

Currently, vegetation, aquatic animals and birds are flourishing at the Emiquon Preserve. This is common for a period of time after reverting farm land to flooded wetlands. Several factors such as existing ground cover, good water quality, and a lack of rough fish allow aquatic and wetland vegetation to grow quickly. Without TNC's ability to manage water levels, this site could experience negative impacts from rough fish and wind fetch.

At the nearby Hennepin and Hopper Lakes (photograph 1) which is also known as the Sue and Wes Dixon Waterfowl Refuge, located 40 miles north of Peoria at approximate Illinois River RM 204; the non-profit corporation known as The Wetland Initiative (TWI) has been restoring the lakes to "create a high-quality backwater lake habitat in order to improve water quality, provide wildlife habitat, and to

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offer a place for the public to enjoy Illinois' historic native landscapes." Prior to 2001, the leveed lakes had been drained for 90 years to support agricultural and livestock farming similar to Emiquon.



Photograph 1. Hennepin and Hopper Lakes

The TWI webpage reports the following characteristics of the Hennepin and Hopper Lakes site:

“Originally sculpted by glacial melt and retreat, the basins of Hennepin and Hopper lakes located just outside of Hennepin, Illinois, were once channels in the Illinois River. As the river meandered and crisscrossed in and around these basins, it created a diversity of bird and waterfowl habitat unique to this part of the country, including lakes, prairies, savannas, marshes, and wet meadows. In 1908, the 2,600-acre wetland was dramatically altered by farmers who leveed, ditched, tiled, and pumped dry the floodplain to sustain corn and soybean fields.

In 2001, the Wetlands Initiative reversed this destruction by turning off the pumps and beginning ecological restoration. Within months more than 1,000 acres of lakes reappeared, filled only by groundwater and precipitation. In the nine years since, wildlife populations have exploded at the site, with birds taking center stage.”

<http://www.wetlands-initiative.org/HennHopper.html>

However, when pumping was halted at the wetland, carp populations increased exponentially. The carp found at this location are invasive, bottom-feeders that stirred up the lake bottom, rooted out plants, reduced water clarity, and ultimately destroyed the marsh habitat. In October 2009, the ILDNR in partnership with TWI issued a press release announcing focused efforts on removing the destructive carp, which have been wreaking havoc on the aquatic ecosystem since 2006. The carp were removed with a massive fish kill which has allowed for the vegetation to recover. In the 2009 press release TWI stated that “By removing the carp, we’ll enable the plants to return. Once the plants return, we’ll have clear water again, and the birds, turtles, snakes, otters, and beaver will return.”

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Through this process, TWI learned that it will need to manage water levels more proactively at the Hennepin and Hopper Lakes site to maintain this high quality marsh habitat. Similarly, the ability to manage water levels at Emiquon is also important to maintaining a high quality wetland habitat.

3. Aquatic and Wetland Conditions. Without a Project, the lack of river connection limits the ability for aquatic organisms to provide wetland functionality. The isolated floodplain would not process nutrients for the Illinois River system or export primary and secondary fish production to benefit the river.

Without the ability to adequately control water levels, sediment suspension associated with wind fetch and natural sediment delivery may impair the aquatic community. Poor water quality associated with sedimentation may provide an advantage to rough fish that tend to be more resilient than desirable native species. This was observed at the previously described Hennepin and Hopper Lakes, where, in 2001, TWI halted pumping operations and allowed the lakes to fill via groundwater and precipitation. The lakes were opened to public fishing in 2004 but the carp population quickly increased disturbing the vegetation and sediment and creating an unfavorable environment for game fish and other aquatic species. An October 2009 joint press release stated, “Since 2006, common carp have been disrupting the lake ecosystem and the waterfowl population has steadily declined. Last fall the total number of migrating waterfowl dropped by 90 percent from its peak in 2004, according to ILDNR surveys.” <http://www.dnr.state.il.us/pubaffairs/2009/October/wetlands.html>

In 2010, ILDNR restocked Hennepin and Hopper Lakes with a mix of game fish and a number of species native to Illinois River backwaters. The majority of the fish stocked in the lake were newly-hatched or immature fish so ILDNR fisheries biologists decided that they should mature for at least two years prior to the onset of fishing pressure. The success of the fish kill and restocking is not fully known, but the lakes were reopened for public fishing in 2012. It is anticipated that if the water levels are managed appropriately that the fishery will be able to be sustained and that the migratory waterfowl will return.

Without the ability to appropriately maintain water levels this same process may occur at Emiquon only at a much larger scale. If this does occur, the fish kill would be substantially larger which would have an impact on migratory waterfowl. Future without-project at Emiquon may result in numerous fish kills and loss of migratory waterfowl habitat over the Project period of analysis.

4. Illinois River Connectivity. Without a Project, it is unlikely that a significant connection with the Illinois River system would be restored. The Emiquon Preserve is a backwater that may serve as a production facility for fish and nutrient processing. Without a Project, the Illinois River will not benefit from the addition of healthy fish and other aquatic organisms as well as nutrient loading for the river’s natural processes. Similarly, the Emiquon backwater will not benefit from the flushing of fresh water or the return of mature river fish, such as the Paddlefish, into the Emiquon backwater.

Without a Project, there is no method for allowing water from the Illinois River into the levee interior to balance hydrostatic pressure when the river is in flood stage. There is a 76 percent probability that flooding will occur on the Illinois River in the next 50 years that will result in overtopping of the existing levee spillway. The amount of damage to the levee that occurs during this overtopping event is a direct function of the head difference between the interior and exterior water level elevations when overtopping begins. Because the levee is primarily composed of clay, a complete failure of the levee

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during overtopping is not anticipated. However, if the levee overtopping does result in a complete breach there would be a significant adverse impact to safe vehicle passage on IL Highway 78/97. The Nature Conservancy's current position is that they do not plan to conduct flood fighting operations during flood events in order to avoid floodway impacts to adjacent properties and to allow for natural flood processes to take place in the preserve area.

B. Problem Identification

1. Problems. The principle problem is ecosystem degradation due to historic conversion of Illinois River floodplain (aquatic, wetland, forest, and prairie) habitat to agricultural uses and loss of ecological connections between the floodplain and the Illinois River. The loss of floodplain connectivity has eliminated natural flood pulses and has prevented native species from using the floodplain during various life stages and times of the year. Natural flood pulses have been altered due to the diversion of Lake Michigan flows, construction of the TDL D levee system and construction of Dams associated with the IWW 9-Foot Navigation Channel Project. Lack of connectivity and ecosystem degradation has resulted in absent or minimized wetland functions such as: nutrient and sediment processing; carbon sequestration; establishment and maintenance of high-quality wetland habitats; delivery of primary and secondary production to the river; moderation of unnatural hydrology; and increased frequency of unnatural fluctuations.

Another equally challenging problem is the introduction of non-native plants and animals to the Illinois River Valley. These invasive species include carp (common, grass, and Asian), and Phragmites, a very aggressive wetland plant. For instance, Asian carp diets overlap highly with those of native planktivorous fishes. Because they consume large quantities of food representing a wide variety of taxa, selectively digesting and egesting viable algae, they can alter food webs and increase trophic competition, reducing the robustness of native fishes like gizzard shad, bigmouth buffalo, and possibly paddlefish (Hoover, et al, 2012).

2. Opportunities. The primary opportunity of the Project is to restore floodplain connectivity to approximately 5,800 acres of high quality floodplain habitat that has been isolated from the Illinois River for nearly 100 years. Other opportunities include:

- landscape-scale restoration of a connected floodplain habitat, with connections from bluff-line to bluff-line across the river in public/conservation ownership;
- addressing the restoration of Key Ecological Attributes (KEAs) as described by TNC, March 2006;
- reducing costs associated with pumping water from interior areas within the levee;
- producing benefits consistent with the North American Waterfowl Management Plan; U.S. Shorebird Conservation Plan's Upper Mississippi Valley/Great Lakes Regional Shorebird Conservation Plan; Partners in Flight Bird Conservation Plan; Clean Water Action Plan; and Mississippi River/Gulf of Mexico Watershed Nutrient Task Force;
- recognizing adaptive management opportunities, such as design project features that allow TNC the flexibility to respond to changing conditions; providing the management capabilities necessary to develop and refine better methods on how to more naturally manage other floodplain areas both in the UMRS and internationally;

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- collaborating in partnership with other governmental agencies (Corps/NRCS and Corps/TNC MOUs), organizations, and the private sector; and
- identifying educational opportunities, such as a potential Eco-Tourism Area near Dickson Mounds; providing ancillary ecotourism and recreational benefits.

C. Resource Significance

1. Institutional Recognition. The institutional significance of the site is widely recognized based on congressional laws. One such law is Section 1103 of the WRDA of 1986, which stated that the Illinois River is a “nationally significant ecosystem and a nationally significant commercial navigation system”. Other congressional laws designated lands adjacent to Emiquon to the USFWS to operate the Emiquon West and Chautauqua Refuges. The USFWS recognizes the significance of the area, as evidenced by the proximity of the Project area lying within the acquisition boundary for Illinois River Fish and Wildlife Refuges that was set in legislation prior to TNC’s acquisition of the property.

In July 1997, the State of Illinois enacted the Illinois River Restoration Act and invested \$51 million to match \$271 million in Federal dollars to implement the USDA’s Conservation Reserve and Enhancement Program on 110,000 acres with the potential to expand to 232,000 acres within the Illinois River Basin.

The U.S. Army Corps of Engineers specifically identified the Project area as a site with high potential for contributing to the success of Goal 3: Floodplain, Riparian and Aquatic Restoration as defined in the Illinois River Basin Restoration Comprehensive Plan. This comprehensive plan was assembled as required by Section 519(b) of the WRDA of 2000.

In March of 2011, the Illinois River Coordinating Council (IRCC) sent a letter to the Director of the USFWS to express support for designating the Emiquon Complex as a “Wetland of International Importance” under the Ramsar Convention. The IRCC is a diverse group of citizens, not-for-profit organizations, and state and federal agencies that coordinates initiatives, projects, and funding to promote the ecological health of the Illinois River and its tributaries.

The State of Illinois has recognized this area as a significant area for cultural and natural history as evidenced by operation of the Dickson Mounds State Museum adjacent to the Emiquon Preserve.

The Illinois River Valley is a focus area of the UMR and Great Lakes Region Joint Venture of the North American Waterfowl Management Plan.

The National Scenic Byways Program highlights the Emiquon Preserve as a point of scenic significance for viewing wildlife. The National Scenic Byways Program is part of the U.S. DOT, Federal Highway Administration. Established in Title 23, Section 162 of the United States Code under the Intermodal Surface Transportation Efficiency Act of 1991 and reauthorized and expanded significantly in 1998 under TEA-21 and again under SAFETEA-LU in 2005, the program is a grass-roots collaborative effort established to help recognize, preserve and enhance selected roads throughout the United States. (ref: http://www.fhwa.dot.gov/hep/scenic_byways/)

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The National Research Council recognized the ecological significance of large floodplain rivers and identified the Mississippi River and the IWW as examples of two such rivers in the U.S. that could become healthy again with proper management and restoration. Floodplain forests are declining in the Mississippi River and the IWW floodplains due to agricultural and urban development, alteration of natural riverine flood pulses, rising water tables, and island loss due to wind and wave action. The remaining forests are changing in composition from high species diversity (including mast-producing trees) to a more monotypic forest dominated by silver maple and even aged stands with little to no understory or regeneration of seedlings. Native floodplain forest with a substantial hard mast-producing species composition is among the rarest ecotypes in the Illinois River floodplain. Remaining fragments are vulnerable to eradication from extreme high water events, and lack the size necessary to be self-sustaining or to support forest-dependent resident and migratory wildlife species that require hard mast food resources.

Within LaGrange Pool, existing land cover is predominately agricultural (47 percent of total floodplain acreage) and likely to remain so for the foreseeable future. Opportunities for restoration of native floodplain ecotypes and habitats are limited by the small percentage of land in public ownership (16 percent of total floodplain acreage). For this reason, the restoration of land and water resources of the Emiquon Preserve has an increased significance.

2. Public Recognition. The Thompson Lake and Flag Lake aquatic and wetland complex (current day Project area) had a rich and diverse fish and wildlife population in the late 1800s and early 1900s, and was therefore a major recreational and commercial hunting and fishing location. In a 1911 report, Thompson Lake was noted as “the most famous and useful breeding ground for the various fish that abound in the Illinois River, and also a wonderful feeding ground for ducks while pursuing their migratory flights” (Havera, 2003). Thompson Lake produced 300 pounds per acre per year of fish and was at the center of an incredible freshwater fishery on the Illinois River that produced 10 percent of the total fish harvest in the United States in the early 1900s. Thompson Lake was boasted to be the Inland Fishing Capital of the World and Havana, Illinois became known as the Fishing Capital of the Illinois River, with as many as 200 fishermen operating within a 10 mile radius in 1910 (Havera, 2003).

The public has historically recognized the significance of the Project area as evidenced by extensive legal battles between the general public and private landowners in 1917, where the State of Illinois Supreme Court ruled that Thompson Lake was private property and was subject to drainage. The *Mason County Democrat* reported in on April 13, 1923 “Take your last look at Thompson Lake. Soon it will be a large area of farm land. For several years they have been working on the levee. The lake will not be there very long.” (Havera 2003 subreference Oswald 1972, Thompson 1989).

A high level of public recognition of the site still exists, as evidenced by the public’s active participation in TNC’s citizens’ advisory group. Similarly, in recent years Emiquon has become a preferred destination for anglers and bird enthusiasts.

3. Technical Recognition. The National Research Council named the Illinois River as one of three large floodplain-river ecosystems in the United States with sufficient ecological integrity to make it a priority for restoration. This Project would greatly assist with this recovery by providing large, contiguous floodplain habitat to sustain native species and to demonstrate the techniques and benefits of this type of large floodplain habitat restoration to a future NFS within the Illinois River

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Basin. This type of habitat is particularly important in the Illinois, where greater than 90 percent of all wetlands and 99 percent of all prairies have been lost.

The Project would greatly benefit numerous avian species. The site is located along the Illinois River basin, a critical mid-migration resting and feeding area of the internationally significant Mississippi River Flyway, utilized by 40 percent of all North American waterfowl and 326 total bird species, representing 60 percent of all species in North America. A survey conducted by the INHS in the fall of 1994 found that 81 percent of the fall waterfowl migration in the Mississippi flyway utilized the Illinois River. Twenty-six avian species are state listed as threatened or endangered; one of which is a candidate for Federal listing and four others are species of concern. Many of these species are associated with wetlands or grasslands, and are also sensitive to landscape fragmentation. Restoration activities would also benefit the federally-threatened decurrent false aster (*Boltonia decurrens*) and provide habitat for a number of state threatened and endangered amphibians, reptiles, birds, fish, and plants.

On February 9, 2010, the Society of Wetland Scientists accepted The INHS publication entitled *Historical and Contemporary Characteristics and Waterfowl Use of Illinois River Valley Wetlands*. This document is a current study on the waterfowl health near the Emiquon Preserve and throughout the Illinois River Basin.

The University of Illinois at Springfield has a field station/research facility on-site at Emiquon for on-going studies. The university offers scholarships for students to conduct studies at Emiquon. A recent study on largemouth bass was highlighted in the Prairie State Outdoors which is touted as Illinois' premier outdoors website.

In a 1995 report, the US Department of the Interior (DOI) listed large streams and rivers as endangered ecosystems in the United States. The US DOI documented an 85 to 98 percent decline in this ecosystem type since European settlement. In particular, large floodplain-river ecosystems have become increasingly rare worldwide. Two of the large floodplain-river ecosystems lay within the UMRS, namely, the Upper Mississippi and Illinois Rivers. These two ecosystems still retain seasonal flood pulses, and more than half of their original floodplains remain unleveled and open to the rivers (Sparks et al. 1998). The UMRS is one of the few areas in the developed world where ecosystem restoration can be implemented on large floodplain-river ecosystems (Sparks 1995).

D. UMRR EMP Goals and Objectives. Formal planning for the UMRS ecosystem management and restoration has been an ongoing process that was institutionalized in the 1970s with a Comprehensive Master Plan completed by the UMR Basin Commission in 1982. The Master Plan proposed an outline for the EMP which was authorized in WRDA 1986. The EMP has been a National leader in ecosystem restoration planning and implementation for 25 years. EMP partners have participated in several project planning cycles to develop regional ecosystem restoration needs and priorities. Their prior experience and strong interagency relationships provided the foundation to develop the ecosystem restoration component of the Navigation and Ecosystem Sustainability Program (NESP) which was authorized in WRDA 2007.

Program partners understand the interrelated information needs of multiple navigation and ecosystem restoration programs, so Reach Planning was conducted to identify ecosystem objectives and subareas where they can be achieved in a program-neutral fashion. Reach Planning relied on participants from

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River Management Team workgroups including the Fish and Wildlife Work Group in the Upper Impounded Floodplain Reach; the FWIC in the Lower Impounded Floodplain Reach; the Illinois River Work Group in the Illinois River; and the RRCT in the Unimpounded Floodplain Reach (also the Lower Impounded Floodplain Reach and the Illinois River).

The *Upper Mississippi River System – Ecosystem Restoration Objectives 2009* report is the final product of a planning process initiated in 2008 for the purpose of identifying areas for new restoration projects and identifying knowledge gaps at a system scale. The report serves as a technical basis for investment decisions through 2013 and as a backdrop for the formulation of specific restoration projects and their adaptive management components.

The reach planning process leads to the identification of high priority areas for restoration of natural river processes (as required by Section 8004 of WRDA 2007). The reach planning process also provides context for formulating project features, defining performance measures, and designing monitoring plans.

The Reach Planning framework emphasized system-wide environmental goals, implementation guidance to achieve objectives, considerations of scale and connectivity, and then identified a stepwise process for setting ecosystem restoration objectives that included: identifying unique characteristics, historic, existing, and future conditions, stressors, objectives, performance criteria, and indicators. Goals and objectives for condition of the river ecosystem are central to river management, and are linked to other elements of the framework.

1. Over Arching Program Goal. To conserve, restore, and maintain the ecological structure and function of the UMRS to achieve the vision.

2. Ecosystem Goals

- Manage for a more natural hydrologic regime (hydrology and hydraulics)
- Manage for processes that shape a physically diverse and dynamic river-floodplain system
- Manage for processes that input, transport, assimilate, and output material within the UMR basin river-floodplains: e.g. water quality, sediments, and nutrients
- Manage for a diverse and dynamic pattern of habitats to support native biota
- Manage for viable populations of native species within diverse plant and animal communities

3. Systemic Habitat Goals (Habitat Needs Assessment). The Habitat Needs Assessment prepared for the EMP in October 2000 summarized habitat needs for the IWW Reach of the UMRS as follows:

- Restore existing backwaters so that 25 percent of existing backwater lakes (19,000 acres) have an average depth of 6 feet
- Increase depth diversity and connectivity throughout the river
- Restore hydrologic variability needed to restore and maintain existing backwater habitats

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4. Illinois River Reach Objectives. The UMRS ecosystem restoration objectives are broken down into four geomorphic reaches. The Emiquon Project area is within the Illinois River reach. Objectives for the reach include:

- restoring aquatic habitat diversity of side channels and backwaters to provide adequate volume and depth for sustaining native fish and wildlife communities
- restoring and maintain side channel and island habitats
- maintaining all existing connections between backwaters and the main channel (connections at the 50 percent exceedance flow duration)
- compacting sediments to improve substrate conditions for aquatic plants, fish, and wildlife
- naturalizing Illinois River and tributary hydrologic regimes and conditions to restore aquatic and riparian habitat
- improving water and sediment quality in the Illinois River and its watershed
- restoring up to an additional 150,000 acres of isolated and connected floodplains along the Illinois River main stem to promote floodplain functions and habitat
- restoring up to 150,000 acres of the Illinois River basin large tributary floodplains
- restoring and/or protect up to 1,000 additional stream miles of riparian habitats
- restoring aquatic connectivity (fish passage) on the Illinois River and its tributaries, where appropriate, to restore or maintain healthy populations of native species
- restoring main stem to tributary connectivity, where appropriate, on major tributaries
- restoring passage for large river fish at Starved Rock, Marseilles, and Dresden Lock & Dams
- restoring and maintain ecological integrity, including habitats, communities, and populations of native species, and the processes that sustain them
- restoring and conserve natural habitat structure and function

As the NFS, TNC outlined the following goals for the Project:

- re-establishing the hydrologic and ecological structure and function of a backwater aquatic wetland on the Illinois River
- providing high quality food and habitat for migrating waterfowl along the Central Flyway (Mississippi and Illinois Rivers).
- Re-establish hydrologic and biochemical connectivity to the Illinois River
- providing educational and recreational opportunities for preserve visitors¹

¹ Educational and recreational opportunities are noted here as part of the NFS goals and are outside of the UMRR-EMP program authorization; therefore, they will not be covered as part of this Project.

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These goals apply to numerous plant and animal species as well as hydrologic phenomenon. In order to capture TNC's goals and key ecological attributes within the context of UMRS goals, a Water Level Management Plan [WLMP (figure 7)] was developed. Based upon existing conditions, monitoring trends, and adaptive management, TNC would implement the best management scenario to meet the Project's goals and objectives. The District provided Illinois River exceedance probability graphs and other technical assistance to TNC during development of this plan.

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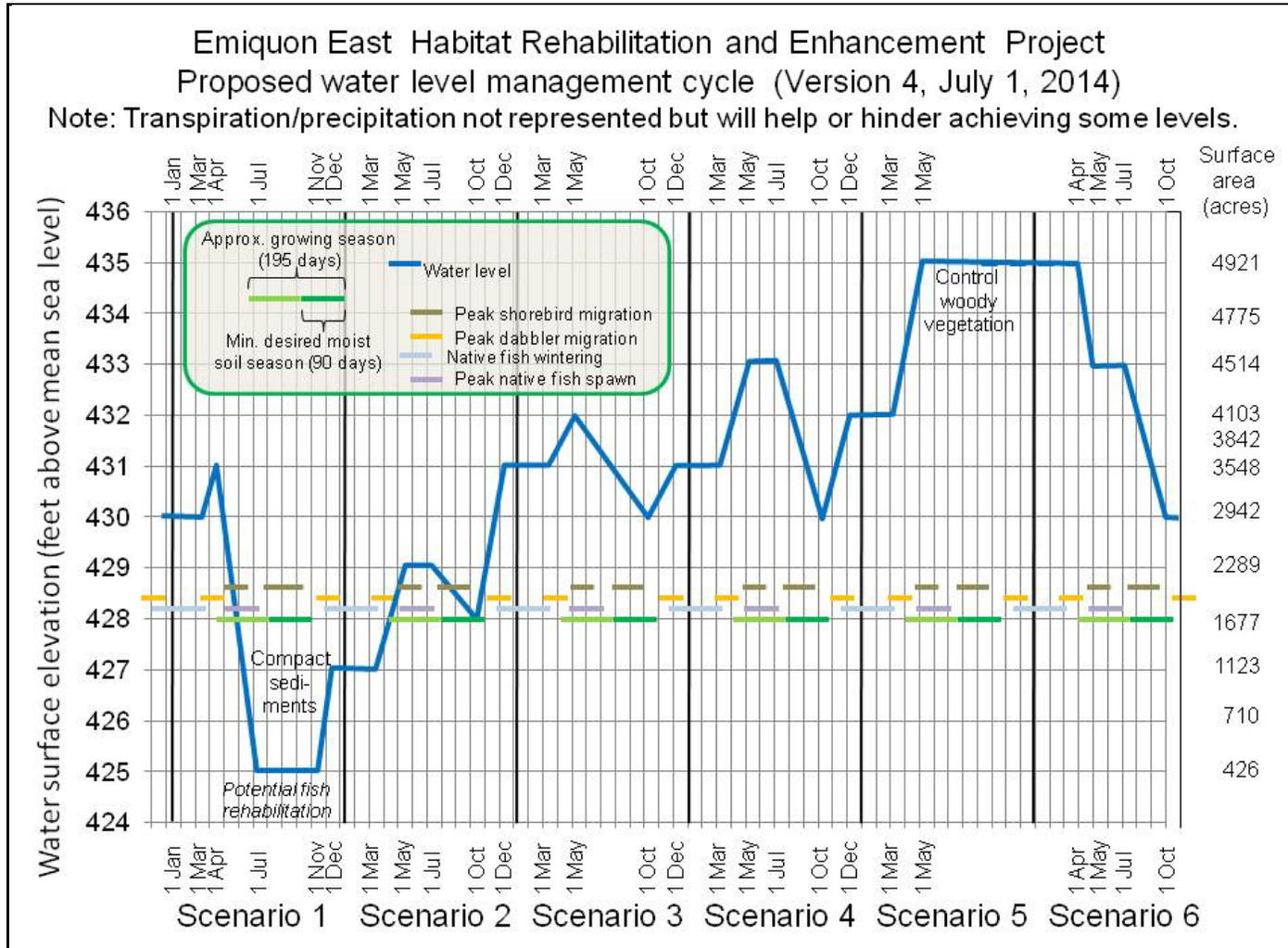


Figure 7. Water Level Management Plan

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E. Planning Constraints and Considerations. In addition to the NFS' management goals, general criteria were considered as constraints or considerations when formulating the Project alternatives:

1. Planning Constraints

a. Wetlands Reserve Program. The site is encumbered with a 30-yr conservation easement through the USDA-NRCS WRP. Project goals features and water management methods must be compatible with the current WRP easement.

b. Avoid/Minimize Impacts to Other Landowners. The TDLD has a legal responsibility to protect landowners within the levee district from adverse effects related to high water. Two private landowners maintain the ownership of about 94 acres of land within the TDLD at elevations of approximately 443 to 445 feet NGVD. This Project must be consistent with the TDLD legal purpose as mandated by the state of Illinois to protect those remaining agricultural properties from adverse impacts associated with high water. If the levee were permanently breached the TDLD would not be in compliance with their legal mandate to protect the remaining two private landowners from high water levels such as those in the Illinois River. There is also the potential for other property owners not in the district to be affected if the levee were overtopped.

2. Planning Considerations

a. Potential Impacts to State Route 78/97. The side slopes of the existing roadway could be subject to erosion under some water levels. The PDT will need to evaluate the Project's potential impact to the state highway and determine if a protective measure is necessary.

b. Natural Gas Line. About 5.6 miles of 8-inch natural gas pipeline runs under portions of the site at an estimated depth of 3 to 5 feet (some places less) below the surface. Ameren, working with TNC, excavated the pipeline every 40 feet and added ballast to keep the pipe from floating to the surface and breaking. Ameren provided TNC with a letter/agreement stating that Ameren will assume responsibility for the gas lines in the future. The PDT will need to consider avoiding this infrastructure or if not possible evaluate the Project's potential impact to the gas pipeline and determine if a protective measure is necessary.

c. Invasive Species – Invasive Vegetation and Rough Fish. There are concerns with invasion of reed canary grass, Eurasian water milfoil and other invasive vegetation. The Illinois River has a high density of Carp. The PDT will need to consider actions that minimize adverse environmental effects associated with excessive Carp fish populations.

d. Real Estate. The NFS must provide the appropriate interest in all lands required for the construction and O&M of the Project. The lands where measures may be installed are located on the TDLD easement as well as TNC property. Measures installed on the TDLD would impact the ability to manage water levels on TNC property. The PDT must consider whether the necessary real estate interests to allow for implementation of the Project features are obtainable.

e. Cultural. Fulton County has one of the highest densities of archeological sites in central Illinois. This is primarily due to the extensive floodplain which contained a rich diversity of plants and animals to exploit for foodstuffs. The Illinois River floodplain and surrounding bluffs in the vicinity of the Project, contain open habitation sites, villages, and burials; and temple mounds, as

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evidence of the extensive occupation extending to a least 12,000 Before Present. The state owned and operated Dickson Mounds Museum, is located directly on the surrounding bluffs of the Project. A National Historic Site and a branch of the Illinois State Museum, the Dickson Mounds Museum features an on-site archaeological museum studying 12,000 years of the Illinois River Valley native residents' history. Prior to the transformation of the agricultural transition to wetlands, the Illinois SHPO, USDA-NRCS, TNC and Corps signed a PPA as part of the WRP easement (signed in October of 2004). The aim of this PA was to provide protection to historic properties located in the easement prior to, and during, the wetlands conversion.

f. Aesthetics. Emiquon is TNC's premier demonstration site and a high visibility site as demonstrated by the National Scenic Byways Program designation. The PDT should consider how project features may be designed to minimize negative impacts on aesthetics.

F. Emiquon East Goals, Objectives, and Potential Enhancement Features. Based on the identified problems and management goals, the following goals, objectives and potential features were considered.

The Project presents the opportunity to restore plant and animal communities that were native to the Illinois River Valley prior to construction of the IWW 9-Foot Navigation Channel Project and the TDL D levee system. The Project seeks to restore hydrological and ecological processes on a site specific and systemic basis. The site specific goal is to restore, to the extent practical, quality, functional, floodplain habitat and ecological processes in an Illinois River Backwater area. The systemic goal is to restore floodplain connectivity from the Illinois River to a productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river. The following objectives have been identified to meet these goals and are summarized in table 3.

1. Restore the natural hydrograph of the Emiquon preserve/Illinois River backwater to approximate pre-settlement conditions. Restore hydrology to an approximation of historical conditions and mimic seasonal variability with water levels generally ranging from 425 to 435 feet. Restoring a connection to the Illinois River would allow for a diverse range of water level management regimes ranging from occasional drawdowns to simulate drought to prolonged filling to simulate flooding.

2. Restore native aquatic habitat and ecological processes. This objective encompasses a diverse range of native vegetation that would have historically been present in the Project area. Potential vegetative restoration/planting could include emergent/submergent vegetation, moist soil plants, prairie plants, and mast trees. The Nature Conservancy has already planted prairie plants and mast trees at elevations greater than 435 feet (NGVD) using funding from the NRCS associated with the WRP easement. Additional planting areas, especially in areas below 435 feet (NGVD) are not anticipated due to the likelihood that native seed base is present to reestablish wetland and semi-wetland habitat. The following describe qualitative and quantitative targets for accomplishing the objective:

Increase rooted emergent and submerged vegetation coverage and diversity.

Increased vegetation coverage would 1) increase the invertebrate population by providing habitat; 2) improve the wetland function because the rooted plants would bind sediments and nutrients; and 3) improve water clarity because the roots would hold the sediment on

the bottom and decrease resuspension. The Key Ecological Attributes for this objective recommend a secchi disk no less than half the maximum water depth measured in late spring/early summer; a water depth not to exceed 2 times the secchi disk during the growing season, and less than 10 percent species composition of invasives (e.g. Eurasian water milfoil or curly leafed pond weed). One measurement of this target would be percentage of suitable habitat that is vegetated, the number of acres within the desired secchi disk reading, the number of different emergent and submergent aquatic plant species, and the percentage of native vs. exotic species composition.

Increase emergent/floating-leaved vegetation coverage and diversity. The KEAs for this objective recommend a stable water depth not to exceed 1.0 meter, a community composition of no less than 90 percent native species, and for cattails to represent no more than 25 percent of the floating plant community. Measurements for this objective include: mean acres of water depth < 1 meter, and percentage of native vs. exotic species composition.

Increase moist soil vegetation coverage and diversity. The KEAs for this objective recommend less than 10 percent composition of exotics in the moist soil zone, and 100 percent exclusion of purple loosestrife. The vegetation should be flooded 1 in 3 years to control willows, and rate of recession should be 1 inch per day, with a 90 day drawdown from June 15 to October 15.

3. Increase the presence of a reliable food source and quality habitat for migratory waterfowl, shorebirds, and other breeding birds. The quality of food and habitat available for migratory waterfowl, shorebirds, and other breeding birds is dependent on the ability to manage water levels at Emiquon. The quality of vegetation and habitat vary for the different species based on how the water levels are managed. Some water levels would benefit one species more than others while an alternate water level may benefit other species in future management years. Respective bird types may be broken down into the following categories with optimal habitat characteristics and measurable targets:

Waterfowl. In the fall (September to November), dabbling waterfowl require shallowly flooded (<50 cm) mature moist soil plants, while diving waterfowl require water depths of 1-5 m and less than 10 percent coverage of emergent vegetation. In the spring (February to May) both dabblers and divers require shallowly flooded areas over residual vegetation. Measurements include: average annual acres of water < 50 cm by month, and mean acres of water 1-5 m.

Wading Birds. Breeding wading birds require shallow water (< 0.5 m) with abundant fish from May through August. Measurements include: average annual acres of water < 0.5 m by month.

Shorebirds. Shorebirds require exposed mud flats and higher elevation areas available for the period July 20 to August 31 with water less than 5 cm deep. In the spring, shorebirds desire shallow wet areas between 0-5 cm. The measurement for this objective is: mean number of acres that have been exposed for less than 30 days within the previous 90 days between July 20 and August 31.

4. Improve processing of nutrients and sediments by reducing sediment resuspension.

Improve processing of nutrients by managing water levels to allow for plant growth. Nutrients may be utilized through plant uptake, natural metabolic cycles (nitrogen cycle), and soil binding. Healthy aquatic habitat may reduce sediment resuspension which would provide for better water clarity which benefits native fish species. An ancillary benefit to water quality would likely occur as well.

5. Restore river floodplain connectivity to provide habitat and function similar to pre-settlement conditions. Restore specific vegetative communities and fish and wildlife species which provide system benefits in addressing nutrient cycling, carbon sequestration, and primary production for the river.

This objective could also contribute to a more natural Illinois River hydrograph including storage of flood waters and reducing summer water level fluctuations on site and in other areas. The measureable targets for this objective may be: days of connectivity between the backwater and the Illinois River, depth distribution of water, mean annual acres flooded at least once every 3 years for at least 90 days (between 11/1-6/14) and exposed for at least 45 days (between Jun 15 and October 14).

6. Increase connectivity to fish nursery and spawning habitats. Many fish species from the Illinois River utilize backwater lakes such as Thompson Lake for nursery and spawning habitat. Providing a connection to the Illinois River would allow these fish to access Thompson Lake and other shallow wetland habitats in Emiquon. The KEA that corresponds to this objective recommends a connection to the Illinois River in April/May once every 3 to 5 years. The measurements for this objective would be: days of connectivity to the Illinois River during the appropriate spawning periods.

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Table 3. Goals, Objectives, and Potential Features of the Emiquon East HREP

Goals	Objectives	Potential Features
<ul style="list-style-type: none"> • Restore, to the extent practical, quality, functional, floodplain habitat and ecological processes in an Illinois River backwater area • Restore floodplain connectivity from the Illinois River to a productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river 	<ul style="list-style-type: none"> • Restore the natural hydrograph of the Emiquon Preserve/ Illinois River backwater to approximate pre-settlement conditions • Restore native aquatic habitat and ecological processes • Increase the presence of a reliable food source and quality habitat for migratory waterfowl, shorebirds, and other breeding birds • Improve processing of nutrients and sediments by reducing sediment resuspension • Restore river floodplain connectivity to provide habitat and function similar to pre-settlement conditions • Increase connectivity to fish nursery and spawning habitats 	<ul style="list-style-type: none"> • Levee Removal • Water Control Structure / Fish passage structure • Pump Station • Reinforced Levee Spillway • Levee Improvements • Berms/Islands

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IV. POTENTIAL PROJECT FEATURES

This section discusses potential enhancement features (figure 8) that meet the goals and objectives outlined in Section III. The potential features are described in the sections that follow.

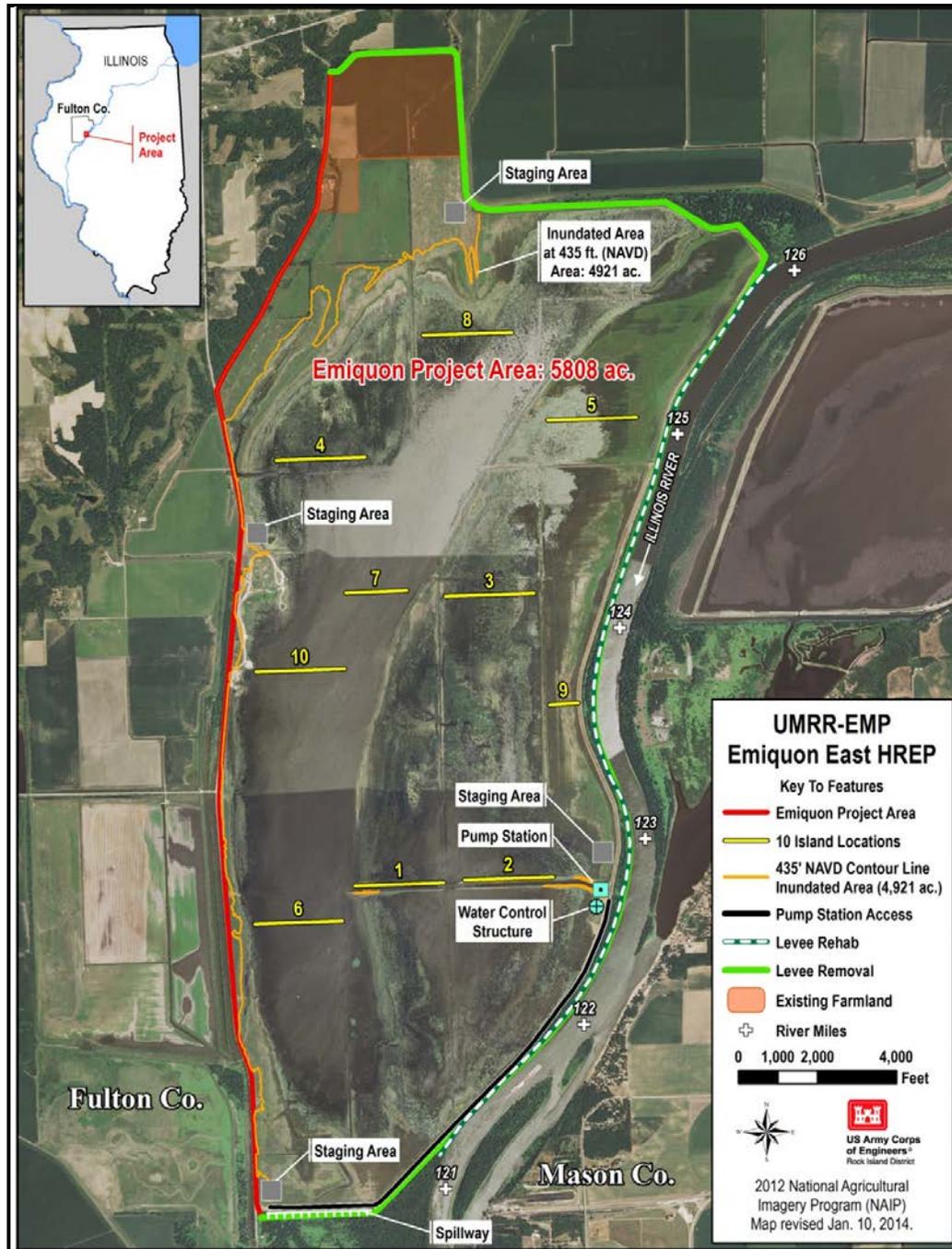


Figure 8. Potential Features for Emiquon East

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A. Levee Removal. This feature may include removal of sections or the entire levee system in order to restore the Illinois River to its natural floodplain width. Removal of the levee would allow for fish passage and nutrient transport from the backwater to the Illinois River but may also cause the backwater hydrology to be subject to the river's water level and sediment load. Levee removal to an elevation below the Illinois River flat pool elevation would facilitate fish passage and nutrient cycling but makes the backwater vulnerable to sediment loading and invasive rough fish and woody vegetation. Levee removal to an elevation above the average yearly river level would allow for some backwater isolation to control woody vegetation and drawdown the interior to compact sediment for aquatic vegetation. However, the fish connectivity and nutrient cycling are not realized on a yearly basis but only during years where the shortened levee section is overtopped. This feature would also violate the legal obligation to protect two landowners within the levee's protected area from high water levels.

B. Water Control Structure(s). Water control features would allow management of water levels within Emiquon, and a controlled connection to the Illinois River to allow fish passage, water input and output. A water control structure would provide TNC the ability to manage the site for a flexible range of water level management regimes as defined in the management plan. The structure would also allow TNC to adaptively manage the site. A structure may allow the site to gravity drain at low river stages, or adding water to the site at appropriate times to properly create and manage wetland habitats. Gravity drainage of the site allows for a significant reduction in pumping costs due to the significant volume of water that is realized at elevations greater than 431 feet. A water control structure also may provide the opportunity to open the gates in anticipation of high Illinois River levels to reduce the potential for damages to the levee caused by overtopping. This feature would require excavating a section of the levee in order to construct the water control structure.

C. Pump Station. The pump station is required in order to facilitate dewatering the preserve below IWW flat pool elevations (approximately 429.2 at Havana). The Nature Conservancy plans to draw site down to 425 at least once every 6 years in order to meet Project goals. Similarly the pump station is required to remain operational at elevation 435 which is the highest inundation elevation required to meet Project goals. The existing pump station was rated as unacceptable during a 1997 Corps Annual Levee Inspection and is therefore not considered to be reliable. In addition, the current pump station is unable to meet the Project goals due to the motors and motor controls located at elevation 434.

D. Reinforced Levee Spillway. The elevation of the southern portion of the levee that acts as a spillway is approximately 452 ft. This elevation corresponds to a 2.6 percent chance exceedance flood (~38.5 year). An Illinois River elevation greater than 452 ft would result in uncontrolled overtopping of the levee. Reinforcing a portion of this spillway (with either articulated concrete matting or reinforced turf materials) in addition to a water control structure would control overtopping. The hardened spillway, in combination with gate openings at the water control structure, would raise the interior water levels to a sufficient height to ensure that when the entire levee system is overtopped, water levels are within 1 foot of each other on the interior and exterior of the complex, thereby reducing flood damage to the complex and the resulting impact to habitat benefits and adjacent infrastructure.

E. Levee Improvements. There are currently reaches of the levee that have moderate to severe erosion on the riverside toe, and there are numerous locations where trees and vegetation are growing in the riprap or in the levee cross-section. These deficiencies reduce the integrity of the levee and

increase the risk of levee failure. Potential Project features could include placing riprap, removing vegetation, and restoring the levee cross-section to design standards. The levee is critical in protecting the Project from water fluctuations and sediment from the Illinois River, and allowing TNC to manage the water levels in the complex to maximize ecosystem benefits.

F. Islands. Wind fetch islands would be constructed throughout the complex to prevent resuspension of sediment due to wind generated waves, thus reducing the turbidity in Thompson and Flag Lakes. Wind driven waves may also cause damage to existing levees, roads, the ridge between Thompson and Flag Lakes, and berms adjacent to ditches. Construction of berms/islands would reduce the fetch lengths, and provide sheltered aquatic habitat and resting/loafing areas for waterfowl. Berms/islands would be constructed by placing adjacent fill material on the existing grade at shallow slopes. It should be noted that these islands would not completely eliminate sediment resuspension. Sediment resuspension would be reduced through several mechanisms: reducing wind fetch length; breaking wind generated waves; and protecting shallow areas which are more prone to sediment resuspension.

G. Description of Specific Measures. Potential measures are actions that could contribute to achieving the Project objectives. Measures are the specific action component of a Project feature. For this Project, numerous measures have been developed for each of the Project features. Professional judgment was used to develop conceptual designs of the measures in order to estimate costs and benefits.

Measures are considered the building blocks of alternatives. Alternatives often consist of multiple measures. To facilitate combining the measures into alternatives, each measure is given an alpha-numerical designation. The Project features and their respective alpha-numerically designated measures to be evaluated are as follows:

Levee Removal

- LR0: No Action
- LR1: Complete removal
- LR2: Notch levee below flat pool (429 NGVD)
- LR3: Notch levee above avg yearly WSE (437.5 NGVD, median WSE for high spring flows)

Water Control Structure

- W0: No Action
- W1: 7' wide - single gate
- W2: 21' wide – triple gate
- W3: 42' wide – multiple gates
- W4: 175' wide – maximum gates

Pump Station

- P0: No Action
- P1: 45,000 gpm of pumping capacity
- P2: 60,000 gpm of pumping capacity
- P3: 60,000/45,000 gpm of pumping capacity

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Reinforced Levee Spillway

- S0: No Action. Leave existing levee at lower elevation
- S1: Articulated concrete mattress and riprap – 1,020-foot width
- S2: Articulated concrete mattress and riprap – 2,190-foot width
- S3: Articulated concrete mattress and riprap – 3,100-foot width
- S4: Reinforced Turf Mat – 1,020-foot width
- S5: Reinforced Turf Mat – 2,190-foot width
- S6: Reinforced Turf Mat – 3,100-foot width
- S7: Reinforced Turf Mat – maximum width (~3,600)
- S8: Fill Spillway to Maximum Levee height
- S9: Partially Fill Spillway with Erodible Sand Material

Levee Rehabilitation

- L0: No Action.
- L1: Restore levee cross-section with rock protection
- L2: Restore levee cross-section by placing material on landward side of levee.
- L3: Restore levee cross-section to accepted design standards
- L4: Install Bioengineering measures to restore riverside toe of levee.

Islands

- I0: No Action
- I1: Construct 5 islands in critical areas
- I2: Construct 10 islands in critical areas

1. Levee Removal

LR0: No Action. The “No Action” measure means that the levee would not be removed or notched. The levee would continue to be subject to O&M by the NFS.

LR1: Complete Removal. This measure consists of removing the entire levee system except the portion that contains state route 78/97. The levee would be removed from the existing grade to an elevation below 428 feet in order to allow for fish passage when the river is at flat pool. This includes the levee along the Illinois River as well as the tie-back levees that connect to the Highway.

LR2: Notch Levee Below Flat Pool (429 NGVD). This measure consists of excavating one or more notches out of the levee. The notches in the levee may be along the Illinois River section or along the tie-back portions. The notches in the levee would be from the existing top of the levee grade to an elevation at least 1 foot below 429 feet in order to allow for fish passage when the river is at flat pool. The excavated notch would be a trapezoidal channel with 3:1 rock reinforced side slopes. The invert of the notch channel would also be reinforced with rock riprap to prevent scour and potential undermining of the rock on the side slopes. A bridge would also be constructed to span the notch opening to allow for vehicle traffic along the levee crown.

LR3: Notch Levee Above Average Yearly Water Surface Elevation (437.5 NGVD, median WSE for high spring flows). This measure consists of excavating the one or more notches out of the levee. The notches in the levee may be along the Illinois River section or along the tie-back portions. The notches in the levee would be from the existing top of the levee grade to an elevation of

437.5 feet which is the median WSE for the Illinois River during the spring months with the highest flow. Statistically, this notch would overtop every other year which would allow for regular connectivity, but would also allow for interior drawdown during years with low river levels. The excavated notch would be a trapezoidal channel with 3:1 rock reinforced side slopes. The invert of the notch weir would also be reinforced with concrete or rock riprap to prevent scour and potential undermining of the rock on the side slopes. A bridge would also be constructed to span the notch opening to allow for vehicle traffic along the levee crown.

2. Water Control Structure

W0: No Action. The “No Action” measure means that water control measures would not be implemented. The FWOP condition for water control would occur, as discussed in Section III. A.

W1: 7' Wide - Single Gate. This measure consists of constructing a U-shaped reinforced concrete channel through the existing levee. The proposed channel invert elevation is 428 feet. The proposed channel width is 8 feet, 6 inches, on center, with an effective opening of 7 feet. The 7-foot opening is spanned with heavy duty grating to allow for vehicles to drive over the structure along the levee. An 84” x 154” sluice gate would be installed on the landward side of the levee. Light duty grating would be installed on the landside shoulder in order to access the sluice gate controls and on the riverside shoulder to access the stoplog slots. Stop log structures would be installed on the riverside and landward side of the sluice gate in order to help manage surface water elevations and provide the ability to close the structure if repairs are needed on the sluice gate. The stop log structures would be timber, plastic or another non-metallic material as Paddlefish are sensitive to metallic objects. The stoplog channels would be vinyl coated prior to installation in order to account for the paddlefish sensitivity to metal. The sluice gates would be steel but would remain out of the water during periods when fish passage is desired. The sluice gate would be operated by an electric motor gate lift operator due to the weight of such a large gate. The electric gate operator would be capable of being controlled manually above the gate and from the outdoor-rated Motor Control Center (MCC). If this measure is combined with a pump measure the pump discharge pipe would outlet from the wall of the riverside apron. An energy dissipation structure would be installed on the interior and exterior sides of the water control structure. The interior energy dissipation structure includes an ogee spillway, a concrete section and a rock rip rap section. The exterior energy dissipation structure would be rock riprap only.

W2: 21' Wide – Triple Gate. This measure consists of constructing three U-shaped reinforced concrete channels through the existing levee. The proposed channel invert elevation is 428 feet. The proposed channel width is 8 feet, 6 inches, on center, with an effective opening of 7 feet. The three 7-foot openings are spanned with heavy duty grating to allow for vehicles to drive over the structure along the levee. An 84” x 154” sluice gate would be installed on the landward side of the levee for each channel structure. Light duty grating would be installed on the landside shoulder in order to access the sluice gate controls and on the riverside shoulder to access the stoplog slots. Stop log structures would be installed on the riverside and landward side of the sluice gate in order to help manage surface water elevations and provide the ability to close the structure if repairs are needed on the sluice gate. The stop log structures would be timber, plastic or another non-metallic material as Paddlefish are sensitive to metallic objects. The stoplog channels would be vinyl coated prior to installation in order to account for the paddlefish sensitivity to metal.

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The sluice gates may be steel but would remain out of the water during periods when fish passage is desired. The sluice gate would be operated by an electric motor gate lift operator due to the weight of such a large gate. The electric gate operator would be capable of being controlled manually above the gate and from the outdoor-rated MCC. If this measure is combined with a pump measure the pump discharge pipe would outlet from the wall of the riverside apron. An energy dissipation structure would be installed on the interior and exterior sides of the water control structure. The interior energy dissipation structure includes an ogee spillway, a concrete section and a rock rip rap section. The exterior energy dissipation structure would be rock riprap only.

W3: 42' Wide – Multiple Gates. This measure consists of constructing six U-shaped reinforced concrete channels through the existing levee. The proposed channel invert elevation is 428 feet. The proposed channel width is 8 feet, 6 inches, on center, with an effective opening of 7 feet. The six 7-foot openings are spanned with heavy duty grating to allow for vehicles to drive over the structure along the levee. An 84" x 154" sluice gate would be installed on the landward side of the levee for each channel structure. Light duty grating would be installed on the landside shoulder in order to access the sluice gate controls and on the riverside shoulder to access the stoplog slots. Stop log structures would be installed on the riverside and landward side of the sluice gate in order to help manage surface water elevations and provide the ability to close the structure if repairs are needed on the sluice gate. The stop log structures would be timber, plastic or another non-metallic material as Paddlefish are sensitive to metallic objects. The stoplog channels would be vinyl coated prior to installation in order to account for the paddlefish sensitivity to metal. The sluice gates may be steel but would remain out of the water during periods when fish passage is desired. The sluice gate would be operated by an electric motor gate lift operator due to the weight of such a large gate. The electric gate operator would be capable of being controlled manually above the gate and from the outdoor-rated MCC. If this measure is combined with a pump measure the pump discharge pipe would outlet from the wall of the riverside apron. An energy dissipation structure would be installed on the interior and exterior sides of the water control structure. The interior energy dissipation structure includes an ogee spillway, a concrete section and a rock rip rap section. The exterior energy dissipation structure would be rock riprap only.

W4: 175' Wide – Maximum Gates. This measure consists of constructing 25 U-shaped reinforced concrete channels through the existing levee. The proposed channel invert elevation is 428 feet. The proposed channel width is 8 feet, 6 inches, on center, with an effective opening of 7 feet. The 7-foot openings are spanned with heavy duty grating to allow for vehicles to drive over the structure along the levee. An 84" x 154" sluice gate would be installed on the landward side of the levee for each channel structure. Light duty grating would be installed on the landside shoulder in order to access the sluice gate controls and on the riverside shoulder to access the stoplog slots. Stop log structures would be installed on the riverside and landward side of the sluice gate in order to help manage surface water elevations and provide the ability to close the structure if repairs are needed on the sluice gate. The stop log structures would be timber, plastic or another non-metallic material as Paddlefish are sensitive to metallic objects. The stoplog channels would be vinyl coated prior to installation in order to account for the paddlefish sensitivity to metal.

The sluice gates may be steel but would remain out of the water during periods when fish passage is desired. The sluice gate would be operated by an electric motor gate lift operator due to the weight of such a large gate. The electric gate operator would be capable of being controlled manually above the gate and from the outdoor-rated MCC. If this measure is combined with a pump measure the pump

discharge pipe would outlet from the wall of the riverside apron. This structure may be replaced with a large dam structure in the design phase if this measure is selected and is determined to be more economical than the multiple U-shaped gates. An energy dissipation structure would be installed on the interior and exterior sides of the water control structure. The interior energy dissipation structure includes an ogee spillway, a concrete section and a rock rip rap section. The exterior energy dissipation structure would be rock riprap only.

3. Pump Station

P0: No Action. The “No Action” measure means that pump station measures would not be implemented. Without the Project, this area is limited to water level management with the existing pump station. The existing pump station was rated as unacceptable during a 1997 inspection, has since sustained fire and tornado damage, and is not considered to be reliable. The outdated pumps would eventually fail and the FWOP condition would occur. See Section III.A.

P1: 45,000 gpm of Pumping Capacity. This measure consists of construction of a new pump structure and installing two new electrical submersible pumps and constructing a new elevated outdoor rated Motor Control Center. The motor control center and pad-mounted service transformer equipment would be installed on an elevated structural platform that would be higher than the maximum flood elevation. One of the new pumps would be capable of passing 30,000 gpm of flow and the other would be rated to pass 15,000 gpm of flow. The pump controls would be installed above the anticipated water surface in a new elevated pump control station. A transformer and electrical conduits and lines to deliver power from the existing direct buried power line to the new pump station are required. This measure includes removing the existing pumps and demolition of the existing pump house. This measure also includes installing a gravel base roadway along the southern portion of the levee crown in order to access the pump station.

This measure would allow for drawdown of the interior water levels over a longer time period than larger pumps but may be more cost effective due to less equipment requirements and reduced power demand costs.

P2: 60,000 gpm of Pumping Capacity. This measure consists of construction of a new pump structure and installing three new electric submersible pumps to drain the preserve as outlined in the water control plan and constructing a new elevated outdoor rated Motor Control Center. The motor control center and pad-mounted service transformer equipment would be installed on an elevated structural platform that would be higher than the maximum flood elevation. One of the new pumps would be capable of passing 30,000 gpm of flow. The other two new pumps would be capable of passing 15,000 gpm of flow. The 15,000 gpm pumps would be used when the maximum pumping capacity is not required, thereby reducing electrical charges. The pump controls would be installed above the anticipated water surface in a new elevated pump control station. A transformer and electrical conduits and lines to deliver power from the existing direct buried power line to the new pump station are required. This measure includes removing the existing pumps and demolition of the existing pump house. This measure also includes installing a gravel base roadway along the southern portion of the levee crown in order to access the pump station.

This measure would allow for drawdown of the interior water levels over a shorter time period than smaller pumps but may be less cost effective due to increased equipment and power demand costs.

P3: 60,000/45,000 gpm of Pumping Capacity. This measure consists of constructing a new pump structure and installing three new electrical submersible pumps to drain the preserve as outlined in the water control plan, installing two new electrical submersible pumps to fill the preserve and constructing a new outdoor rated Motor Control Center. The motor control center and pad-mounted service transformer equipment would be installed on an elevated structural platform that would be higher than the maximum flood elevation. The three new pumps to drain the preserve would be composed of one new pump capable of passing 30,000 gpm of flow and two new pumps capable of passing 15,000 gpm of flow. The 15,000 gpm pumps would be used when the maximum pumping capacity is not required, thereby reducing electrical charges. The two new pumps to fill the preserve would be composed of one new submersible electric pump capable of passing 30,000 gpm of flow and one new submersible electric pump capable of passing 15,000 gpm of flow. The pump controls would be installed above the anticipated water surface in a new elevated pump control station. A transformer and electrical conduits and lines to deliver power from the existing direct buried power line to the new pump station are required. This measure includes removing the existing pumps and demolition of the existing pump house. This measure also includes installing a gravel base roadway along the southern portion of the levee crown in order to access the pump station.

This measure would allow for drawdown of the interior water levels over a shorter time period than smaller pumps but may be less cost effective due to increased equipment and power demand costs. This measure would also provide a method to pump water into the interior from the river.

4. Reinforced Levee Spillway

S0: No Action. The “No Action” measure means that levee spillway reinforcement would not be implemented. The FWOP condition would occur, as discussed in Section III.A.

S1: Articulated Concrete Mattress and Riprap – 1,020-foot width. This measure consists of installing 1,020 lineal feet of articulated concrete mat on the crest and landward side slope of the levee spillway. This measure also consists of installing a concrete cut-off wall on the riverside shoulder of the levee as well as rock riprap on the riverside slope and toe. This measure would require some clearing and grubbing and minor grading to assure a level articulated concrete spillway surface. The reinforced spillway would be centered in the straight section of the existing levee. The reinforced spillway side slopes would be graded to 6:1 and protected with rock riprap. The remainder of the lower levee section would be raised to the top of levee elevation (456 feet) with fill material. The fill material would be excavated from on-site borrow locations.

S2: Articulated Concrete Mattress and Riprap – 2,190-foot width. This measure consists of installing 2,190 lineal feet of articulated concrete mat on the crest and landward side slope of the levee spillway. This measure also consists of installing a concrete cut-off wall on the riverside shoulder of the levee as well as rock riprap on the riverside slope and toe. This measure would require some clearing and grubbing and minor grading to assure a level articulated concrete spillway surface. The reinforced spillway would be centered in the straight section of the existing levee. The reinforced spillway side slopes would be graded to 6:1 and protected with rock riprap. The remainder of the lower levee section would be raised to the top of levee elevation (456 feet) with fill material. The fill material would be excavated from on-site borrow locations.

S3: Articulated Concrete Mattress and Riprap – 3,100-foot width. This measure consists of installing 3,100 lineal feet of articulated concrete mat on the crest and landward side slope of the levee spillway. This measure also consists of installing a concrete cut-off wall on the riverside shoulder of the levee as well as rock riprap on the riverside slope and toe. This measure would require some clearing and grubbing and minor grading to assure a level articulated concrete spillway surface. The reinforced spillway would be centered in the straight section of the existing levee. The reinforced spillway side slopes would be graded to 6:1 and protected with rock riprap. The remainder of the lower levee section would be raised to the top of levee elevation (456 feet) with fill material. The fill material would be excavated from on-site borrow locations.

S4: Reinforced Turf Mat and Riprap – 1,020-foot width. This measure consists of installing 1,020 lineal feet of reinforced turf mat on the crest, riverside and landward side slopes of the levee spillway. This measure would require some clearing and grubbing and minor grading to assure a level spillway surface. The reinforced spillway would be centered in the straight section of the existing levee. The reinforced spillway side slopes would be graded to 6:1. The remainder of the lower levee section would be raised to the top of levee elevation (456 feet) with fill material. The fill material would be excavated from on-site borrow locations.

S5: Reinforced Turf Mat and Riprap – 2,190-foot width. This measure consists of installing 2,190 lineal feet of reinforced turf mat on the crest, riverside and landward side slopes of the levee spillway. This measure would require some clearing and grubbing and minor grading to assure a level spillway surface. The reinforced spillway would be centered in the straight section of the existing levee. The reinforced spillway side slopes would be graded to 6:1. The remainder of the lower levee section would be raised to the top of levee elevation (456 feet) with fill material. The fill material would be excavated from on-site borrow locations.

S6: Reinforced Turf Mat and Riprap – 3,100-foot width. This measure consists of installing 3,100 lineal feet of reinforced turf mat on the crest, riverside and landward side slopes of the levee spillway. This measure would require some clearing and grubbing and minor grading to assure a level spillway surface. The reinforced spillway would be centered in the straight section of the existing levee. The reinforced spillway side slopes would be graded to 6:1. The remainder of the lower levee section would be raised to the top of levee elevation (456 feet) with fill material. The fill material would be excavated from on-site borrow locations.

S7: Reinforced Turf Mat and Riprap – Maximum Width. This measure consists of installing reinforced turf mat on the crest, riverside and landward side slopes of the existing levee spillway (~3600 feet). This measure would require some clearing and grubbing and minor grading to assure a level spillway surface. The reinforced spillway side slopes would be graded to 6:1 if steeper existing grade otherwise left as existing.

S8: Fill Spillway to Maximum Levee Height. This measure consists of filling the existing auxiliary spillway with clay material to maximum levee elevation (~456 feet) in order to reduce the frequency of overtopping and provide additional time for the interior to fill through the gates before overtopping. This alternative may require additional material for creating a shallower slope on the landward side of levee to prevent failure during overtopping of the levee during extreme high flood events.

S9: Partially Fill Spillway with Erodible Sand Material. This measure consists of filling the auxiliary spillway with erodible sand material to an elevation 2 feet below maximum height of levee (456 feet). This measure would allow for a reduction of the frequency of flooding while providing a concentrated flow area during extremely high flooding events.

5. Levee Rehabilitation

L0: No Action. The “No Action” measure means that levee rehabilitation would not be implemented. The FWOP condition would occur, as discussed in Section III.A.

L1: Restore Levee Cross-Section with Rock Protection. This measure consists of restoring the levee design cross-section at the eroded areas by placing stone on the riverside slope and toe. This measure also includes removing trees and other unacceptable vegetation from levee. This measure would also require minimal cut and fill on the levee crown to assure a uniform elevation for hydraulic performance during extreme flood events.

L2: Restore Levee Cross-Section by Placing Material on Landward Side of Levee. This measure consists of restoring the minimum levee design cross-section by placing material on landward side of levee. This measure also includes removing trees and other unacceptable vegetation from levee. This measure would also require minimal cut and fill on the levee crown to assure a uniform elevation for hydraulic performance during extreme flood events.

L3: Restore levee Cross-Section to Accepted Design Standards. This measure consists of restoring the design levee cross-section to a minimum of a 10-foot crown and 3:1 side slopes. This measure also includes removing trees and other unacceptable vegetation from levee. This measure would also require minimal cut and fill on the levee crown to assure a uniform elevation for hydraulic performance during extreme flood events.

L4: Install Bioengineering Measures to Restore Riverside Toe of Levee. This measure consists of installing bendway weirs, rock barbs, or longitudinal peaked stone toe protection to divert the higher channel velocity away from the streambank. This measure would allow for natural deposition of soil which would restore the riverside toe of the levee over time, but would not address existing erosion along the river side slope of the levee.

6. Islands

I0: No Action. The “No Action” measure means that islands would not be implemented. The FWOP condition would occur, as discussed in Section III.A.

I1: Construct Five Islands in Critical Areas. This measure consists of constructing 5 islands that would have the greatest reduction in wind fetch distances and sediment re-suspension. These islands are considered to be the minimum number of islands necessary to reduce the impact of wind driven waves. The location of these islands was determined in a wind fetch analysis. Their numbering reflects their level of significance and priority for construction. The fill material would be obtained by excavating the areas adjacent to the designated island location, ensuring that the clay layer covering the shallow aquifer is not punctured.

I2: Construct All Islands. This measure consists of constructing all islands that would result in a significant reduction in wind fetch distances and sediment re-suspension. These islands are considered to be the optimal number of islands necessary to reduce the impact of wind driven waves. The location of these islands was determined in a wind fetch analysis. Their numbering reflects their level of significance and priority for construction. The fill material would be obtained by excavating the areas adjacent to the designated island location, ensuring that the clay layer covering the shallow aquifer is not punctured.

H. Initial Array of Project Alternatives and Screening. This section describes measures that meet the goals and objectives of this Project. Each measure was evaluated to determine its potential for environmental restoration and enhancement. Cost estimates were also derived for each of the feasible measures.

The Project features and measures each fulfill a need at the refuge. While many of the features and resulting measures identified are to meet a specific environmental need in the water management plan that was developed by TNC, there are some features that also provide a flood risk reduction component as an ancillary benefit to the environmental benefits.

The measures associated with the levee removal and water control structure features are the only features that meet the goal of reestablishing the backwater connection with the Illinois River. This connection is important to achieving the environmental benefits associated with aquatic habitat restoration, especially native fish overwintering habitat. However, these features alone would not be able to achieve all of the desired environmental benefits as optimized in the WLMP because they do not allow for the site to drawdown below the flat pool elevation. While the measures associated with the levee removal and water control structure features have partial value in aquatic habitat restoration, they also provide an ancillary benefit of reducing the flood risk potential of Project failure by neutralizing the pressure on the levee, or removing the levee, which reduces the risk of a catastrophic levee breach.

The measures associated with the pumps feature are critical to achieving desired water levels within a framework of reasonable expectations of the river elevations based on historic probabilities. The measures associated with the pumps feature would not be able to meet the Project goal of reestablishing connectivity with the Illinois River alone. The P1 and P2 measures can meet the environmental habitat goals optimized with the desired WLMP most of the time but are limited by the amount of precipitation and groundwater infiltration. The P3 measure may be combined with the “No Action” water control structure measure and still meet the WLMP due to the ability to pump water into the preserve from the Illinois River.

Measures associated with the reinforced spillway feature do not impact the WLMP during periods of average precipitation but do provide a benefit during and following extreme high water events. During extreme high water events the reinforced spillway allows the interior to fill with water which neutralizes the pressure on the levee and lowers the risk of catastrophic levee breaches occurring. If the levee remains intact then the habitat benefits are realized. If the levee is compromised then there may be lower habitat benefits for a period of time until the levee can be repaired and the ecosystem stabilized.

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Measures related to the Island feature are designed to provide aquatic habitat as well as increase the resiliency of the Project site due to their ability to reduce erosion associated with wind fetch. Erosion associated with wind fetch may be a significant concern during management years where the WSE is intentionally held high.

1. Formulation of Alternatives. There are a limited number of alternatives that exist for measures combined with the levee removal measures because the intended purpose of the pump, reinforced spillway, and levee rehabilitation measures are all dependent on the levee being intact. In the same ways alternatives are limited by the combination of various width water control structures and reinforced spillway measures. The widths associated with the reinforced spillway measures were developed to be combined with a particular water control structure measure. For example the W1 alternative is for a 7-foot wide water control structure. In order to provide the same level of protection that currently exists, the reinforced spillway must be at least 3100 feet in length. So the W1 measure may not be combined with any reinforced spillway measures that have a length less than 31,00 feet but may be combined to create alternatives with reinforced spillway measures that are greater than 3,100 feet in length. Table 4 is a matrix depicting all of the possible alternative combinations.

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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands	
LR0: No Action	W0	S0.	P0	L0	I0	
		S1				
		S2				
		S3	P1	L1		I1:
		S4				
		S5				
		S6	P2	L3		I2
		S7				
		S8				
	S9	P3	L4			
	S0.			P0	L0	I0
	S1					
	S2					
	S3	P1	L1	I1		
	S4					
	S5					
	S6	P2	L3	I2		
	S7					
	S8					
	S9	P3	L4			
	S0.			P0	L0	I0
	S1					
	S2					
	S3	P1	L1	I1		
	S4					
	S5					
	S6	P2	L3	I2		
S7						
S8						
S9	P3	L4				

LEGEND	S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands
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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands
LR0: No Action	W3: 42' wide – multiple gates	S0	P0	L0	I0
		S1			
		S2		P1	L1
		S3			
		S4			
		S5	P2	L3	
		S6			
		S7			
		S8	P3	L4	I2
	S9				
	W4: 175' wide – maximum gates	S0.	P0	L0	I0
		S1			
		S2		P1	L1
		S3			
		S4			
		S5	P2	L3	
		S6			
		S7			
S8		P3	L4	I2	
S9					
LEGEND Shaded areas signify that the measure is NOT combinable with the other measures.		S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands

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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands		
COMPLETE REMOVAL							
LR1: Complete removal	W0	S0	P0	L0	I0		
		S1		P1		L1	
		S2				L2	I1
		S3	P2		L3		
		S4			L4	I2	
		S5				P3	L0
		S6	P1				L1
		S7		L2	I1		
		S8		P2		L3	
	S9	L4	I2				
	W1: 7' wide – single gate		S0		P0	L0	I0
			S1	P1		L1	
		S2	L2			I1	
		S3	P2		L3		
		S4			L4		I2
		S5				P3	L0
		S6	P1				L1
		S7		L2	I1		
S8		P2		L3			
S9	L4		I2				
LEGEND Shaded areas signify that the measure is NOT combinable with the other measures.			S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands	

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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands				
COMPLETE REMOVAL									
LR1: Complete removal	W2: 21' wide – triple gate	S0	P0	L0	10				
		S1							
		S2							
		S3	P1	L1		11			
		S4							
		S5							
		S6	P2	L3			12		
		S7							
		S8							
	S9	P3	L4						
	S0								
	S1								
	S2								
	W3: 42' wide – multiple gates			S3	P1	L1		10	
				S4					
				S5					
				S6	P2	L3	11		
				S7					
		S8							
		S9	P3	L4	12				
		S0							
		S1							
	S2								
	W4: 175' wide – maximum gates	S3				P1		L1	10
		S4							
		S5							
		S6				P2	L3	11	
S7									
S8									
S9		P3	L4	12					
S0									
S1									
S2									

LEGEND	S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands
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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands		
FULL HEIGHT NOTCH							
LR2: Notch below flat pool elevation 429	W0	S0	P0	L0	10		
		S1					
		S2					
		S3	P1	L1		11	
		S4					
		S5					
		S6	P2	L3			12
		S7					
		S8					
	S9	P3	L4	10			
	S0						
	S1						
	W1: 7' wide – single gate	S2	P1		L1	11	
		S3					
		S4					
		S5	P2		L3		12
		S6					
		S7					
		S8	P3	L4	10		
		S9					
		S0					
	W2: 21' wide – triple gate	S1	P0	L0		11	
		S2					
		S3					
		S4	P1	L1			12
		S5					
		S6					
S7		P2	L3	10			
S8							
S9							
W2: 21' wide – triple gate	S0	P3	L4		11		
	S1						
	S2						
	S3	P1	L1			12	
	S4						
	S5						
	S6	P2	L3	10			
	S7						
	S8						
S9	P3	L4	11				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	12	
	S3						
	S4						
	S5	P1		L1	10		
	S6						
	S7						
	S8	P2	L3	11			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			12	
	S2						
	S3						
	S4	P1	L1		10		
	S5						
	S6						
	S7	P2	L3	11			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			12	
	S1						
	S2						
	S3	P1	L1		10		
	S4						
	S5						
	S6	P2	L3	11			
	S7						
	S8						
S9	P3	L4	12				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	10	
	S3						
	S4						
	S5	P1		L1	11		
	S6						
	S7						
	S8	P2	L3	12			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			10	
	S2						
	S3						
	S4	P1	L1		11		
	S5						
	S6						
	S7	P2	L3	12			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			10	
	S1						
	S2						
	S3	P1	L1		11		
	S4						
	S5						
	S6	P2	L3	12			
	S7						
	S8						
S9	P3	L4	10				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	11	
	S3						
	S4						
	S5	P1		L1	12		
	S6						
	S7						
	S8	P2	L3	10			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			11	
	S2						
	S3						
	S4	P1	L1		12		
	S5						
	S6						
	S7	P2	L3	10			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			11	
	S1						
	S2						
	S3	P1	L1		12		
	S4						
	S5						
	S6	P2	L3	10			
	S7						
	S8						
S9	P3	L4	11				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	12	
	S3						
	S4						
	S5	P1		L1	10		
	S6						
	S7						
	S8	P2	L3	11			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			12	
	S2						
	S3						
	S4	P1	L1		10		
	S5						
	S6						
	S7	P2	L3	11			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			12	
	S1						
	S2						
	S3	P1	L1		10		
	S4						
	S5						
	S6	P2	L3	11			
	S7						
	S8						
S9	P3	L4	12				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	10	
	S3						
	S4						
	S5	P1		L1	11		
	S6						
	S7						
	S8	P2	L3	12			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			10	
	S2						
	S3						
	S4	P1	L1		11		
	S5						
	S6						
	S7	P2	L3	12			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			10	
	S1						
	S2						
	S3	P1	L1		11		
	S4						
	S5						
	S6	P2	L3	12			
	S7						
	S8						
S9	P3	L4	10				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	11	
	S3						
	S4						
	S5	P1		L1	12		
	S6						
	S7						
	S8	P2	L3	10			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			11	
	S2						
	S3						
	S4	P1	L1		12		
	S5						
	S6						
	S7	P2	L3	10			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			11	
	S1						
	S2						
	S3	P1	L1		12		
	S4						
	S5						
	S6	P2	L3	10			
	S7						
	S8						
S9	P3	L4	11				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	12	
	S3						
	S4						
	S5	P1		L1	10		
	S6						
	S7						
	S8	P2	L3	11			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			12	
	S2						
	S3						
	S4	P1	L1		10		
	S5						
	S6						
	S7	P2	L3	11			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			12	
	S1						
	S2						
	S3	P1	L1		10		
	S4						
	S5						
	S6	P2	L3	11			
	S7						
	S8						
S9	P3	L4	12				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	10	
	S3						
	S4						
	S5	P1		L1	11		
	S6						
	S7						
	S8	P2	L3	12			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			10	
	S2						
	S3						
	S4	P1	L1		11		
	S5						
	S6						
	S7	P2	L3	12			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			10	
	S1						
	S2						
	S3	P1	L1		11		
	S4						
	S5						
	S6	P2	L3	12			
	S7						
	S8						
S9	P3	L4	10				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	11	
	S3						
	S4						
	S5	P1		L1	12		
	S6						
	S7						
	S8	P2	L3	10			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			11	
	S2						
	S3						
	S4	P1	L1		12		
	S5						
	S6						
	S7	P2	L3	10			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			11	
	S1						
	S2						
	S3	P1	L1		12		
	S4						
	S5						
	S6	P2	L3	10			
	S7						
	S8						
S9	P3	L4	11				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	12	
	S3						
	S4						
	S5	P1		L1	10		
	S6						
	S7						
	S8	P2	L3	11			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			12	
	S2						
	S3						
	S4	P1	L1		10		
	S5						
	S6						
	S7	P2	L3	11			
	S8						
	S9						
W2: 21' wide – triple gate	S0	P3	L4			12	
	S1						
	S2						
	S3	P1	L1		10		
	S4						
	S5						
	S6	P2	L3	11			
	S7						
	S8						
S9	P3	L4	12				
S0							
S1							
W2: 21' wide – triple gate	S2	P0			L0	10	
	S3						
	S4						
	S5	P1		L1	11		
	S6						
	S7						
	S8	P2	L3	12			
	S9						
	S0						
W2: 21' wide – triple gate	S1	P3	L4			10	
	S2						
	S3						
	S4	P1	L1		11		
	S5						
	S6						
	S7	P2	L3	12			
	S8						
	S9						
W2: 21' wide – triple gate	S0						

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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands
FULL HEIGHT NOTCH					
LR2: Notch below flat pool elevation 429	W3: 42' wide – multiple gates	S0	P0	L0	I0
		S1			
		S2			
		S3	P1	L1	I1
		S4			
		S5			
		S6	P2	L3	I2
		S7			
		S8			
	S9	P3	L4	I2	
	W4: 175' wide – maximum gates	S0	P0	L0	I0
		S1			
		S2			
		S3	P1	L1	I1
		S4			
		S5			
		S6	P2	L3	I2
		S7			
S8					
S9	P3	L4	I2		
LEGEND		S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands
Shaded areas signify that the measure is NOT combinable with the other measures.					

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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands		
PARTIAL HEIGHT NOTCH							
LR3: Partial notch to elevation 437.5 ft	W0	S0	P0	L0	I0		
		S1		P1		L1	
		S2				L2	
		S3	P2	L3	I1		
		S4		L4			
		S5		P3		L4	
		S6	P0		L0	I0	
		S7			L1		
		W1: 7' wide – single gate	S8	P1	L2	I1	
	S9		L3				
	S0		L4				
	W2: 21' wide – triple gate		S1	P2	L4	I2	
			S2		P3		L4
			S3				P0
			S4	L1			
			S5	P1	L2		
			S6		L3		
		S7	P2	L4	I2		
		S8		P3		L4	
		S9				L4	
	LEGEND Shaded areas signify that the measure is NOT combinable with the other measures.		S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands	

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Table 4. Possible Alternative Combinations

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands	
PARTIAL HEIGHT NOTCH						
LR3: Partial notch to elevation 437.5ft	W3: 42' wide – multiple gates	S0	P0	L0	I0	
		S1		P1		L1
		S2				L2
		S3	P2		L3	
		S4			P3	L4
		S5				P0
		S6	P1			
		S7		L2		
		S8		P2	L3	
	S9	P3	L4			
	S0		P0		L0	
	S1			P1	L1	
	S2	L2				
	S3	P2	L3			
	S4		P3		L4	
	S5				P0	L0
	S6	P1				L1
	S7		L2			
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1	P1			L1		
S2		L2				
S3		P2	L3			
S4			P3	L4		
S5				P0	L0	
S6		P1			L1	
S7	L2					
S8	P2		L3			
S9		P3	L4			
S0			P0	L0		
S1						

2. Screening of Alternatives. The water control structure measures and the reinforced spillway measures are directly related with respect to the system hydraulics. The water control measures with more bays allow for the interior to fill more rapidly during extreme flood events which corresponds with a shorter required spillway crest width to minimize the difference in WSEs when the levee does begin to overtop. The following water control structure measures and reinforced spillway measures may be screened from evaluation for the reasons presented:

Levee Removal Measures Screened

- **LR1 (complete removal) and LR2 (notch levee below flat pool)** may be screened out because while these measures meet the goal of reestablishing the backwater connection with the Illinois River system, they do not allow for adequate water level management of the site to meet all of the other key ecological attributes that derive habitat benefits and further may result in adverse environmental affects. The following information supports this decision.

In 2002, large river scientists, managers, and stakeholders attended four UMR and IWW System Environmental Objectives Planning Workshops to partner in establishing objectives used in developing UMR-IWW Navigation Study Environmental Alternatives. The IWW workshop participants concluded that leveed floodplain areas bordering the southern pools of the Illinois River should remain disconnected from the mainstem river to better restore and maintain native floodplain habitat (*ENV Report 50 – Interim Report for the UMR-IWW Navigation Study – Environmental Objectives Planning Workshops*).

Although floodplain reconnection is an ecosystem restoration priority in most Mississippi River floodplain areas, the poor quality of the mainstem Illinois River has resulted in the need to maintain disconnection to better control natural water level fluctuation, limit exotic fish access, and reduce sedimentation rates in backwaters. The result of this disconnection is an improved and more easily maintained native floodplain aquatic habitat that may be reconnected to the mainstem in the future if Illinois River conditions improve.

Appendix I of ENV Report 50 captured the following plenary discussion comments related to the Illinois River Floodplain.

- “Until Carp populations are controlled, we need to keep the selected large agricultural levees in place for the marshland habitats.”
- “Whole floodplain from Peoria to Bartonville needs to be maintained, protected and enhanced.”
- “It would be preferable to have this open, but in order to protect this habitat, we cannot. These leveed-off agricultural areas are 100-year-old time capsules.”

Specific leveed floodplain objectives (*ENV Report 50 – Appendix D*) identified during the IWW Objective Planning Workshop included:

- “maintain habitat-protecting levees (e.g., Hennepin/Hopper) until river conditions are adequate to allow reconnection”

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- “maintain 50 percent of currently isolated backwaters for exclusion of exotics and protection of high quality habitats”
- “re-establish missing marsh habitat by maintaining the levees”

The above discussion and objectives have resulted in agreement between Mississippi River Basin scientists and stakeholders that environmental restoration of lower Illinois River floodplain is best realized through maintaining disconnection or a managed connection between the Illinois River and its floodplain. Basin partners have continued to support this floodplain restoration effort through coordination of multiple Programs including the Illinois River Basin Restoration Program – 519, the EMP, and the NESP.

- **LR3 (Notch levee above average yearly water surface elevation (437.5 NGVD, median WSE for high spring flows))** may be screened out because while the notch elevation would keep flow out of the backwater half of the time in order to allow for drawdowns to compact sediment and realize the associated habitat benefits, it would also restrict native fish passage in the fall and early winter months for overwintering habitat. This alternative does not allow for the key ecological attribute to be realized and limits spring and summer ecological attributes from being realized. Also this alternative may bring in large sediment loads and would be limited in its ability to deliver fish and nutrients to the river from the backwater.

Water Control Structure Measures Screened

- **W4 (175-foot gate opening)** may be screened out because while it may serve to fill the interior solely by gate control; the flow rate that enters through these gates during high river elevations is extreme and requires stilling basins and other non-environmental measures to be functional. This measure may also be screened based on its high cost.

Pump Station Measures Screened

- **P1 [45,000 gallons per minute (gpm)]** pump capacity was screened out because it does not have the capacity to achieve the necessary drawdown in the 30 day time required in TNC’s WLMP.
- **P3 (60,000/45,000 gpm)** pump capacity was screened out for all of the alternative combinations that include water control structures. This measure is intended to meet the desired WLMP without the benefit of a gate structure to allow the gravity flow of water into the preserve. This measure may only be combined with alternatives that include the “W0-No Action” water control structure measure.

Reinforced Spillway Measures Screened

- **S3 (3100-foot ACM spillway width); S6 (3100-foot RTF spillway width); and S7 (RTF maximum width ~3,600-foot width)** may be screened out due to an unfavorable placement for the spillway. Spillway lengths greater than 2800 feet require a 60 degree bend in the spillway. This alignment would result in concentrated flow and shear forces in the vicinity of this bend and is not good reinforced spillway design practice. The spillway may not be moved to other

sections of the levee because of the significant amount of soil material that would have to be moved. Refer to Appendix H, *Hydrology and Hydraulics* for the overtopping analysis.

- **S8 (fill spillway to max levee height)** may be screened from the evaluation because raising the spillway elevation to the top of levee elevation would increase the flow in the floodplain during storm events that would have normally overtopped the spillway into the TDL. It is unlikely that the state of Illinois would allow for this option to enter into construction since they have a zero foot floodway rise policy in Illinois.
- **S9 (partially fill spillway with erodible material)** may be screened from the evaluation for the same reasons as S8, as well as, the undesirable potential loading of massive amounts of sediment to the Illinois River system when the sand spillway erodes during high flood events.

Levee Rehabilitation Measures Screened

- **L1 (Restore levee cross-section with rock protection); L2 (Restore with landside placement); L3 (Restore to accepted standard); and L4 (Install bioengineering measures)** may all be screened because it is not required that levees be at flood control standards for the purpose of environmental restoration. While there is erosion observed along the riverside slope of the levee, the requirement for a 3H:1V slope is associated with flood protection under the PL84-99 program and other accepted standards, but does not apply to this Project authority. It is recommended that the NFS regrade/smooth the areas of the levee that have vertical sections due to erosion along the riverside toe such that the existing slopes become uniform at 2.5H:1V or greater. Refer to Appendix G, *Geotechnical Considerations* for this analysis. The NFS is required to assure that the levee is functional for the duration of the Project.

Table 5 displays the alternative matrix following the cost effective screening of measures. Measures may not be further screened at this time, but will be evaluated in the Incremental Cost Analysis by respective alternative.

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Table 5. Alternative Matrix Following Cost Effective Screening of Measures

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands	
LR0: No Action	W0: No Action	S0	P0	L0	I0	
		S1		P1		L1
		S2			L2	
		S3	P2		L3	I1
		S4		L4		
		S5			P3	L4
		S6	I2			
		S7				
		S8	W1: 7' wide - single gate	S0	P0	L0
	S1	P1		L1		
	S2			L2		
	S3			P2	L3	I1
	S4	L4				
	S5				P3	L4
	S6	I2				
	S7					
	S8	I2				
	S9					
LEGEND		S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands	
Gray areas signify that the measure is NOT combinable with the other measures.						
Yellow areas signify that the measure has been screened out.						

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Table 5. Alternative Matrix Following Cost Effective Screening of Measures

Levee Removal	Water Control Structure	Reinforced Levee Spillway	Pump Station	Levee Rehabilitation	Islands	
LR0: No Action	W2: 21' wide - triple gate	S0	P0	L0	I0	
		S1				
		S2	P1	L1		
		S3				
		S4				
		S5	P2	L3	I1	
		S6				
		S7			P3	L4
		S8				
	S9					
	W3: 42' wide - multiple gates	S0	P0	L0	I0	
		S1				
		S2	P1	L1		
		S3				
		S4				
		S5	P2	L3	I1	
		S6				
		S7			P3	L4
		S8				
	S9					
	W4: 175' wide - maximum gates	S0	P0	L0	I0	
		S1				
		S2	P1	L1		
		S3				
		S4				
		S5	P2	L3	I1	
		S6				
S7		P3			L4	
S8						
S9						
LEGEND		S1: ACM – 1020-ft width S2: ACM – 2190-ft width S3: ACM – 3100-ft width S4: RTF – 1020-ft width S5: RTF – 2190-ft width S6: RTF – 3100-ft width S7: RTF – 3600-ft width S8: Fill to Max S9: Partial Fill w/ Sand	P0: No Action P1: 45,000 gpm pump P2: 60,000 gpm pump P3: 60,000/45,000 gpm pump	L0: No Action L1 : Restore w/ rock protection L2: Restore w/ landside placement L3: Restore to accepted standard L4: Install Bioengineering Measures	I0: No Action I1: Construct 5 islands I2: Construct all islands	

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V. EVALUATION OF FEASIBLE PROJECT FEATURES AND FORMULATION OF ALTERNATIVES

A. General. Measures that were not screened out due to limitations are now combined and evaluated based on environmental benefits and their respective costs. Since the “No Action” alternatives for Levee Removal and Levee Rehabilitation are the only measures remaining from these features, these measures will not be included in the following alternatives in order to avoid confusion and unnecessary nomenclature. Table 6 displays all of the alternatives to be evaluated.

Table 6. Project Alternatives

No WCS

Without Pump	W0S0P0I0	W0S0P0I1	W0S0P0I2
With Pump 2	W0S0P2I0	W0S0P2I1	W0S0P2I2
With Pump 3	W0S0P3I0	W0S0P3I1	W0S0P3I2

7-Foot WCS

Without Pump	W1S0P0I0	W1S0P0I1	W1S0P0I2
With Pump 2	W1S0P2I0	W1S0P2I1	W1S0P2I2

21-Foot WCS

No Spillway/No Pump	W2S0P0I0	W2S0P0I1	W2S0P0I2
No Spillway/Pump 2	W2S0P2I0	W2S0P2I1	W2S0P2I2
ACM Spillway/No Pump	W2S2P0I0	W2S2P0I1	W2S2P0I2
ACM Spillway/Pump 2	W2S2P2I0	W2S2P2I1	W2S2P2I2
RTF Spillway/No Pump	W2S5P0I0	W2S5P0I1	W2S5P0I2
RTF Spillway/Pump 2	W2S5P2I0	W2S5P2I1	W2S5P2I2

42-Foot WCS

No Spillway/No Pump	W3S0P0I0	W3S0P0I1	W3S0P0I2
No Spillway/Pump 2	W3S0P2I0	W3S0P2I1	W3S0P2I2
ACM Spillway/No Pump	W3S1P0I0	W3S1P0I1	W3S1P0I2
ACM Spillway/Pump 2	W3S1P2I0	W3S1P2I1	W3S1P2I2
ACM Spillway/No Pump	W3S2P0I0	W3S2P0I1	W3S2P0I2
ACM Spillway/ Pump 2	W3S2P2I0	W3S2P2I1	W3S2P2I2
RTF Spillway/No Pump	W3S4P0I0	W3S4P0I1	W3S4P0I2
RTF Spillway/Pump 2	W3S4P2I0	W3S4P2I1	W3S4P2I2
RTF Spillway/No Pump	W3S5P0I0	W3S5P0I1	W3S5P0I2
RTF Spillway/Pump 2	W3S5P2I0	W3S5P2I1	W3S5P2I2

B. Environmental Outputs. The District, TNC, the ILDNR, the INHS, and the USFWS conducted a habitat analysis to assess environmental outputs (benefits) of the proposed Project. This multi-agency team assessed existing Project area conditions and projected FWOP conditions and expected impacts of proposed Project features and alternatives. The PDT assessed Project benefits for wetland and aquatic habitat types. For the wetland assessment, the PDT utilized the Wildlife Habitat Appraisal Guide (WHAG), a numerical habitat appraisal system based on USFWS Habitat Evaluation Procedures 1980) developed by the Missouri Department of Conservation and the Soil Conservation

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Service (Urlich, et al., 1984). For the aquatic habitat assessment, the PDT used the Aquatic Habitat Appraisal Guide (AHAG) (Mathias, et al., 1996). Since the Project features had both aquatic and wetland benefits/impacts, the PDT combined the WHAG and AHAG results to produce the final results.

A detailed description of the habitat analysis is provided in Appendix C, *Habitat Evaluation and Quantification*. This appendix includes discussions on the model assumptions, how acre quantities were derived, and how the PDT perceived how the Project area would respond to the proposed features over time. Table 7 shows the annualized habitat output for each Project feature including the No Action alternative.

Table 7. Annualized Environmental Outputs for Each Proposed Management Measure

Feature Description	Aquatic AAHUs	Wetland AAHUs	Net Total AAHUs
Water Control Structure			
W0 - No Action	57,340		0
W1 - 7ft Single Gate	69,579		12,239
W2 - 21ft Triple Gate	69,579		12,239
W3 - 42ft Multiple Gate	69,579		12,239
Pump			
P0 - No Action		11,835	0
P2 - 60,000 GPM Pump		44,715	32,880
P3 - 60,000 GPM/45,000 GPM Pump		44,715	32,880
Reinforced Spillway			
S0 - No Action	0	0	0
S1 - ACM 1,020ft Width Spillway	9	3	12
S2 - ACM 2,190ft Width Spillway	17	6	23
S4 - RTF 1,020ft Width Spillway	0	0	0
S5 - RTF 2,190ft Width Spillway	0	0	0
Islands			
I0 - No Action		0	0
I1 - 5 Islands w/out water control		361	361
I1 - 5 Islands w/ water control		907	907
I2 - 10 Islands w/out water control		638	638
I2 - 10 Islands w/ water control		2,203	2,203

¹No habitat value since there is no work proposed below elevation 440.

C. Cost Estimates. Table 8 identifies the design and construction cost for each measure along with their respective monitoring and adaptive management costs. Design and construction costs do not account for real estate costs because the water level extent is the same for all combinations of measures. The design and construction costs are annualized for each measure and added to the annualized Operation and Maintenance, Repair, Replacement and Rehabilitation costs for each of the respective measures (table 9). The breakdown of the costs of construction and O&M are highlighted in greater detail in Appendix F. The annualized cost was determined based on the Federal Discount Rate for FY14 of 3.5 percent.

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Table 8. Cost by Measure

Management Measure	Contract Cost	Design & Construction Mgmt ¹	Monitoring & Adaptive Mgmt Costs	Subtotal Cost ²
Water Control Structure				
W0 - No Action	\$0	\$0	\$0	\$0
W1 - 7ft Single Gate	\$2,594,626	\$1,141,635	\$509,452	\$4,245,714
W2 - 21ft Triple Gate	\$3,161,783	\$1,391,185	\$509,452	\$5,062,420
W3 - 42ft Multiple Gate	\$4,012,519	\$1,765,508	\$509,452	\$6,287,480
Pump				
P0 - No Action	\$0	\$0	\$0	\$0
P2 - 60,000 GPM Pump	\$1,696,341	\$746,390	\$452,846	\$2,895,577
P3 - 60,000 GPM/45,000 GPM Pump	\$2,167,888	\$953,871	\$452,846	\$3,574,605
Reinforced Spillway				
S0 - No Action	\$0	\$0	\$0	\$0
S1 - ACM 1,020ft Width Spillway	\$2,220,249	\$976,910	\$200,000	\$3,397,159
S2 - ACM 2,190ft Width Spillway	\$4,590,607	\$2,019,867	\$200,000	\$6,810,474
S4 - RTF 1,020ft Width Spillway	\$510,482	\$224,612	\$150,000	\$885,094
S5 - RTF 2,190ft Width Spillway	\$920,710	\$405,112	\$150,000	\$1,475,822
Islands				
I0 - No Action	\$0	\$0	\$0	\$0
I1 - 5 Islands w/out water control	\$2,294,776	\$1,009,701	\$169,817	\$3,474,294
I1 - 5 Islands w/ water control	\$2,294,776	\$1,009,701	\$169,817	\$3,474,295
I2 - 10 Islands w/out water control	\$3,218,815	\$1,416,279	\$169,817	\$4,804,911
I2 - 10 Islands w/ water control	\$3,218,815	\$1,416,279	\$169,817	\$4,804,911

¹ Costs include Plans and Specifications, Engineering During Construction, Planning During Construction, Construction Management (S&A), and Operation Manual.

² Lands and Damages are not included in Subtotal Cost but are equal for all of the possible combinations of measures. Lands and Damages are estimated at \$4,850,000 total cost or an annualized cost of \$206,773.

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Table 9. Annualized Costs and Benefits by Measure

Management Measure	Annualized Subtotal Cost ¹	Annualized OMRR&R Cost	Annualized Total Cost (By Measure) ¹	Outputs (Net AAHU)
Water Control Structure				
W0 - No Action	\$0	\$0	\$0	0
W1 - 7ft Single Gate	\$181,011	\$4,551	\$185,562	12,239
W2 - 21ft Triple Gate	\$215,830	\$6,669	\$222,499	12,239
W3 - 42ft Multiple Gate	\$268,059	\$9,846	\$277,904	12,239
Pump				
P0 - No Action	\$0	\$0	\$0	0
P2 - 60,000 GPM Pump	\$123,449	\$63,005	\$186,454	32,880
P3 - 60,000 GPM/45,000 GPM	\$152,399	\$96,465	\$248,864	32,880
Reinforced Spillway				
S0 - No Action - No Gate	\$0	\$1,304	\$1,304	0
S0 - No Action - 7' WCS	\$0	\$1,331	\$1,331	0
S0 - No Action - 21' WCS	\$0	\$312	\$312	0
S0 - No Action - 42' WCS	\$0	\$286	\$286	0
S1 - ACM 1,020ft Width Spillway	\$144,833	\$1,196	\$146,030	12
S2 - ACM 2,190ft Width Spillway	\$290,356	\$2,639	\$292,995	23
S4 - RTF 1,020ft Width Spillway	\$37,735	\$532	\$38,267	0
S5 - RTF 2,190ft Width Spillway	\$62,920	\$544	\$63,463	0
Islands				
I0 - No Action	\$0	\$0	\$0	0
I1 - 5 Islands w/out water control	\$148,122	\$0	\$148,122	361
I1 - 5 Islands w/ water control	\$148,122	\$0	\$148,122	907
I2 - 10 Islands w/out water control	\$204,851	\$0	\$204,851	638
I2 - 10 Islands w/ water control	\$204,851	\$0	\$204,851	2203

¹Lands and Damages are not included in Subtotal Cost or Annualized Total Cost (By Measure) but are equal for all of the possible combinations of measures. Lands and Damages are estimated at \$4,850,000 total cost or an annualized cost of \$206,773.

D. Alternative Comparison. The measures costs and benefits are summed by the alternatives outlined in Section V.A. The estimated land value is annualized and incorporated for each of the respective alternatives and then analyzed in the IWR Planning Suite Incremental Cost Analysis (CE-ICA) Software. Tables 10 and 11 and figure 9 generated in CE-ICA displays the alternatives that are cost effective and best buys plans

The best buy plans are then evaluated based on their incremental cost and output. The CE-ICA software program generated a bar chart with the best buy alternatives (figure 10). The W2S2P2I2 alternative had a significantly higher incremental cost compared to the others such that the graph was dramatically distorted. The bar chart in figure 11 shows the best buy plans without the W2S2P2I2 alternative. The incremental costs for the best buy alternatives may be seen in table 12.

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Table 10. Cost Effective Plans

Name	Cost ¹	Output	Cost Effective
W0S0P0I1	\$356,200	361	Yes
W0S0P2I1	\$542,654	33,787	Yes
W1S0P2I1	\$728,242	46,026	Yes
W3S1P2I2	\$1,022,013	47,334	Yes

¹ Cost includes an annualized Lands and Damages cost of \$206,773 for each alternative.

Table 11. Best Buy Plans

Name	Cost ¹	Output	Cost Effective
No Action Plan	\$0	0	Best Buy
W0S0P2I0	\$394,532	32,880	Best Buy
W1S0P2I0	\$580,120	45,119	Best Buy
W1S0P2I2	\$784,971	47,322	Best Buy
W2S2P2I2	\$1,113,573	47,345	Best Buy

¹ Cost includes an annualized Lands and Damages cost of \$206,773 for each alternative.

Table 12. Incremental Costs of Best Buy Plans

Best Buy Plan	Normalized Output	Total Cost Annualized Cost	Average Cost/Unit	Incremental Cost	Incremental Output	Incremental Cost
W0S0P0I0	0	\$0	\$0	\$0	0	\$0
W0S0P2I0	69.45	\$394,532	\$12.00	\$394,532	32,880	\$12
W1S0P2I0	95.3	\$580,120	\$12.86	\$185,588	12,239	\$15
W1S0P2I2	99.95	\$784,971	\$16.59	\$204,851	2,203	\$93
W2S2P2I2	100	\$1,113,573	\$23.52	\$328,602	23	\$14,287

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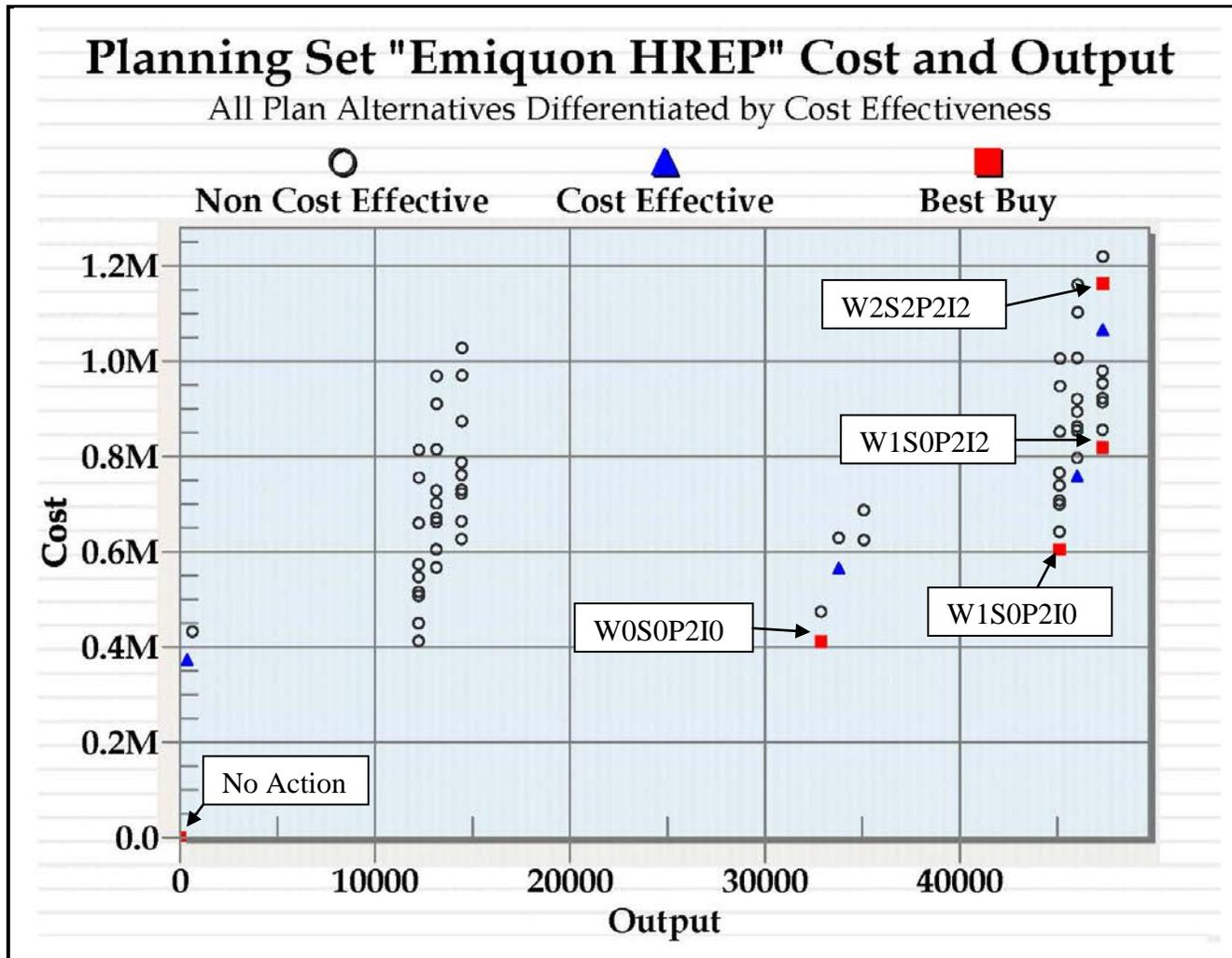


Figure 9. Plan Alternatives by Cost Effectiveness

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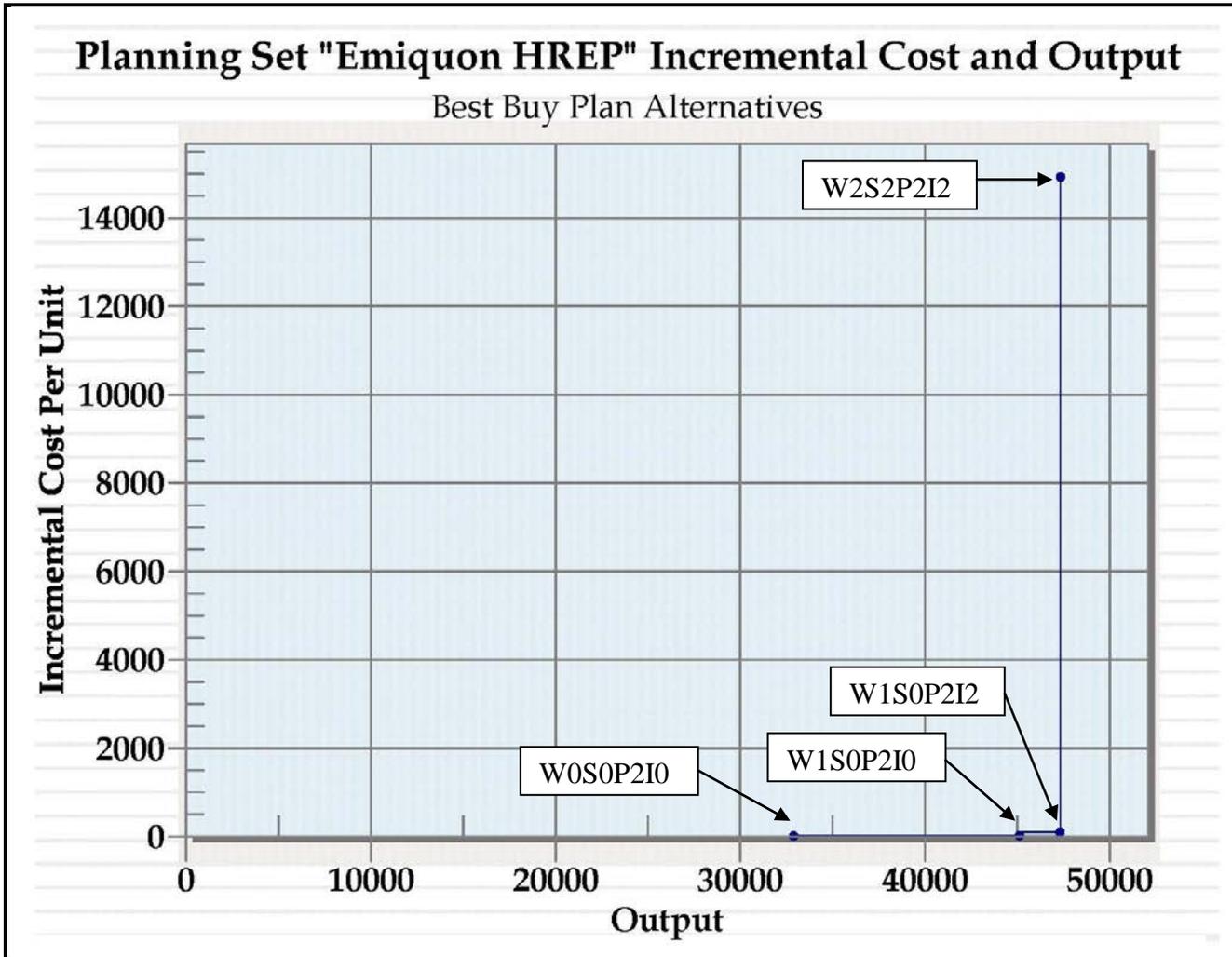


Figure 10. Best Buy Incremental Cost

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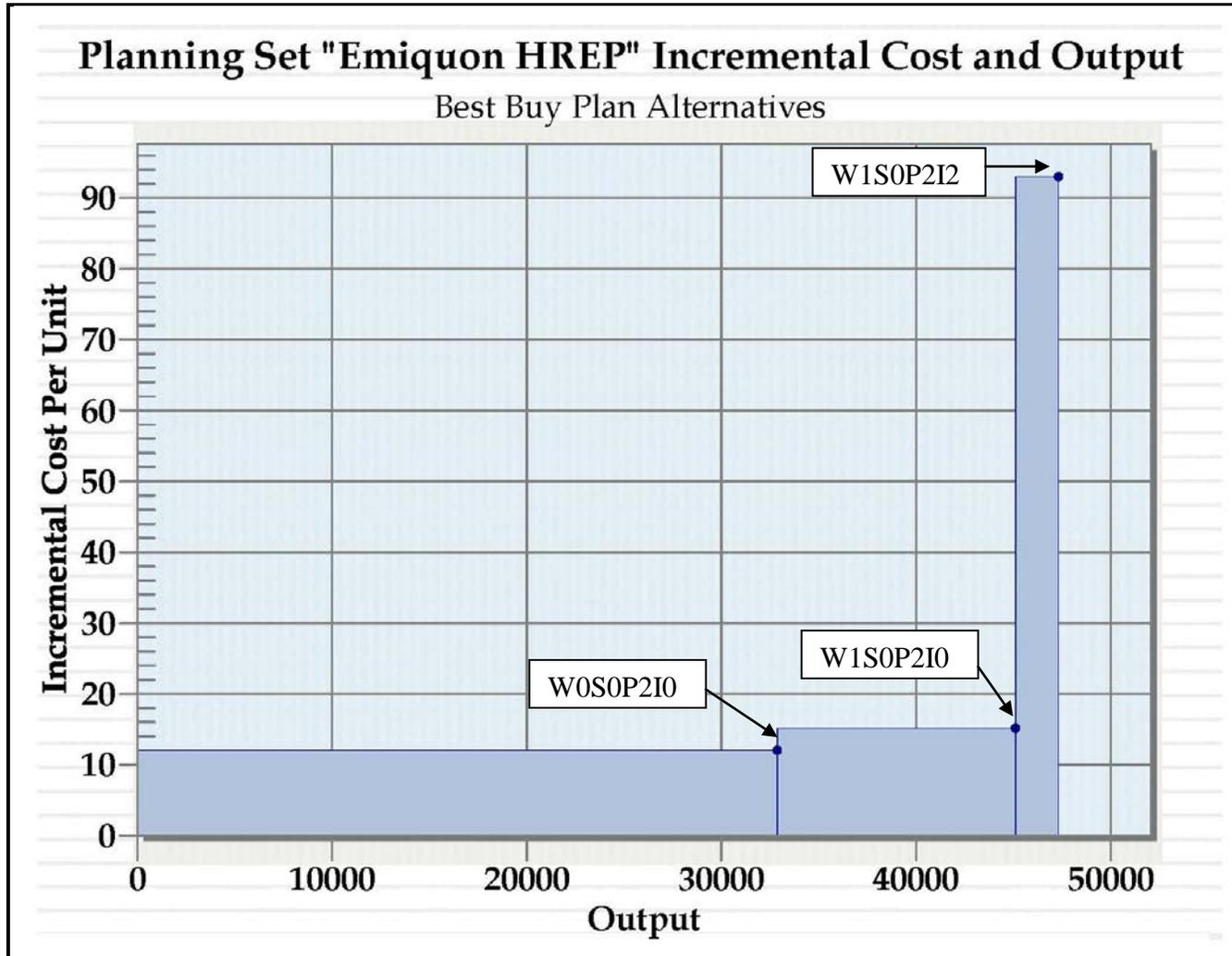


Figure 11. Best Buy Incremental Cost Minus Highest Option

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The “best buy” alternatives were evaluated using the four evaluation criteria of the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G paragraph 1.6.2 (c)). The four criteria are as follows:

Completeness. All of the alternatives are equally complete in that they may be constructed and maintained independent of external influences. The completeness of all of the alternatives is dependent on the NFS obtaining a Compatible Use Authorization (CUA) from the USDA-NRCS due to the presence of their WRP easement on the Project area. All of the alternatives are believed to be equally complete in terms of being able to obtain the CUA from the NRCS.

Effectiveness. Alternative W0S0P0I0, the “No Action” alternative, is the least effective plan because it does not address either of the Project goals of restoring quality, functional, floodplain habitat and ecological processes in an Illinois River backwater area or restoring floodplain connectivity from the Illinois River to a productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river.

Alternative W0S0P2I0 is a more effective alternative than the “No Action” alternative because it includes a pump station which would achieve the goal of restoring the Illinois River backwater area through intentional drawdowns which is required for long term health of the backwater habitat and ecology. However, this alternative does not include a water control structure feature and thus is ineffective in achieving the Project goal of restoring floodplain connectivity from the Illinois River to the productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river.

Alternatives W1S0P2I0, W1S0P2I2 and W2S2P2I2 are all effective in achieving the Project goals of restoring quality, functional, floodplain habitat and ecological processes in an Illinois River backwater area; and restoring floodplain connectivity from the Illinois River to a productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river.

However, Alternatives W1S0P2I2 and W2S2P2I2 are more effective than alternative W1S0P2I0 at meeting the objectives related to providing food, foraging and resting areas for migratory waterfowl as these alternatives include islands which are a limited resource in this area dominated by open water. TNC reports that at times when portions of the former pump station access road are exposed they have observed waterfowl in this area to forage and rest on it. Islands 1 and 2 would be built in this general vicinity for either of these project alternatives.

The effectiveness of island habitat in meeting the objectives associated with food, forage and resting for migratory waterfowl is well document on the UMRS and within the UMRP program. The Peoria Lake HREP which constructed a large island to reduce wind fetch and provide food, foraging and resting areas reported observed wetland benefits, such as an increase in waterfowl populations from 5,300 ducks (9 species) in fall 1992 to 70,700 ducks (18 species) in the fall of 1997. Increases in the Spring migration were documented as well, increasing from 1,000 ducks in 1992 to 3,000 in 1998.

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The Peoria HREP also reported aquatic benefits from construction of the island features, due to a wave height reduction of 37% which resulted in improved water clarity. This improved water quality contributed to an increase in fish species from a measured 5,400 fish (36 species) in 1991 to 37,200 (59 species) in 1997. These benefits were documented based on observations and while attempts are made to capture all of the anticipated benefits in an environmental model such as WHAG/AHAG these models are not intended to be all encompassing. They are intended to provide a comparative estimate of benefits based on habitat quality and habitat quantity to support decision making.

Alternatives W1S0P2I2 and W2S2P2I2 are more effective in meeting a key ecological need, according to the National Science Foundation (documented in institutional significance section), of providing island habitat where islands are systemically being lost in the IWW as a result of wind and wave erosion.

Efficiency. Alternative W0S0P0I0, the “No Action” plan, is an efficient plan because there is no cost required though no benefits are realized.

As mentioned in the incremental cost analysis portion of the Report the alternative W2S2P2I2, although a Best Buy, is orders of magnitude higher in cost with a small amount of additional benefits. This alternative is not efficient in that the additional cost per output from the W1S0P2I2 plan to the W2S2P2I2 plan resulted in nearly \$15,000 per output where the other alternatives were less than \$100 per unit of output.

Alternatives W0S0P2I0, W1S0P2I0 and W1S0P2I2 all have comparable average cost per unit ranging between \$12.00 per AAHU to \$16.60 per AAHU. Similarly, these alternatives have reasonably comparable incremental costs ranging from \$12 per incremental output to \$93 per incremental output.

The PDT evaluated the efficiency associated with a 5-islands configuration with potential to adaptively manage up to a 10-islands configuration in order to manage costs while assuring that the island measures were being optimized for those that have the greatest impact on wind fetch and environmental benefits. As mentioned in the description of the measures the 5-islands measure consists of the 5 islands that would have the greatest reduction in wind fetch distances and sediment re-suspension. These islands are considered to be the minimum number of islands necessary to reduce the impact of wind driven waves. The location of these islands was determined in a wind fetch analysis. Their numbering reflects their level of significance and priority for construction. Environmental benefits were calculated for each of the respective islands with and without water control. While the first 5 islands provide the greatest reduction in wind fetch distances and sediment re-suspension islands 6-10 provide greater environmental benefits per dollar spent such that the 10-islands measure has a more favorable incremental cost per habitat unit. This demonstrates that while the 5 islands alternatives are cost effective that the 10 islands alternatives are more efficient at achieving environmental benefits at a lower incremental cost.

The monetary cost per unit of environmental output (AAHU) is important in understanding the efficiency of project alternatives. However, it is also important to understand how the environmental output model calculates those benefits. The WHAG/AHAG model used in this study is similar to many other environmental models in estimating habitat benefits based on

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habitat suitability indices and acres of habitat. In some cases the acres become the driving force in the environmental benefits a project is representing. In the case of Emiquon the islands feature has nearly identical habitat suitability index values as the pumping feature but because the islands area (acres) is so small relative to the larger basin (110 acres vs. 2500 acres) their environmental output (AAHU's) are much smaller. The difference in acres between the Project features translates into a pump feature estimating 32,880 AAHU's versus 2,200 AAHU's for features that have similar suitability for the various species.

For more information on the habitat evaluation refer to Appendix C, *Habitat Evaluation and Quantification*.

Acceptability. One of the considerations for local acceptability of this Project is that it must be consistent with the TDL legal requirements that there be no impact of inundated water on the tile drainage of the remaining agricultural producers in the TDL. The maximum WSE is 435ft for all of the alternatives. The remaining agricultural producers are all located at higher elevations. The property located in the southwest corner of Section 29 of Township 5N-Range 4E is the only property that is in close proximity to the maximum WSE. The PDT used 1ft contour resolution LIDAR data to evaluate the maximum WSE impact to the remaining agricultural producers. The PDT determined that the approximate invert elevation of the drainage ditch that is closest to the tile drain outlet is approximately 437ft so the PDT does not anticipate any adverse impacts to the ability of the adjacent properties tile drains to maintain positive gravity flow. All of the alternatives have a maximum WSE of 435ft which means they are all equally acceptable in terms of their implementability.

The Project was also required to be acceptable to the NRCS given their WRP easement over much of the Project area. A letter was provided to the Corps by NRCS to document that they have reviewed the plans and concurs that the Project may be compatible with the WRP easement. All projects are believed equally acceptable.

Acceptability may also be evaluated based on the satisfaction that the alternatives deliver. Alternatives that include the islands feature are anticipated to provide greater satisfaction to the environmental agencies as well as the public based on the diversity of habitat they provide. The islands add a variety of topographic diversity at a shallow slope which provides scarce edge habitat and unique shallow water habitat that benefits migratory waterfowl as well as aquatic fish and plant species. Alternatives W1S0P2I2 and W2S2P2I2 that include islands may provide greater satisfaction to anglers as the islands would provide a loafing area for fish and other aquatic species.

In accordance with the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* the alternative evaluation must also consider the four primary accounts: National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED) and Other Social Effects (OSE). These are described as follows:

National Economic Development. Alternatives W1S0P2I2 and W2S2P2I2 which include an island feature would provide national economic development benefits in the form of reduced costs associated with maintenance of the interior levee slopes including the highway road slopes which may

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experience erosion due to wind driven wave erosion and reduced risk of costly road repairs should the road slopes fail. Other alternatives will not provide any NED benefits.

Environmental Quality. The EQ account seeks to capture favorable and unfavorable changes to the environmental, aesthetic and cultural attributes of the natural and cultural resources. The Project area has a number of identified sites of varying cultural resource significance. These sites occur at varying elevations and locations around the Project area. The existing impacts of wind induced wave erosion or wind fetch may result in unfavorable effects to the integrity of the cultural resources sites. Wind induced wave erosion may also have an adverse effect on and ecological processes due to poor water quality associated with resuspension of sediments. Alternatives W1S0P2I2 and W2S2P2I2 that include islands to reduce wind fetch are more favorable to cultural resource sites and ecological processes than those alternatives without islands.

Regional Economic Development. The RED account considers changes in the distribution of regional economic activity based on the scenarios. All of the alternatives except the “No Action” alternative provide regional economic benefits. An IMPLAN regional economic evaluation was conducted and resulted in approximately \$2 million in combined direct, indirect and induced effects from construction of an alternative including a water control structure, pump station and 10 islands. Alternatives that include fewer features would have lesser economic effects and those which have more features would provide greater economic effects. The IMPLAN valuation may be viewed in Appendix M, *Plan Formulation and Economics*.

Other Social Effects. The OSE account captures any aspects not covered in the other 3 accounts that may provide bearing on the decision making process. All of the alternatives are equally dependant on the levee remaining intact to provide environmental benefits. Erosion of the levee and highway roadslope due to wind induced wave erosion is a consideration in life, safety and long-term O&M of the Project. Alternatives W1S0P2I2 and W2S2P2I2 that include island features to break up wind fetch are likely to incur less significant wave induced erosion on the levee slopes thus minimizing the potential for life and safety issues associated with levee and/or road failure.

Another social effect is the reduced energy demand and cost associated with alternatives W1S0P2I0, W1S0P2I2 and W2S2P2I2. These alternatives include a water control structure to dewater the Project area when river levels are low and in accordance with the WLMP. The reduced energy demand results in less adverse impacts to air and water quality associated with traditional coal-fired energy production facilities common to this area.

Table 13 displays a comparison of the best buy alternatives with respect to the four P&G criteria and four primary accounts.

Table 13. Comparison of Best Buy Alternatives Using P&G Criteria and Primary Accounts ¹

	P&G Criteria				P&G Primary Accounts			
	Completeness	Effectiveness	Efficiency	Acceptability	NED Benefits	EQ Benefits	RED Benefits	OSE Benefits
W0S0P0I0	Yes	Not Effective	Most Efficient	Acceptable	No	No	No	No
W0S0P2I0	Yes	Partially Effective	More Efficient	Acceptable	No	No	Yes	No
W1S0P2I0	Yes	Effective	Efficient	Acceptable	No	No	Yes	Partial
W1S0P2I2	Yes	Most Effective	Efficient	Most Acceptable	Yes	Yes	Yes	Yes
W2S2P2I2	Yes	Most Effective	Not Efficient	Most Acceptable	Yes	Yes	Yes	Yes

¹ Green - good or favorable
Brown - partially good/partially favorable
Red - not good/not favorable.

E. Recommended Plan

National Ecosystem Restoration Plan. For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, was recommended. The Recommended Plan was shown to be cost effective and justified to achieve the desired level of output. This plan is identified as the National Ecosystem Restoration (NER) Plan. Using the results from the IWR Plan, four P&G accounts, four P&G criteria, and evaluating the significance of the ecosystem outputs, Alternative W1S0P2I2 was identified as the NER plan. The Recommended Plan is based on the following considerations:

- This alternative is complete in that it would be constructed and maintained independent of external influences.
- This alternative is consistent with the Federal Objective as defined in the P&G.
- This alternative is cost effective and considered the most effective plan in achieving the Project goals of restoring quality, functional, floodplain habitat and ecological processes in an Illinois River backwater area; and restoring floodplain connectivity from the Illinois River to a productive backwater area, which serves as fish spawning grounds and a nutrient recharge to the river due to the inclusion of islands.
- This alternative achieves a desired level of output by restoring nationally significant habitat, including island habitat where islands are systemically being lost in the IWW as a result of wind and wave erosion according to the National Science Foundation.
- This alternative is comparable to the lowest cost option in terms of average cost per unit. This alternative is marginally higher than the lowest cost options in terms of incremental cost but is significantly lower in cost than the highest cost option and provides an additional 2,200 AAHUs of environmental benefits of a unique habitat type in this portion of the river. The habitat suitability between the highest and lowest incremental output project measures are similar, the acres of potential habitat are driving the difference in benefits. This alternative reasonably maximizes ecosystem restoration benefits compared to costs.

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- This alternative is acceptable based on implementability and the satisfaction it may provide to environmental agencies and the public.
- This alternative provides national economic benefits due to cost savings associated with reduced maintenance of the levee interior slopes and the roadway slopes.
- This alternative addresses the environmental quality considerations related to reducing adverse impacts on cultural resources associated with wind induced wave erosion.
- This alternative addresses the environmental quality consideration related to reducing adverse impacts on ecological resources associated with poor water quality due to resuspension of sediments.
- This alternative addresses the other social effects considerations related to potential life and safety concerns associated with erosion and failure of the levee and roadslope due to wind induced erosion. This alternative also addresses the energy demand consideration and related air and water quality impacts.

VI. RECOMMENDED PLAN DESCRIPTION WITH DESIGN, CONSTRUCTION, AND OPERATION & MAINTENANCE CONSIDERATIONS

A. General. The Recommended Plan is Alternative W1S0P2I2, which includes measures W1 (7 foot wide gate), S0 (no spillway reinforcement), P2 (60,000 gpm pumping capacity), and I2 (Construction of 10 islands). The Plan is shown in figure 12 and in Appendix Q, Plate 8.

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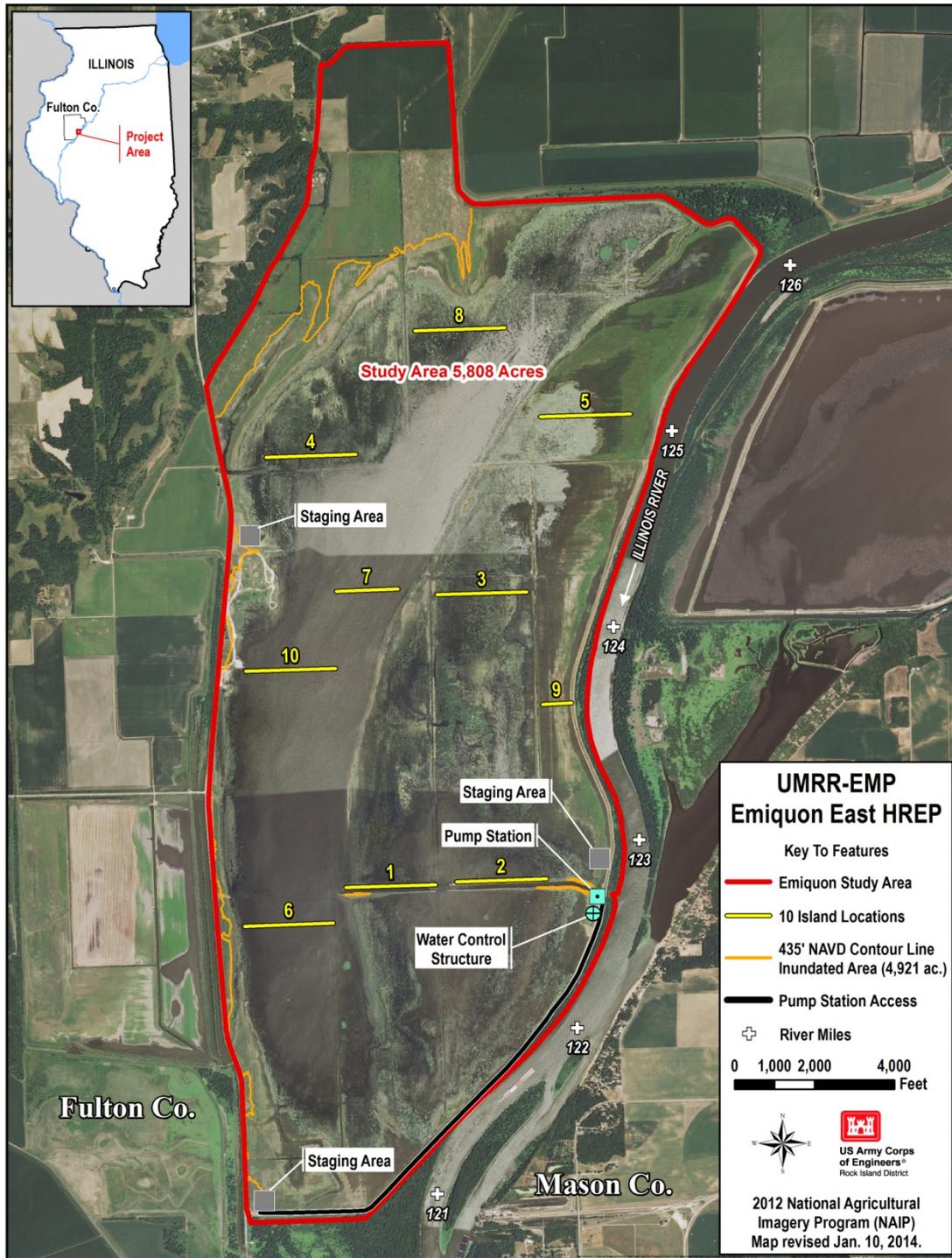


Figure 12. Emiquon East Recommended Plan

B. Description of Recommended Plan

1. Water Control Structure. A water control structure would be constructed in the location of the existing pump station in order to utilize existing interior drainage and to reduce excavation requirements for the structure. Excavation of the existing levee and landside and riverside channels would be required to allow the gravity flow of water as outlined in the water control plan.

To construct this feature, it is likely the TDLD would perform unwatering of the drainage district to the furthest level possible prior to construction. A cofferdam may be required for the construction to ensure that the Emiquon preserve is not impacted by fluctuating river levels during construction.

The structure developed for this DPR to meet the proposed WLMP includes a 7-foot water control structure is a U-shaped reinforced concrete channel with a sheet pile cutoff wall. The proposed channel invert elevation is 428 feet with a top of structure elevation of 455 feet to match adjacent levee top elevations and allow for vehicular transport across the top of the structure. The 7-foot opening is spanned with heavy duty grating to provide access across the water control structure for maintenance vehicles. Light duty grating spans the structure on each side of the heavy duty grating to provide an operating platform for the sluice gate and access to the stoplog slots. One purpose of this structure is to allow for fish passage which could be allowed by the placement of boulders embedded into the bottom of the structure to allow for resting areas for fish passage.

An 84" x 154" steel sluice gate would be installed on the landward side of the levee. The gates would remain out of the water during periods when fish passage is desired in order to assure no impact on passage of paddlefish. The sluice gate could be operated by an electric motor gate lift operator that is controlled manually at the elevated outdoor rated motor control center.

Stop log structures would be installed to allow the NFS to close off the structure to do repair work on the gate or do other water control manipulations. The stoplog material would be evaluated during plans and specification, but could consist of timber, plastic or another non-metallic material. The stoplog channels could be vinyl coated prior to installation in order to account for paddlefish sensitivity to metal.

Once the water control feature is opened, it forms a connection to the IWW in which fish passage may occur. The fish would be attracted to this opening when a high attracting velocity is detected. However, the velocities may be too high to allow the fish to pass through. Boulder placement within the water control structure was discussed during feasibility to provide resting areas for fish during these high velocity periods. For feasibility design, it was assumed that we would have rows of 5-foot diameter boulders which would be embedded to about 25 percent of their depth, at a spacing to reduce velocities to match fish burst swimming capabilities. Further design is required for boulder spacing and placement during plans and specifications.

An Ogee spillway would be designed to create energy dissipation on the landside of the water control structure. Large riprap would be placed along the landside and riverside channels leading to the structure. Additionally, riprap protection adjacent to the water control structure would be placed on the riverside of the structure in both upstream and downstream directions.

To place riprap, it is likely that water levels would need to be high enough that rock can be transported

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by barge to the site along the Illinois Waterway, and the material would be placed from the barge onto the adjacent levee and into the drainage channels. While the contractor may opt to transport small loads of riprap along the top of the levee, the cost would be greater, and it is unlikely that the contractor would proceed in this manner. Therefore, riprap placement would likely occur when river levels are such that the rock barge would have at least four to six feet of water depth to access the site from the river.

The Nature Conservancy is developing an alternative water control structure design. Any alternative design proposed during the Planning, Engineering and Design (PED) phase must meet the requirements for water level management and other constraints outlined in this DPR.

For more detail, refer to Appendix Q, Plates 18, 19 and 20; Appendix H, *Hydrology and Hydraulic*; and Appendix K, *Structural Considerations*.

2. Pumping System. This measure consists of demolition of the existing pump house as well as removal of the existing pumps. Three submersible electric pumps would provide a 60,000 gpm capacity to draw down the lake as required by the water control plan. One of the new pumps would be capable of passing 30,000 gpm of flow. The other two new pumps would be capable of passing 15,000 gpm of flow. The pump controls and transformer would be installed on the top of the levee or cantilevered off of the shoulder of the levee in a new elevated outdoor rated motor control center. The motor control center and pad-mounted service transformer equipment would be installed at or above the 500-year flood elevation. Electrical conduits and lines to deliver power from the existing direct buried power line to the new pump station would be installed to connect the transformer. A gravel base access road would be constructed along the southern portion of the levee crown in order to access the pump station. The pump discharge pipe would run up the landward side slope and outlet through the water control structure wall into the riverside apron beyond the riverside stop log structure. Refer to Appendix R, Plates 24, 25, and 26; Appendix H, *Hydrology and Hydraulics*; and Appendix J, *Mechanical and Electrical Considerations* for more details.

The Nature Conservancy is developing an alternative pumping system design. Any alternative design proposed during the PED phase must meet the requirements for water level management and other constraints outlined in this DPR.

3. Islands. This measure consists of constructing 10 interior islands. Islands will provide topographic diversity for this backwater area. The recommended design is for 10 islands to be strategically placed throughout the Project area to prevent resuspension of sediment due to wind generated waves, thus reducing turbidity. The islands will not completely eliminate sediment resuspension. Island construction helps by reducing wind fetch length and forcing wind generated waves to break while the protection of shallow areas is achieved through seasonal drawdowns and recruitment of moist soil vegetation.

A detailed hydraulic analysis was performed for this wind/wave fetch analysis for this specific report (using Automated Coastal Engineer System Modeling Software and ASCE publications). A geotechnical analysis, including constraints for borrow and excavation depths, was performed. Information regarding the design was also obtained from experience as outlined in the *UMRR Environmental Design Handbook* as well as lessons learned from various HREPs.

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Criteria for island design included the following:

- reducing wind fetch length which in turn will reduce wave height and sediment resuspension;
- breaking wind generated waves to reduce wave height and sediment resuspension;
- protecting shallow areas which are more susceptible to sediment resuspension;
- allowing the islands to be functional for most water levels predicted in the WLMP;
- avoiding and protect environmentally sensitive and cultural areas;
- using existing topographic features to reduce fill quantities; and
- maintaining sufficient layer of clay over the underlying aquifer for all borrow sites (do not puncture the lake pan).

Island orientations chosen were based on the prevailing wind direction. During plans and specifications, analysis of wind fetch from directions other than the primary wind direction will be performed to develop the final island layout. Lessons learned from the Peoria Island HREP Initial Performance Evaluation Report (specifically the barrier island) outline the importance of considering various wind directions and site specific wind data for final layouts.

An iterative process for island placement occurred to provide the optimum island locations in order to reduce wave height. The island crown elevations were selected to prevent overtopping by wave run up. These elevations are similar to the existing elevations observed at the Old Norris Farm Pump House Road.

The construction of islands would require borrow from adjacent land. Geotechnical borings would be required in these areas to ensure that the borrow depth would not penetrate the surface clay layer resulting in a point in the Project interior that would be directly connected to the groundwater. This type of connection could result in an additional intrusion of water during low water periods, or unwanted drainage of water during high water periods. Lessons learned from other ecosystem projects, such as the Bay Island HREP, outline the need that the shallow aquifer be protected to ensure effective water level management within the complex. If it is not possible to protect the aquifer at any of the island locations shown, the island locations will be updated to optimize the reduction of wave heights while protecting the underlying aquifer. Shallow borrow areas are shown adjacent to each island location. These can be seen in the typical section shown and in the plan views for each island on the attached drawings. Borrow areas would be kept as close to the constructed feature as possible in order to minimize construction costs. During construction, close monitoring of all borrow activities will be required to ensure that excavation depths do not pierce the underlying aquifer.

Final island design and layout will consider recommendations from the Adaptive Management Team (AMT) and will incorporate lessons learned from projects such as Swan Lake, Peoria Lake and Bay Island HREP projects.

In order to construct the islands, the interior could be drained by the newly constructed pumps. Any drawdown recommended for construction purposes should be consistent with the NRCS CUA. If the

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area could not be drawn down, equipment that can work in wet and submerged conditions would be used.

For further detail, refer to Appendix Q, Plates 10 to 16; Appendix H, *Hydrology and Hydraulics*; and Appendix G, *Geotechnical Considerations*.

C. Project Summary. Table 14 summarizes the Project features in the Recommended Plan. Additional details would be developed during plans and specifications which might cause minor modifications to the summarized data provided in this table.

Table 14. Emiquon East HREP Feature Summary

Feature	Measurement	Unit of Measure
Water Control Structure (W1)		
Number of Gates	1	EA
Gate Opening	7	FT
Structure Length (perpendicular to levee)	178.5	FT
Sluice Gate	84 x 156	SQ IN
Top Structure Elevation	455	ft NGVD
Gate Invert Elevation	428	ft NGVD
Sheet Pile Cutoff Wall Bottom Elevation	393.5	ft NGVD
Ogee Spillway Invert Elevation	418	ft NGVD
Excavation for structure, channel and connection to river	21,375	CY
Riprap (650# top size)	11,100	TN
Riprap (400# top size)	2,200	TN
Bedding Stone	4,700	TN
Stones for Fish Passage	30	Boulders
Grating for Vehicle Passage	1,800	lb
Heavy Duty Panels	50	lb/SF
Heavy Duty Panels	3 by 8	SF
Heavy Duty Panels	4	EA
Light Duty Panels	25	lb/SF
Light Duty Panels	3 by 8	SF
Light Duty Panels	4	EA
Stop Log Structure	1	EA
Pump Station (P1)		
Demolish Pump house, includes removal of pumps and engines	1	EA
15,000 gpm submersible Pumps	2	EA
30,000 gpm submersible pump	1	EA
Discharge Diameter Size	42	inch
Landside Sill Elevation	418	ft NGVD
Pump Pad		
Plan View Dimensions	31'7" x 28' 6 1/8"	
Trash Rack	1	ea
Discharge Pipe		
Number	3	ea
Diameter	42	in
Total Length	400	ft
Access Road		
Location	Top of Levee	
Width	12	Feet

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Table 14. Emiquon East HREP Feature Summary

Feature	Measurement	Unit of Measure
Thickness	4	Inches
Length	13,000	Feet
Road Stone	1,500	TN
Islands (I2)		
Islands	10	EA
Island Top Width	10	FT
Top Elevation	436	ft NGVD
Side Slopes	10H:1V	
Islands 1, 2, 3, 4, 5, 6, 8, 10 Length	2,250	FT
Islands 7 Length	1,050	FT
Island 9 Length	750	FT
Islands (I2)		
Excavation Depth	424	ft NGVD
Excavation Width	60	ft
Island 1 Fill	27,600	CY
Island 2 Fill	90,600	CY
Island 3 Fill	122,300	CY
Island 4 Fill	42,000	CY
Island 5 Fill	155,400	CY
Island 6 Fill	5,200	CY
Island 7 Fill	31,100	CY
Island 8 Fill	13,900	CY
Island 9 Fill	22,400	CY
Island 10 Fill	52,000	CY

D. Design Considerations. The Project has been developed to a feasibility level of design. Design details are included in the technical appendices. As with all feasibility level studies, these details would be refined in the Plans and Specifications (P&S) Stage.

1. Site Elevations. Estimates of flat pool at the Project site were made based upon a linear interpolation of flat pool elevation at the Copperas Creek gage located upstream of the Project site (RM 136.8) and flat pool elevation at the Havana gage located downstream of the Project site (RM 119.6). Flat pool elevation ranges from 429.2 ft NGVD at the downstream end of the Project (RM 120.9) to 429.3 ft NGVD at the upstream end of the Project (RM 125.9). The slope of the river between these two gages varies as a function of flow. Hydraulic information for these gages is available at RiverGages.com. While it is possible that a major flood could overtop the existing levee system, it is unlikely that regular seasonal floods would impact the interior of the existing levee and disrupt construction. However, high water observed on the IWW may have impacts on construction of the water control structure and pump station, and scheduling to avoid high water during construction should be considered.

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2. Division Regulations DIVR 1110-1-403 Mississippi Valley Division/Mississippi River Commission Policy on River Diversions. The features of the Recommended Plan features and the proposed WLMP were quantitatively evaluated for local and systemic impacts to the Illinois River by the PDT. The results of this analysis are discussed in Appendix H. The planned water control structure diversion is a 7-foot gate and is not anticipated to have adverse local and/or system impacts with regards to the ambient river water and sediment flow. The operation of the Recommended Plan should not impact existing engineering features and projects, such as levees or other river training structures, nor is it expected to have any significant cumulative impacts on the system. The local and/or system impacts would be evaluated fully as part of the Plans and Specifications phase of the Project. Per *DIVR 1110-2-240 "Preparation of Water Control Plans and Manuals"*, a water control plan will be developed during Plans and Specifications.

3. Historic Properties. Historic properties are addressed in the existing conditions section of this report (Section II.J.). The layout and design of the islands and pump station location were conducted to avoid impacts to the historic properties. However, it is important that areas to avoid during construction access and borrow added to the Project Plans and Specifications contract addressing requirements or process for the contractor in the case historic properties are encountered during construction will be included. Table 14: Probable Construction Sequence, lists dewatering of the Emiquon Preserve (Table 14: sequence 9) and island construction (Table 14: Sequence 10). District Contracts and construction efforts shall allow time in the schedule for the NRCS to conduct Phase II test investigations of 11F675, 11F679, and 11F238 and determine whether these sites are eligible for listing to the NRHP. NRCS may consider avoidance of these sites or conduct full scale mitigation under the purview of the TNS and Illinois SHPO, in compliance with the NHPA. Compliance with the NHPA shall be completed following sequence Table 14: sequence 11, and prior to inundation of Emiquon Preserve following Project construction.

4. Hazardous, Toxic, and Radioactive Waste. While the NFS received a letter of No Further Remediation from the IEPA regarding previous contamination at this site, it is recommended that the NFR letters be included in the P&S package. Additionally, as required for all earth working projects in the Rock Island District, it is also recommended that the Environmental Protection specification section include requirements for HTRW testing of any material to be brought onto the site or removed from the site to ensure the material is not contaminated. If contaminated material is identified, USACE would stop work and follow the steps outlined in ER 1165-2-132.

5. Public Access and Security. Safety and security are important parameters which would be detailed during the P&S Phase. Creating an attractive nuisance—the possibility of people fishing off of the top of the water control structure—is a concern. Additionally, vandalism and safety issues were also considered, particularly with respect to the pump station controls and water control structure. More details would be designed during the P&S stage.

6. Impacts to Illinois Department of Transportation Highways. The proposed water control plan would result in water crossing onto ILDOT property. At the time of this report, the extent of these impacts was not fully evaluated, but will require further evaluation during the plans and specifications stage. The PDT did a preliminary evaluation and determined that substantial erosion or other damages are not anticipated on the ILDOT property. The PDT position is also based on observation of the current condition which does not show any signs of erosion on the roadway slopes following the prolonged inundation of the roadway slopes when the interior water level rose above

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434ft in 2010 prior to the power being restored to the pump station. Coordination with the NFS and ILDOT has been conducted and the NFS is aware that they would be responsible for repairing any erosion that does occur due to this Project as part of the typical O&M. The ILDOT provided a letter indicating that an inundation easement is not necessary for this Project and requested that a contact be identified to resolve problems if they arise. This letter is provided in Appendix D since it largely relates to real estate concerns.

E. Construction Considerations

1. Construction Materials. Only common construction materials are required for this Project and can likely be obtained from local sources.

2. Construction Access. Access to the pump station and water control structure would likely be by the top of the levee or from the IWW by barge. Construction of the islands would likely occur once the interior is drained, and low pressure equipment may be required to construct the islands. Floating equipment could be used for island construction if a draw down is not possible.

3. Permits. This Project complies with Nationwide Permit #27 and its associated conditions. Since this action falls under a general permit, the District followed Corps of Engineer guidelines, Engineer Regulation 1105-2-100. Nationwide and regional permits fall under the category of general permits. A general permit is issued subject to the Section 404(b)(1) Guidelines and to any conditional standards pursuant to Section 404(e) of the Clean Water Act. The conditions of a general permit shall be used in lieu of this regulation for those Federal activities which the District Commander determines to be applicable. Appendix B, Clean Water Act Compliance details the District's analysis on the Project's compliance with NWP #27's conditions.

4. Storm Water Pollution and Erosion Control. An NPDES permit for storm water control would be required for a disturbance of an area of the size we are proposing for construction. This permit would be obtained by the Contractor during construction.

5. Construction Schedule Constraints. Scheduling of construction contracts would depend on availability of funds, and based on expected funding, it is likely the contract would be awarded in at least two construction contracts.

Endangered species are present, but there are no time constraints associated with the protection of these species.

Waterfowl hunting occurs in the Project area and this would have to be coordinated with construction timing and the safety of workers and ensuring that protected habitat areas are not disturbed during these times. The NFS has indicated that hunting in construction areas would be prohibited as required during construction.

6. Construction Sequence. The probable construction sequence is summarized in table 15. If the contract is divided into two construction stages, sequence items 1 through 8 would be in the Stage I of Construction, with the remaining features being constructed in Stage II.

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Table 15. Probable Construction Sequence

Sequence	Construction Work Item	Instructions	Purpose
1	Construct Pump Station Access Road	Required from southwest corner of site to the water control structure	to allow the contractor to access the work site and to transport personnel and materials not deliverable by barge
2	Demolish Existing Pump Station	Remove all pumps, engines, buildings and other materials at the existing pump station	to provide clean construction area for construction of new pump station and water control structure
3	Install Cofferdam	Install Cofferdam around propose new pump station and water control structure. Tie into existing levee.	to provide a dry area to construct features; additionally, this would ensure that the interior does not have an uncontrolled connection to the river during flood conditions
4	Excavate Levee and Water Channels	Excavation is required to install the water control structure and to tie into the existing interior drainage channel and to the IWW.	to ensure that the water control structure and pump station can control water levels as design
5	Construct Water Control Structure	Construct as designed	to meet Project goals
6	Construct Pump Station	Pump station and water control structure can be constructed at the same time	to meet Project goals
7	Place Stone Protection Around and Adjacent to Structures	Stone can be placed in all areas except immediately adjacent to the structures at the same time the pump station and water control structure are constructed. Final rock placement adjacent to the structures would be placed once these structures are finalized	to prevent erosion associated with water velocities near the pump station and water control structure
8	Remove Cofferdam	Cofferdam would be removed once all features in the inside of the cofferdam are constructed	to allow the pump station and water control structure to be operational
9 (optional)	Drain the Interior	Use pump station to drain the interior to at least an elevation of 424 ft NGVD.	to allow the interior to solidify so construction equipment can travel to the island locations and such that borrow material is usable. If this is not feasible based on NRCS CUAs or adverse weather conditions, the islands would be constructed using floating equipment.
10	Construct Islands	Construct islands using adjacent borrow.	to meet Project goals

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F. Operational Considerations. Operation of water supply and water control features restores habitat to meet Project goals. To that effect, the wetlands may be drained in the spring to allow establishment of vegetation, and flooded in the fall to provide feeding and resting habitat for migrating waterfowl and providing habitat for overwintering fish. Controlled water level fluctuations provide a wider variety and dependable supply of food for migrating waterfowl and resident species.

At a minimum, one operator would be required to operate the pumps and the water control structure, with labor costs based on the number of days the pump is running and on how many gate manipulations are required in one year. Gate operation would likely occur through an electric mechanism or a drill operator which would minimize the operator time to open and or close the gates. Remotely operated gates would also be considered during plans and specifications.

Electrical costs associated with operating the pumps would vary depending on the frequency and duration of operation. The Nature Conservancy owns the direct buried medium voltage power service cables which runs through the levee and is responsible for all O&M on these lines. Once a demand is set - that would be the demand for a 12 month time frame, not monthly. So if both pumps run and set a demand that would be the demand for 12 months. There is opportunity to keep a smaller power demand. Once the peak demand is applied then that rate is in effect starting the date of use for 12 months at which time the clock resets and the power demand is re-analyzed. There must be full awareness of the billing consequence prior to operating the pumps, especially if more than one pump is operated at a time. Since the pumps must be periodically exercised if not in use for long durations, it would not be wise to simply exercise the pumps together, but rather to stagger their exercise operation.

Total estimates of annual operation costs are shown in, Appendix F, *Cost Estimate*. A complete list of operation needs would be provided in an O&M manual after construction. The final pumping plan would be developed based on the WLMP.

G. Maintenance Considerations. The proposed features have been designed to ensure low annual maintenance requirements. Maintenance would include performing routine maintenance on the pumps. An annual pump station inspection should also be performed. Pumps should be exercised periodically to ensure operational readiness. Due to demand charges, it is recommended that this is staggered to reduce electrical charges from the utility.

Debris removal is anticipated at the pump intakes while the pump is in operation and in the water control structure. Additionally, partial stone replenishment around the water control structure and throughout the discharge and intake channels is expected to be required every 10 years to avoid excessive erosion.

Steel components of the water control structure, specifically the top grating, may require replacement every 10 years. The stems and operators associated with the water control gates may require replacement if damaged during operations.

Pump repairs may be required every 20 years. The type of repairs would depend on the damage received.

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It is anticipated that the TDLD would continue to operate and maintain its levee system within acceptable flood protection guidelines, including weed and tree control along the perimeter levee, and repairing any erosion damage to the riverside of the levee to acceptable standards. While the existing levee has a riverside slope greater than 2.5H:1V which is considered relatively stable to protect an environmental restoration project, it is not within typical flood protection standards. These costs are not considered Project costs.

If the water is maintained at a high water level, the levee toe and toe along the ILDOT road embankment would be inundated for a period of time. Depending on wave wash action, some erosion may be observed in these areas, and minor repairs may be required by the NFS in these areas. At the time of this report, the real estate requirements had not been established. It is possible that either a construction cost associate with placing erosion protection would be assigned, or maintenance costs would be developed to repair these areas if any damage if noticed.

Any required maintenance at the archeological sites had not been developed at the time of this report.

The estimated annual maintenance costs are presented in Section VIII, *Cost Estimates*. Maintenance requirements would be further detailed in the Project's O&M manual published after construction completion.

H. Repair, Rehabilitation and Replacement Considerations. For analysis purposes, the costs presented for OMRR&R are based on a 50-year period of analysis. However, the NFS is expected to operate and maintain the Project until it is no longer authorized. As such, the NFS should expect to incur costs associated with this responsibility outside of the 50-year period of analysis.

Overtopping of Emiquon's natural spillway (with construction of the Recommended Plan) is expected to result in velocities of approximately 20 ft/s, when the river stage reaches 454 ft NGVD. The 7 ft-wide gate is not expected to provide significant enough interior filling to reduce velocities and associated damages. Before the interior WSE exceeds the spillway toe (~435) very high shear stresses at the levee toe would result in significant scour. Damages due to spillway overtopping are expected along the spillway crown and along the interior spillway slope with the greatest amount of scouring expected at the toe of the spillway. For purposes of estimating repair costs, it was assumed that 3 feet of material would be removed from the spillway crown and interior slope along the length of the levee.

Currently, direct buried medium voltage power service cables travel from the southwest corner of the Project to the pump station along the levee. At the time of a cable failure it would be repaired using a medium voltage cable splice and put back into service, therefore it is recommend that the cable be assumed to be reliable through the 50-year period of analysis. It cannot be predicted if there would or would not be a cable failure within the Project life, but it is predictable that the service entrance power cables would probably not be addressed until or unless there is a cable failure at which time the cable(s) would most likely be repaired instead of replaced.

For the water control structure, the gates should have a Project life of at least 50 years. The concrete structure may require some repairs after 75 years of operation. The pumps replacement may be required after 60 years of Project life.

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VII. SCHEDULE FOR DESIGN AND CONSTRUCTION

Table 16 presents the schedule of Project completion steps.

Table 16. Project Implementation Timeline

Project Item	Duration	Start	Completion
Definite Project Report and Project Partnership Agreement			
District Quality Control Review	14	3/21/2011	4/4/2011
Agency Technical Review	60	4/4/2011	7/3/2013
Value Engineering Study	30	5/1/2011	5/31/2011
Alternative Formulation Briefing	140	10/28/2013	03/19/2014
Public Review ¹	70	03/24/2014	05/30/2014
IEPR (Not applicable)	0	N/A	N/A
MVD Approval of DPR (Policy Guidance Memo)	30	07/01/2014	08/27/2014
PPA Approval and Execution	90	08/29/2014	11/28/2014
Plans and Specifications			
Prepare Plans and Specifications Stage I	180	11/29/2014	05/28/2015
DQCR	30	05/29/2015	06/30/2015
ATR	60	06/30/2015	08/30/2015
BCOE	60	08/30/2015	10/30/2015
Contract Award	60	10/31/2015	12/31/2015
Prepare Plans and Specifications Stage II	180	05/20/2015	11/16/2015
DQCR	60	11/16/2015	01/15/2016
ATR	60	01/15/2016	03/14/2016
BCOE	60	03/14/2016	05/14/2016
Contract Award	60	05/14/2016	07/13/2016
Construction			
Stage I Construction	365	12/19/2015	12/19/2016
Stage II Construction	365	07/13/2016	07/13/2017
Operation			
Complete O&M Manual	90	07/13/2017	10/11/2017
Turn Project Over to Sponsor	30	10/11/2017	11/10/2017

¹ A Public Meeting was conducted during the period of public review.

VIII. COST ESTIMATES

Table 17 presents a summary of the total project costs for the fully funded estimate (FFE) and the constant dollar estimate (CDE). The complete tables of certified project costs are located in Appendix F, *Cost Estimate*. The FFE was calculated based on the proposed construction schedule, expected escalation costs, and a contingency factor, and represents the money expected to be spent at the end of Project construction. Table 18 outlines the CDE and FFE costs by major line items. Quantities and

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costs may vary during final design. All cost estimates are calculated using October 2014 effective price levels. The FFE is marked up to midpoint of construction. All Project features are subject to 65 percent Federal and 35 percent non-Federal cost share

A. Operation, Maintenance Repair, Rehabilitation and Replacement Considerations. The proposed Project features have been designed to ensure low annual O&M requirements. Operation, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) costs are outlined in Chapter 7 of this report. The estimated total OMRR&R cost is approximately \$3,408,268 over the 50-year period of analysis as shown in table 19. The estimated annual OMRR&R costs at present day value are \$67,556 at the Federal Discount Rate of 3.5 percent (table 20). These quantities and costs may change during final design. A complete list of O&M needs would be provided in an O&M manual following construction.

B. Post Construction Monitoring Considerations. Monitoring and data collection timing and responsibilities are summarized in table 21. Monitoring and data collection estimated costs are presented in table 22. More details on the proposed monitoring plans are located in Appendix O.

C. Adaptive Management. Adaptive Management /Monitoring Plan Setup and Implementation costs are outlined in tables 23 and 24. More details on the proposed adaptive management plan are located in Appendix O.

D. Value Engineering. Per ER 11-1-321, Value Engineering, states that the VE program applies to all procurement acquisitions that are federally funded, managed, and or executed by the Corps of Engineers, including Civil Works construction projects. ER 11-1-321, change 1 dated 01 January 2011 corrects that the VE study applicability is for total Project costs from \$2 million to \$1 million in Paragraph 2 of ER 11-1-321 dated 28 February 2005. The subject VE study occurred in May 2011.

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Table 17. Total Project Cost Summary

**** TOTAL PROJECT COST SUMMARY ****

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PROJECT: Emiquon East HREP (P2 405314)
LOCATION: Havana, IL

DISTRICT: Rock Island District
POC: CHIEF, COST ENGINEERING, Charles R. Van Laarhoven

PREPARED: 8/18/2014

This Estimate reflects the scope and schedule in report; Emiquon I t Rehabilitation and Enhancement DPR - Aug 2014

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				Spent Thru: 1-Aug-14 (\$K)	L	COST (\$K)	CNTG (\$K)	FULL (\$K)	
						EOC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)						M
A	B	C	D	E	F	G	H	I	J	K		L	M	N	O
06	FISH & WILDLIFE FACILITIES	\$4,301	\$936	22%	\$5,237	3.8%	\$4,463	\$972	\$5,435			\$4,524	\$985	\$5,508	
13	PUMPING PLANT	\$1,696	\$369	22%	\$2,065	3.3%	\$1,752	\$381	\$2,133			\$1,775	\$385	\$2,162	
15	FLOODWAY CONTROL & DIVERSION STR	\$2,595	\$565	22%	\$3,159	3.8%	\$2,693	\$586	\$3,279			\$2,729	\$594	\$3,323	
CONSTRUCTION ESTIMATE TOTALS:		\$8,592	\$1,870		\$10,462	3.7%	\$8,908	\$1,939	\$10,847			\$9,028	\$1,965	\$10,993	
01	LANDS AND DAMAGES	\$4,850	Included		\$4,850	3.8%	\$5,033		\$5,033			\$5,033		\$5,033	
30	PLANNING, ENGINEERING & DESIGN	\$1,540	\$144	9%	\$1,683	4.5%	\$1,609	\$150	\$1,759			\$1,620	\$151	\$1,771	
31	CONSTRUCTION MANAGEMENT	\$859	\$86	10%	\$945	4.5%	\$898	\$90	\$987			\$920	\$92	\$1,012	
PROJECT COST TOTALS:		\$15,841	\$2,100	13%	\$17,941		\$16,447	\$2,179	\$18,626			\$16,600	\$2,209	\$18,809	

CHIEF, COST ENGINEERING, Charles R. Van Laarhoven

PROJECT MANAGER, Ellen Milliron

CHIEF, REAL ESTATE, Stuart P. Jackson

CHIEF, PLANNING, xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING, xxx

CHIEF, PM-PB, xxx

CHIEF, DPM, xxx

ESTIMATED TOTAL PROJECT COST: \$18,809

ESTIMATED FEDERAL COST: 65% \$12,226

ESTIMATED NON-FEDERAL COST: 35% \$6,583

22 - FEASIBILITY STUDY (CAP studies): \$1,620

ESTIMATED FEDERAL COST: 65% \$1,053

ESTIMATED NON-FEDERAL COST: 35% \$567

ESTIMATED FEDERAL COST OF PROJECT \$13,279

Note: The Lands and Damages and Real Estate Federal Acquisition cost already includes contingency as provided by the Real Estate Branch.

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Table 18. Project Design and Construction Cost Estimates

Account	Feature	CDE (\$)	FFE (\$)
01	Lands and Damages	\$5,033,000	\$5,033,000
02	Relocations	\$0	\$0
06	Monitoring and Adaptive Management	\$1,367,000	\$1,386,000
06	Construct 10 Islands (I2)	\$4,068,000	\$4,122,000
13	Pumping Plant (P2)	\$2,133,000	\$2,162,000
15	Diversion Structure (W1)	\$3,279,000	\$3,323,000
30	Planning, Engineering and Design	\$1,759,000	\$1,771,000
31	Construction Management	\$987,000	\$1,012,000
	Estimated Total Project Costs	\$18,626,000	\$18,809,000
22	Definite Project Report		\$1,620,000
	Total Project Costs Subject to Cost Sharing	\$18,626,000	\$20,429,000
	Total Federal Cost (65%)	\$12,106,000	\$13,279,000
	Definite Project Report	\$1,620,000	\$1,620,000
	Remaining Federal Costs	\$10,486,000	\$11,659,000
	Non-Federal Cost (35%)¹	\$6,520,000	\$7,150,000
	Estimated non-Federal Work-In-kind Contribution	\$5,412,000	\$5,485,000
	Estimated non-Federal Lands and Damages	\$5,033,000	\$5,033,000
	Required non-Federal Cash Contribution	\$0	\$0
	Excess non-Federal Lands and Damages	\$3,925,000	\$3,368,000

¹In accordance with 12 May 2000 EMP Program Implementation Guidance, the sponsor may be afforded up to 80 percent of the non-Federal cost share in the form of in-kind services. EC 1165-2-208 3.g.(4) further clarifies that for those authorities that specify a limit on the amount of credit that can be afforded, such as EMP, the maximum dollar amount of credit that may be afforded is the amount of the NFS's required contributions of funds, the value of the in-kind contributions, or the stated amount or percentage, whichever is less. For this Project, the maximum allowable in kind contribution would be \$5,720,800. The specific items of work-in-kind for inclusion in the PPA are anticipated to be the Pumping Plant (Pump Station) and Diversion Structure (Water Control Structure).

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Table 19. Estimated Total Operation and Maintenance Costs (October 2014 Price Level)

	Quantity	Unit Type	Unit Price	Sub-Total	Event Frequency	Total
W1 - One Gate						
400 # Riprap Replenishment (assume 5% replacement every 10 yrs)	110	TN	\$55.97	\$6,156.70	5	\$30,783.00
650# Riprap Replenishment (assume 5% replacement every 10 yrs)	550	TN	\$60.78	\$33,429.00	5	\$167,145.00
Debris Removal at Water Control Structure (assume one laborer 4 hours per every gate)	4	Hours	\$50.00	\$200.00	50	\$10,000.00
Labor (assume 2 operators, 4 hour day for each gate manipulation)	16	Hours	\$50.00	\$800.00	50	\$40,000.00
Replace Grates	1	LS	\$3,746.00	\$3,746.00	1	\$3,746.00
						\$251,674.00
P2 - 60K GPM						
Electrical Parts Replacement	1	LS	\$6,250.00	\$6,250.00	5	\$31,250.00
Pump Station Inspection (1 inspector 8 hours each year)	8	Hours	\$80.00	\$640.00	50	\$32,000.00
Electrical Cost	1	LS	\$43,212.1	\$43,212.12	50	\$2,160,606.00
Replacement Road Aggregate	144	TN	\$31.58	\$4,547.52	5	\$22,738.00
Debris Removal at Pump Intakes	364	Hours	\$50.00	\$18,200.00	50	\$910,000.00
						\$3,156,594.00

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Table 20. Estimated Annual Operation and Maintenance Costs (October 2014 Present Value)

	Annual Operations (Debris Removal and Gate Operation)	400# Riprap Replenishment (Present Value)	650# Riprap Replenishment (Present Value)	Grate Replacement (Present Value)	Annualized Value of Present Value Components	Total Annualized OMRR&R
W1 – One Gate	\$1,000.00	\$12,740.48	\$69,176.89	\$1,381.33	\$3,551.33	\$4,551.33
Year 9		\$4,517.36	\$24,527.89			
Year 19		\$3,202.44	\$17,388.28			
Year 29		\$2,270.27	\$12,326.88	\$1,381.33		
Year 39		\$1,609.44	\$8,738.76			
Year 49		\$1,140.96	\$6,195.07			

	Annual Operations (Debris Removal, Operation and Inspection)	Electrical Parts Replacement (Present Value)	Road Aggregate Replenishment (Present Value)	Annualized Value of Present Value Components	Total Annualized OMRR&R
P2-60K GPM Pump	\$62,052.12	\$12,933.55	\$9,410.49	\$952.61	\$63,004.73
Year 9		\$4,585.82	\$3,336.66		
Year 19		\$3,250.97	\$2,365.42		
Year 29		\$2,304.68	\$1,676.89		
Year 39		\$1,633.83	\$1,188.78		
Year 49		\$1,158.25	\$842.75		

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Table 21. Monitoring Timing and Responsibility

Objective/Data Mgmt ¹	Activity	Water Quality Data		Natural Resource Data ¹	Agency	Remarks
		Apr-Sep	Oct-Mar			
1	Analyze Illinois River Hydrology			M Nov-Feb	TNC	Adaptive management requirement
1	Aerial Veg. Surveys/Imagery			Y Aug	TNC	
1	Veg Surveys (Stratified Random Sampling)			M Jun-Oct	TNC/ILDNR/LTRMP	LTRMP protocol
1	Veg Surveys (Fixed Transects)			M Jun-Oct	TNC/INHS	INHS protocol
2a	Fish Survey			W	TNC/ILDNR/LTRMP	Timing of surveys will vary
2b	Fish Survey			W	TNC/INHS	Surveys conducted only when the gate is open; timing of surveys will vary.
2c	Primary Production			W	TNC	Surveys conducted only when the gate is open; timing of surveys will vary.
3	Aerial Waterfowl Surveys			W Oct-Dec	TNC/INHS	
3	Waterfowl Brood Surveys			M Jun- Aug	TNC/INHS	
3a	Veg Surveys (Stratified Random Sampling)			M Jun-Oct	TNC/ILDNR/LTRMP	
3b	Veg Surveys (Fixed Transects)			M Jun-Oct	TNC/INHS	
3c	<i>B. decurrens</i> Surveys			Y Aug	TNC/Corps/USFWS	
4	Nutrient Processing to include: total suspended solids, total phosphorus, orthophosphates, nitrate/nitrite, and total kjeldahl nitrogen	Bi-Weekly			TNC/Corps	Grab sample conducted at 2 locations
			M			Grab sample conducted at 2 locations during the non-growing season.
4	Monitoring sondes to include: turbidity, dissolved oxygen, specific conductance, water temperature, and pH	Continuous			TNC/Corps	3 continuous data collection locations (see Appendix O for calibration and data collection schedule)
4	Continuous data monitoring to include: Secchi disk, water depth, water elevation, wind direction, wind velocity, and wave height	Continuous			TNC/Corps	3 continuous data collection locations (see Appendix O for calibration and data collection schedule)

¹ W = Weekly
M = Monthly
Y = Yearly

See Appendix Q, plate 21 for active monitoring sites.

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Table 22. Preliminary Cost Estimates for Implementing the Monitoring Program for the Project

Objective/Data Management	Activities	PED Data Acquisition (yearly cost)	10-year Total ¹ (cost shared)
Objective 1	Document annual water level decisions	\$1,134	\$8,278
Objective 2	Aquatic Processes Monitoring	\$5,000	\$36,500
Objective 3	Waterfowl surveys and Monitoring	\$15,000	\$109,500
Objective 3	Vegetation Surveys (Transects, aerial surveys, LTRMP sampling)	\$31,000	\$226,300
Objective 3	<i>B. decurrens</i> Monitoring	\$1,000	\$7,300
Objective 4	Water Quality Monitoring (Grab samples)	\$3,600	\$26,280
Objective 4	Water Quality Monitoring (Continuous)	\$13,500	\$98,550
Database Management	Database development, management, maintenance and communication efforts (i.e., meetings, webpage, conferences)	\$70,234	\$512,708
TOTAL		\$70,234	\$1,025,416

¹ Yearly cost based on 6 sampling efforts over a 10-year period plus a 2.6% per year inflation factor per sampling effort.

Table 23. Preliminary Cost Estimates for Set-up of the AMP for the Project

Category	Annual Cost	2-year Total
Detailed Adaptive Management Plan and Program Set-up (during PED and construction)	\$25,000	\$50,000

Table 24. Preliminary Cost Estimates for Implementing the AMP for the Project

Category	Annual Cost	six-year Total
Management of AM Program (Post Construction)	\$2,500	\$18,900
Assessment	\$2,500	\$18,900
Decision Making	\$2,500	\$18,900
TOTAL		\$7,500
		\$56,700

IX. ENVIRONMENTAL EFFECTS

A. Summary of Effects. The Project is a large and complex site with a variety of resources varying greatly in quantity and quality. The goals for the Project are to restore wetlands, aquatic habitat, and restore floodplain value and functions. For proposed Project improvements (water control structures and islands), no significant alteration of the current vegetative cover type is anticipated, with the exception of the immediate construction footprint. The proposed measures are expected to have a net positive effect on the quality of existing habitat over the life of the Project. The expected increases in habitat quality and quantity would help to fulfill management objectives to meet TNC's goals for the site, as outlined in Section III. Section II outlines the impacts associated with the No Action Alternative.

The District determined the alternatives carried forward for analysis would not pose any additional or significant environmental impacts beyond the Recommended Plan. The District selected this plan based on its high level of habitat benefits, ability to meet the Project's goals, and it was the "best buy" alternative.

B. Land Use and Infrastructure. Construction of water control features would occur primarily in the levee right of way at the present day pump station location and its outfall to the river. There would be a construction zone buffering this area. These areas were created in the 1920s as part of the TDLD construction and subsequent farming. If vegetation clearing is required for any Project feature, it would be limited to the minimum necessary for construction.

The proposed construction sequence would begin with dewatering the Project area from its current elevation (@432 NVGD) down to elevation 425 NVGD. The only remaining water would be in the ditches once used for the TDLD operation and agricultural purposes. In a fully functioning backwater habitat, a seven foot dewatering could be a significant impact, yet could also provide a regeneration of the wetland. Historically, the Illinois River hydrology had wet periods and dry periods with wetland benefits resulting from both. Naturally occurring dry periods have long term benefits such as soil compaction, willow control, and invasive fish control.

There is private farming taking place within the levee at Emiquon, but it is above elevation 435 feet, and therefore would not be impacted with the proposed water level management. This includes field drainage and backing up any drain tiles. Since no soils would be impacted by this Project, it complies with the Farmland Protection Policy Act.

C. Natural Resources. The existing condition of the Emiquon Preserve is excellent. There is a rich diversity of wetland and aquatic vegetation, migratory bird use is high, and the primary production of zooplankton and phytoplankton is excellent. However, the quality of the preserve will deteriorate over time. It is well documented habitat restoration projects experience an initial period where they flourish, but over time these backwater habitat complexes degrade if the water levels remain stable. Natural backwater areas rely on the Illinois River flood pulse, and without it, there is no recharge in the system to sustain it. Emiquon's initial period of high quality habitat began in 2007 when TNC began its habitat management mission. The District and TNC believe that over time, the Emiquon preserve will decline in its ability to provide aquatic and wetland benefits to the Illinois River Valley.

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The Project would allow for primary production of important biomass, such as plant leaves, stems, seeds, zooplankton, and phytoplankton to the Illinois River – an essential part of a river’s health and vigor. These tiny plants, animals, and other organic material would nourish the habitats, and animals living in the river.

The District evaluated the effects of the Project on the quality and quantity of fish and wildlife habitat using WHAG and AHAG methodologies, as described in Section V.B. and Appendix C, *Habitat Evaluation and Quantification*. These habitat evaluation methods were used during Project planning to evaluate features in terms of increased benefits to fish and wildlife resources. Optimization of AAHUs in relation to Project costs for evaluated species is considered the goal of plan selection. Table 7 in Section V.B. summarizes the results of the habitat evaluations while a more detailed analysis may be found in Appendix C, *Habitat Evaluation and Quantification*. Assessment of Project impacts also was based on experience from past and current management practices.

1. Hydrologic and Hydraulic Conditions. With the Project, the Emiquon Preserve would go from a relatively stable lake level to a management scenario ranging from dry, or dewatered (el. 425), to lake levels reaching 10 feet (el 435) (figure 8). This management regime would manipulate the water level for the desired habitat outputs. The TNC would operate the pump station to produce their desired water levels resulting in habitat outputs mimicking the natural rise and fall of the river. The management plan has short term environmental trade-offs each year of; as water level drops aquatic habitat declines and wetland habitat values increase. Yet these short term impacts are natural in the overall cycle of a river’s hydraulic pulse. However, these fluctuating water levels have long term, sustainable benefits to the overall quality of the Emiquon Preserve.

Appendix H details the Project features’ effects on the hydraulic condition at Emiquon.

2. Wetland Resources. Currently there are 868 acres of emergent wetlands at Emiquon. This is comprised nicely with a mix of wetland types such as sedge meadows, cattail/bulrush, emergent wetlands, and bottomland hardwoods to name a few. Based upon other floodplain areas converted to agriculture and then reconverted to wetlands without water control, like Hennepin Hopper (see Section III.A.2. for more details), and Lake Chautauqua, with a constant water level, the wetlands between the shore and deep water generally decline with rough fish and wind fetch impacts.

The proposed Project features and TNC’s WLMP would reduce or eliminate any problems with a static water level. These floodplain areas thrived with predictable flood pulse and the Project planners anticipate the current wetlands to maintain their value over the life of the Project rather than decline or be eliminated without management.

The primary benefits would be increased reliability of moist-soil food production and access to feeding areas during fall and spring migration. Migratory waterfowl, shorebirds, and wading birds would benefit from more reliable feeding and resting areas. Muskrat populations should not be negatively affected, and would be expected to benefit from an increase in emergent and moist-soil vegetation, as indicated by the WHAG analysis. Fish would use the wetland edges as foraging, spawning, and escape cover.

3. Aquatic Resources. Currently there are 3,591 acres of aquatic habitat. This is the area just beyond the emergent habitat (1.5 feet deep) out to the deepest water levels. These areas include flats,

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and old ditches throughout the preserve. Currently these areas are home to submergent vegetation and primarily lake fish species.

The proposed Project's water level management and connectivity to the river would improve the aquatic resources over the life of the Project by consolidating the bottom and removing rough fish during low water periods and increasing aquatic habitat during high water period thereby increasing overwintering and spawning habitat.

Reconnecting the river with the Emiquon complex would introduce river fish species into the backwater to complete their life cycle requisites not readily possible now. These life requisites include overwintering habitat and spawning areas.

The Project would have a positive impact on the invasive Asian carp species (bighead carp (*Aristhythys nobilis*), silver carp (*Hypthalmichthys molitrix*), black carp (*Mylopharyngodon piceus*), and grass carp (*Ctenopharyngodon idella*) and the European species, common carp (*Cyprinus carpio*). The Project's primary production contribution to the river would provide a food source for the filter feeding Asian carp and provide feeding and spawning habitat for common and grass carp.

While these exotic, undesirable species would benefit from the Project, the District and TNC hypothesize the Project would provide native fish species the habitat benefits they need to make them more competitive with invasive fish species; benefits desperately needed on the Illinois River. Water level management adjustments would be employed to keep invasive species benefits to a minimum and native fish benefits at a maximum.

Fish passage is part of this Project because the goal is restoring historic floodplain functions and contributions to the Illinois River ecology. Part of this function was to provide spawning, nursery, and overwintering habitat to a variety of fishes including river fishes that may use the preserve for one or more of their life stage requirements.

While routine fish kills are part of the management plan, other ecological processes would be taking place at the same time, like a regrowth of wetland plants, consolidation of sediments, and shorebird feeding areas (mudflats).

Also, operation of a gate compared to a 2-way pump to manage water levels is in the interest of the government based on the reduced operating cost of the water control structure versus the 2-way pump. The PDT realizes carp introduction would add to the management challenges, yet feel the benefits to native fishes and to the Illinois River System would outweigh the potential carp impacts.

4. Migratory Birds. With Project conditions should ensure a valuable long term stop for waterfowl, wading birds and other migrating birds on their way to either their wintering areas, or nesting areas in the spring. The area would offer an important nutritional food and resting area necessary for a vigorous migration.

As mentioned throughout this report, there will be tradeoffs between wetland and aquatic resources over the life of the Project. However, the Preserve managers would have the ability to flood or dewater the preserve based on nearby refuges and their management scenario for that particular year. For instance, when the Lake Chautauqua NWR is at peak condition for migrating birds, Emiquon

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could be dewatered or flooded to recharge the wetland or reduce invasive species. This balance based cooperation between habitat management areas would optimize opportunities for wildlife so there would always be a backwater area birds could use during their migrations.

5. Endangered Species. Suitable habitat for the sheepsnose mussel and the eastern prairie fringed orchid is not present within the construction footprint, and the District does not anticipate the Project would impact existing habitat for either species. For these reasons, the District determined the proposed Project would have **No Effect** the sheepsnose mussel or prairie fringed orchid.

Incidental impacts to individual specimens of decurrent false aster may occur during construction of the water control features. These effects would be minor and short-term. The TNC's post construction water level management would provide the predictable flood pulse suitable for the decurrent false aster's life cycle and promote its viability with a river connection to Illinois River downstream habitats. The experimental *B. decurrens* population study would not be impacted by construction. Any short term impacts to *B. decurrens* would be offset by the long term predictable water level management. The *B. decurrens* is a key attribute TNC identified as being integral to their management of the preserve. Appendix O, *Monitoring and Adaptive Management*, outlines the monitoring proposed for the Project, including *B. decurrens* to promote its success within the preserve as well as providing a seed source for downstream habitats and eventual viability as a species.

The District prepared a biological assessment (BA) to assist with Endangered Species Act, Section 7 consultation. The BA identified measures the District and TNC would take to not only avoid negative impacts but enhance the present *B. decurrens* populations at Emiquon Preserve. The measures include:

- **Conservation Measures for *B. decurrens*.** The TNC's post construction WLM would provide the predictable flood pulse suitable for the decurrent false aster's life cycle and promote its viability with a river connection to Illinois River downstream habitats. Long-term predictable WLM would offset any short-term construction impacts to *B. decurrens*.

The *B. decurrens* is a key attribute TNC identified as being integral to their management of the preserve. The Project's adaptive management plan outlines the monitoring proposed for the Project, including *B. decurrens*. The TNC would promote *B. decurrens* success within the preserve as well as providing a seed source for downstream habitats and eventual viability as a species.

- **Protective Measures for *B. decurrens*.** The District is proposing the following additional conservation measures for the Emiquon *B. decurrens* population:
 - The District will identify the two *B. decurrens* locations on all the Project's plans and specification drawings as "Sensitive Areas" (Appendix P, *Plates*). Any construction activity such as Project feature construction, staging, haul roads, or borrow sites would not be permitted in these areas.
 - If any *B. decurrens* is found outside the previously identified Sensitive Areas prior to construction, the District will add these new sites with an adequate buffer to the plans and specifications drawings. These new areas would also be avoided during construction.

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- If Project construction does not begin before September 7, 2016 (5 years after the 2011 survey described herein), the District will re-coordinate with the USFWS and survey the Project area for *B. decurrens* prior to any construction activities. The coordination and survey will validate the existing conditions have not changed, or will detail the potential impacts and conservation measures the District would implement to avoid impacts to individual plants, local populations, or the overall species.
- **Enhancement Measures for *B. decurrens*.** The TNC's proposed management goals include *B. decurrens* protection and reestablishment on the Illinois River. The TNC would adhere to the following management of the current population:
 - Annual census should take place to monitor the presence and condition of the Emiquon *B. decurrens* population.
 - Surveys should also be conducted downstream of the preserve to determine if the river *B. decurrens* population is stable, and or growing.

In a letter dated June 25, 2014, the USFWS (Appendix A, *Correspondence*) provided their concurrence the Project is not likely to adversely affect *B. decurrens* as long as there are avoidance measures integrated into the construction activities. The District and TNC have integrated these measures into the Project planning and long term management of the Project.

The federally-endangered Indiana bat (*Myotis sodalis*) may roost and forage for insects along the Illinois River floodplain during spring and summer months. The USFWS lists the bat as potentially occurring statewide in Illinois, and suitable habitat for the species exists in the Project vicinity floodplain forests. Because the proposed construction does not require any trees removed, there would be no loss of any potential roost trees. Because construction would take place during daylight, it would not impact the bat's foraging areas and routines.

The District does not expect any adverse impacts to state-listed threatened or endangered species resulting from Project construction or subsequent operation and management. Least bittern and king rail were among the species evaluated as part of the WHAG analysis, and these are expected to benefit from Project implementation.

In a letter dated April 23, 2014, the ILDNR (Appendix A, *Correspondence*) listed several state listed species of concern. The following species have the highest potential for project impacts. The state-endangered Blanding's turtle and smooth softshell may occur in the Project vicinity. The ILDNR recommends the construction area be searched for these species each day before the start of work and when transporting equipment. If one is encountered, wait for the turtle to leave the area or contact Michelle Simone with the Department's Natural Heritage Division. This stipulation would be added to any bidding packages and construction drawing notes.

The ILDNR also stressed the importance of maintaining high quality and abundant submersed aquatic vegetation to assure quality starhead topminnow habitat. While the construction period of dewatering may have short term impacts to this species, the overall construction benefits along with adaptive management, the long term project benefits would have a net positive effect on the species.

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Throughout the PED phase, construction, and adaptive management implementation, the District, TNC, and ILDNR will work closely to ensure the Project would not have long term negative impacts on any state-listed species.

6. Invasive Species. This Project does not authorize or carry out any actions likely to promote long-term invasive species proliferation. The Project's primary production contribution to the river would provide a food source for the filter feeding Asian carp and provide feeding and spawning habitat for common and grass carp.

While these exotic, undesirable species would benefit from the primary production contribution the District and TNC hypothesize the Project would provide native fish species the habitat benefits they need to make them more competitive with invasive fish species; benefits desperately needed on the Illinois River. The proposed water level management and connectivity to the river would improve the aquatic resources over the life of the Project by consolidating the bottom and removing rough fish during low water periods and increasing aquatic habitat during high water periods thereby increasing overwintering and spawning habitat and decreasing invasive woody vegetation.

In addition, invasive carp species are targeted for control so they do not have adverse long term impacts to the Project. Any subsequent occurrence of any invasive species in the Project vicinity should not solely be the result of the implementation of the Project. This Project is in full compliance with the Corps' invasive species control policies.

The proposed project is in compliance with EO 13112. Fish sampling in 2013 captured 92 Common Carp in 2013, higher than the 62 caught in 2012, but less than the record high of 146 in 2011 (ILDNR, 2013). As the 2013 flood overtopped the Emiquon levee was overtopped Asian carp species (Bighead and Silver Carp) were observed entering the preserve (personal communication between J. Jordan and Emiquon Preserve Mgr D. Blodgett). The carp are there and will continue to be there with or without the Project. Given this fact, the proposed project, via adaptive management, will reduce the impacts of invasive species better than having no project at all.

D. Socioeconomic Resources and Human Use

1. Community and Regional Growth. No impacts to the growth of the community or region would be realized as a result of the Project. The Project goal is to restore approximately 5,800 acres of floodplain habitat in the TDLD, increasing the attractiveness of the area for wildlife observation, photography, birding, fishing and hiking. Thompson Lake is part of TNC's larger Emiquon Preserve.

2. Community Cohesion. The proposed floodplain restoration Project could positively impact community cohesion by serving as a catalyst for attracting visitors and recreationists from other communities to the area. Any potential increase in recreation activities within the Emiquon site would not adversely impact area property owners. Local support for the Project is strong, and no public opposition has been identified.

3. Displacement of People. No residential displacement would occur as a result of the Project.

4. Property Values and Tax Revenues. The Emiquon complex is located on land owned by The Nature Conservancy. No change in property values or tax revenues would occur.

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5. Public Facilities and Services. The Project could positively impact public facilities and services by increasing overall habitat diversity, resulting in heightened opportunities for ecotourism and recreational use on the western half of the Emiquon Preserve.

6. Life, Health, and Safety. A Phase I HTRW Environmental Site Assessment conducted for the Project revealed one REC in the Emiquon East Project area. There was no evidence of RECs at the surrounding properties. The site was remediated and TNC received an NFR letter from the Illinois EPA. Based on the Phase I ESA and the documentation received in the NFR letter, it was determined that this land is not an HTRW site and no further HTRW assessments would need to be conducted for this Project.

A natural gas pipeline runs under portions of the site. Ameren, working with TNC, weighted the pipeline to keep it from floating to the surface and breaking.

7. Business and Industrial Growth. No significant changes in business and industrial activities would occur during Project construction.

8. Employment and Labor Force. Project construction may result in some short-term employment opportunities within Fulton County; however, no significant long-term benefits would be realized. The regional economic impact assessment reported that the proposed alternative would require about 44 man-years of labor from various industries to complete construction. Man-years of labor is not the number of permanent jobs created, and the number does not distinguish between full and part-time jobs. With a reported 2009 total county labor force of 16,909 and an unemployment rate of 11.1 percent (IL Dept. of Employment Security, Economic Information & Analysis Division, January 2011), it is likely that the demand for workers for this Project could be fulfilled through the local labor unions.

9. Farm Displacement. No farms or farmsteads would be displaced. No prime and unique farmland would be impacted. The land use at this site was converted from row crop agriculture to open water wetland. The Project site was converted to wetland, and agricultural practices ceased when TNC enrolled a total of nearly 6,300 acres into a 30-year easement with the United States Department of Agriculture's WRP.

10. Noise Levels. Heavy machinery would generate a temporary increase in noise levels during Project construction; however, the Project site is basically rural in nature. No significant long-term noise impacts would result.

11. Aesthetics. Restoration features should be designed and constructed with minimal negative impacts to the aesthetics of the area. The enhancement of natural areas and open space should be aesthetically pleasing and enhance the overall viewscape for visitors.

E. Historic Properties and Cultural Resources. The District's March 26, 2012 correspondence (Appendix A) documented the opinion that the then Section 206 Emiquon Preserve Project as proposed would have *No Adverse Effect* to any significant historic properties within the APE, and future Project construction efforts are conditioned upon proposed Phase II testing of sites 11F675, 11F679, and 11F2381. By copy of that letter, the Corps initiated consultation with the Native tribes and other interested consulting parties, as promulgated under new amendments to the NHPA (2000).

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Those on the Distribution List were provided with the March 26, 2013 correspondence to allow comment under the NHPA and to be notified of any environmental documents associated with the proposed Project. Those on the Distribution List did not receive a copy of enclosure 3; since this information is protected under Section 304 of the NHPA and not available for public distribution (Also, enclosure 3 is not included as part of the March 26, 2013 correspondence in Appendix A). Requests for site location information can be directed to the Illinois Historic Preservation Agency, Springfield, Illinois. Copies of the Emiquon East Report have been provided to those on the Distribution List for any additional Project comment. By letter, the IHPA concurred with the Project undertaking as planned (Appendix A, dated April 12, 2013). No other comments or correspondence were received from others on the Distribution List.

F. Water Quality. With the introduction of Illinois River water into the preserve, water quality may change near the pump station, but any differences or turbidity, temperature, and chemistry between the preserve and river water should quickly dissipate. This Project complies with the Clean Water Act Section 404 and Section 401. The Project would meet the conditions of Nationwide Permit #27, which states,

“Activities in waters of the United States associated with the restoration, enhancement, and establishment of tidal and non-tidal wetlands and riparian areas and the restoration and enhancement of non-tidal streams and other non-tidal open waters, provided those activities result in net increases in aquatic resource functions and services...”

This Project complies with Section 401 Water Quality Certification since it meets the IEPA conditions in accordance with the provisions of 35 11. Adm. Code 405.108 for Nationwide Permit 27. Additional discussion of aquatic and water quality impacts and the District’s Nationwide Permit #27 justification is contained in Appendix B, *Clean Water Act Compliance*.

Within the Emiquon Preserve and the TDLD, there are no designated 303(d) waters. The Illinois River (Water ID D-31) has a 66.58 mile river segment with 303(d) designation. This river segment has 303(d) designation resulting from unacceptable mercury, PCBs, and fecal coliform levels. Under these conditions, humans should not eat fish and have primary contact from recreation.

The Emiquon Project would not contribute to the contaminant load of the Illinois River based on Emiquon’s current levels of contamination and the already elevated levels of contamination.

G. Hazardous, Toxic, and Radioactive Waste. The Project would not introduce any HTRWs to the environment in the Project vicinity. The plans include best management practices to properly contain fuels and wastes during construction and project facility operation.

H. Cumulative Impacts. The Council on Environmental Quality (CEQ) regulations require the District to consider the cumulative effects of a program when evaluating potential environmental impacts for an EA or EIS. The CEQ defines cumulative effects as:

The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action (40 CFR § 1508.).

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Cumulative effects most likely arise when a relationship exists between a proposed action and other actions expected to occur in a similar location during a similar time period. The geographic boundaries considered in the cumulative effects analysis was limited to the Emiquon and TDL D area including the Illinois River as it runs through Fulton and Mason Counties, Illinois. Typical Corps planning looks out up to 50 years for economic benefit analysis. Therefore the District considers 50 years for this cumulative effects analysis.

Past, present, and reasonably foreseeable actions overlapping with, or in proximity to the proposed action are most likely to have the potential to result in cumulative effects. In addition, programs similar to habitat management are also likely to have a cumulative effect, albeit not a significant impact.

1. Past Actions. Past actions play a large role in how the river is managed and used today. Human manipulation is a relatively new endeavor for the Illinois River, yet its influence is integral to managing the Project.

While modern farming prompted the construction of the levees, thus ending the natural connection of the Project area with the Illinois River, without the agriculture levees built in the 1920s, the water control features would not be feasible for this Project. In the 1920s, the Corps installed the lock and dam system on the UMRS (including the Illinois River). While the locks and dams ensured a reliable 9-foot navigation channel for river shipping, they did not alter flooding, but took away the river levels dropping below the 9-foot level.

Urbanization in the watershed, farming, and the navigation project have created an unpredictable river hydrograph and have shut off the backwater and floodplain areas from the mainstem river. This has reduced the habitat value for both the backwater areas and river.

2. Ongoing and Future Actions. The TNC's Emiquon Preserve is a part of the approximately 6,300 acre TDL D, and approximately 500 acres of the 1,200 acre Globe Drainage and Levee District and adjacent areas for a total of approximately 7,134 acres. The USFWS manages the Emiquon NWR (approximately 2,200 acres) immediately southwest of the Project area. The USFWS also manages the Chautauqua NWR (approximately 4,500-acre) immediately across the river to the east. Between the three management areas, approximately 13, 834 acres of wildlife management currently takes place. This area of Illinois has become an important migration stop for waterfowl in the Central Flyway.

With the Project, TNC anticipates working cooperatively with the other refuge managers to balance their management practices to optimize the available habitat in the area. For instance each site recognizes the value of drying out the wetland to consolidate sediments and to promote plant growth, but in these dry years, waterfowl migration values are probably at their lowest. Therefore, through communication, only one site at a time may dewater their site to reduce these low values from all happening at the same time giving migrating birds reliable habitat every year.

The Corps and NRCS have several programs to restore wetlands and river habitat projects in general. Within the vicinity the NRCS has entered into a Wetlands Reserve Program with private parties including TNC. These agreements provide revenue to the private party in return for converting their farmland to a wetland easement.

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The Corps and USFWS partnered to restore the Chautauqua Wildlife Refuge in the 1990s. The Project included the construction of a reliable pump station and restoring the levee system for waterfowl management. This was also part of the Corps' EMP.

Although minor short-term impacts are likely to occur to local animals and plants within the construction footprint, no significant cumulative adverse impacts are expected. The habitat restoration measures proposed as part of this Project should have long-term benefits to the fish and wildlife populations utilizing the site. This Project, cumulatively with other habitat restoration projects and other ecosystem restoration efforts on the Illinois River, should help to counter past and ongoing adverse impacts to the river ecosystem such as sedimentation, pollution, and general decline in riverine and floodplain habitat.

I. Probable Adverse Environmental Impacts Which Cannot Be Avoided. The most notable unavoidable adverse impact would be the clearing of vegetation for construction of Project features. This is mostly non-native grass along the levee and at the base of the levee.

J. National Historic Preservation Act. The Project is in compliance with the NHPA of 1966, amended through 2000 (NHPA, Public Law 89-665; 16 U.S.C. 470 et seq.). NHPA and its implementing regulations 36 CFR Part 800: "Protection of Historic Properties," establishes the primary policy, authority for preservation activities, and compliance procedures. The NHPA ensures early consideration of historic properties preservation in Federal undertakings and the integration of these values in to each agency's mission. The Act declares Federal policy to protect historic sites and values in cooperation with other nations, states, and local governments. The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally-assisted undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking, take into account the effect of the undertaking of any district, site building, structure, or object that is included in or eligible for inclusion in the NRHP. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such undertaking.

Although the Corps assures compliance with the NHPA and that no significant historic properties would be affected by the Project, as proposed; if any undocumented historic properties are identified or encountered during the undertaking, the Corps would discontinue all direct activities and resume coordination with the IHPA to identify the significance of the historic property and determine potential effects under Section 106 of the NHPA of 1966 and 36 CFR Part 800. Similarly, if any changes to the Project are proposed or occur, the Corps would resume coordination with the IHPA to identify the significance of the historic property and determine potential effects under Section 106 of the NHPA of 1966 and 36 CFR Part 800.

If human remains, funerary objects, sacred objects, or objects of cultural patrimony are encountered or collected, the Corps would comply with all provisions outlined in the appropriate state acts, statutes, guidance, provisions, etc., and any decisions regarding the treatment of human remains would be made recognizing the rights of lineal descendants, Tribes, and other Native American Indians and under consultation with the State Historic Preservation Officer/Tribal Historic Preservation Officer(s) and the other consulting parties, designated Tribal Coordinator, and/or other appropriate legal authority for future and expedient disposition or curation. When finds of human remains, funerary objects, sacred objects, or objects of cultural patrimony are encountered or collected from Federal lands or federally

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recognized tribal lands, the Corps would coordinate with the appropriate federally recognized Native American Tribes, pursuant to the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001 *et seq.*) and its implementing regulations (43 CFR Part 10).

K. Compliance with Environmental Statutes. Compliance with applicable statutes is summarized in table 25.

Table 25. Relationship of Plans to Environmental Protection Statutes and Other Environmental Requirements

Federal Environmental Protection Statutes and Requirements	Applicability/ Compliance
American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)	Full compliance
Analysis of Impacts on Prime and Unique Farmland (CEQ Memorandum, 11 Aug 80)	Full compliance
Archaeological and Historic Preservation Act, 16 U.S.C. 469, et seq.	Full compliance
Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668d	Full Compliance
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq.	Full compliance
Clean Water Act, Sections 404 and 401	Full compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not applicable
Endangered Species Act of 1973, as amended, 16 U.S.C. 1531, et seq.	Full compliance
Environmental Justice, (EO 12898)	Full compliance
Farmland Protection Policy Act. 7 U.S.C. 4201, et seq.	Full compliance
Federal Water Project Recreation Act, 16 U.S.C. 4601(12), et seq.	Full compliance
Flood Plain Management (EO 11988)	Full compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460/-460/-11, et seq.	Not applicable
Marine Protection Research and Sanctuary Act, 33 U.S.C. 1401, et seq.	Not applicable
Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712; Ch. 128;18; 40 Stat. 755)	Full compliance
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full compliance
National Historic Preservation Act, 16 U.S.C. 470a, et seq.	Full compliance
Native American Graves Protection and Repatriation Act	Full compliance
Protection of Wetlands (EO 11990)	Full compliance
Rivers and Harbors Act, 33 U.S.C. 403, et seq.	Full compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Not applicable
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	Not applicable

Full compliance: Having met all requirements of the statute for the current stage of planning (either pre or post authorization)

Not applicable: No requirements for the statute are needed; compliance for the current stage of planning.

L. Short-Term Versus Long-Term Productivity. Construction activities would temporarily disrupt wildlife and human use of the Project area. Long-term productivity for natural resource management would benefit considerably by the construction of this Project. Long-term productivity would be enhanced through increased reliability of seasonal water levels, promoting the success of emergent and moist-soil vegetation and providing more dependable feeding and resting areas for migratory and resident wildlife. Overall habitat diversity would be increased, and both game and nongame wildlife

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species would benefit from the proposed Project. In turn, both consumptive and nonconsumptive users would realize heightened opportunities for recreational use of the Emiquon Preserve.

M. Irreversible Resource Commitments. The purchase of materials and the commitment of man-hours, fuel, and machinery to perform the Project are irretrievable. Other than the aforementioned, none of the proposed actions are considered irreversible.

N. Relationship of the Proposed Projects to Other Planning Efforts. The proposed Project is in compliance with TNC's Illinois River Site Conservation Plan (1998). The proposed Project is not in conflict with any land-use plans currently being used for the site.

X. PROJECT PERFORMANCE ASSESSMENT MONITORING

A. General. Appendix O, *Adaptive Management/Monitoring Plan*, outlines the feasibility level Monitoring and Adaptive Management Plan (Plan) for Emiquon East. The AMT developed this Plan with assistance from the PDT. This Plan identifies and describes the monitoring and adaptive management activities proposed for the Project and estimates their cost and duration. The AMT would refine the plan in the plans and specs phase as the PDT develops specific design details.

The Plan for the Project describes and justifies whether adaptive management is needed in relation to the proposed project management alternatives identified in the Project feasibility study. The Plan also identifies how the District and TNC would use adaptive management for the Project and who would be responsible for this Project-specific adaptive management program. The Plan outlines how the results of the Project-specific monitoring program would be used to adaptively manage the Project, including specification of conditions demonstrating Project success.

The Plan for this Project reflects a level of detail consistent with the Project feasibility study. The District's primary intent was to develop monitoring and adaptive management actions appropriate for the Project's restoration goals and objectives. The specified management actions permit the District to estimate the adaptive management program costs and duration of the Project.

B. Project Monitoring Plan. Monitoring would be the link between Project goals and objectives with Project features. The TNC and Project stakeholders would use the information gained from the monitoring to validate management results, adaptively manage the Project features to meet the Project goals, and to improve future projects along the Illinois River and the UMRS. Appendix O outlines the specific monitoring actions for this Project.

XI. REAL ESTATE

The Emiquon East HREP is authorized under the WRDA of 1986, (P.L. 99-662), Section 1103 as amended. The Project area is located within the TDLD, which is located immediately northwest of Havana, Illinois in Fulton County and approximately 40 miles southwest of Peoria, Illinois. The Project area is located on the right descending bank of the Illinois River between river miles 121 and

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126, and between the Illinois River and State Highways 78 and 97. The Nature Conservancy is the NFS.

The Project site was acquired by TNC in April of 2000 with an assumed size of 6,661 acres. At the north end of the Project area about fourteen acres of easement will be acquired from two private owners. The NFS must also acquire an approximate 273 acre levee easement from the TDLD.

The State of Illinois will need to either vacate or permit TNC water rights at the borrow sites inside of the Project boundary. Any needed repairs on the IDOT right-of-way will require TNC to acquire a permit from the State's Bureau of Operations. The IDOT provided a letter explaining that they wish to manage any necessary roadway maintenance concerns due to the implementation and management of the Emiquon project on a case by case basis.

The only potential relocation currently noted is the natural gas pipeline that meanders through the Project. The NFS and the easement owner have already concluded negotiations to allow water inundation of this easement area. No relocations are evident at this time.

The Project requires agreement from the NRCS. Shortly after acquisition of the land, TNC sold a 30 year easement to the NRCS, an agency of the U.S. Department of Agriculture, for the WRP. As detailed in Section V of the Real Estate Plan Appendix, the WRP easement owner has control of water management and hydrology at about 98% of the Project area. A CUA acceptable to NRCS, TNC, and the District will require extensive three-way negotiations.

There are remaining issues that result from intense and prolonged discussions with TNC regional representatives and legal counsel. Subsequently, there have been other partnership projects with TNC as a NFS where standard PPA language was agreed to. MVR-RE has provided the Real Estate Plan with encouragement that these issues will be resolved on a national level. Due to the complexity of the remaining issues, reference Appendix D, Real Estate Plan for more detailed information.

XII. IMPLEMENTATION RESPONSIBILITIES AND VIEWS

A. Federal Responsibilities. The Federal Government would provide 65 percent of the first costs of the Construction of the Water Control Structure, Pumping System and Island features. The Federal Government would pay 65 percent of the costs incurred during the feasibility planning phase and the design phase. The Federal portion of this Project is estimated at \$12,106,000. The District is responsible for project management and coordination with the USFWS and other affected agencies. The District would submit the Definite Project Report (DPR) for approval and design; prepare plans and specifications; complete all NEPA requirements; execute a Project Partnership Agreement (PPA) with TNC; advertise and award a construction contract; and perform construction contract supervision and administration.

B. Non-Federal Sponsor Responsibilities. The TNC is the NFS for this Project. This section describes the responsibilities of the NFS in conjunction with the Federal Government to implement the Recommended Plan. A model PPA has been reviewed by the NFS and its legal representation. The NFS is aware of the responsibilities. The PPA would be executed prior to implementation. In accordance with

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public law 106-53 (Section 210 of WRDA 1999) TNC, as a non-profit entity may assume the responsibility of being a NFS with consent of the affected local government. A letter of intent to serve as the NFS as well as consent of the affected local government is provided in Appendix A.

In accordance with Section 1103 of Public Law 99-662, as amended, the NFS shall cost share 35 percent of construction costs, including provision of all lands, easements, rights-of-way, and necessary relocations.

The feasibility study; plans and specifications; engineering during construction; and construction management costs shall be included as part of the total Project cost to be shared 65 percent Federal and 35 percent non-Federal. The sponsor would be responsible for operating and maintaining the Project at 100 percent non-Federal expense upon completion of construction.

The non-Federal Sponsor shall:

- provide all lands, easements, rights-of-way and relocations determined by the Federal Government to be necessary for construction, operation, and maintenance of the Project;
- provide, during construction, any additional costs as necessary to make the total non-Federal contributions equal to 35 percent of the total Project costs. The non-Federal Project cost share is estimated at \$6,520,000. The NFS may receive credit towards its share of Project costs for the value of the LERRD provided for Project purposes. The estimated costs of the LERRD required for the Project is approximately \$5,033,000. In accordance with EMP and planning guidance the NFS may provide work-in-kind as part of their cost share responsibilities up to \$5,720,800;
- for so long as the Project is authorized, operate, maintain, repair, replace, and rehabilitate the completed Project or functional portion of the completed Project, at no cost to the Federal Government, in accordance with the applicable Federal and state laws and any specific directions prescribed by the Federal Government. The operation, maintenance, repair, replacement, and rehabilitation costs are estimated at \$67,556 annually;
- hold and save the Federal Government from damages due to the construction and O&M of the Project, except where such damages are due to the fault or negligence of the Federal Government or its contractors;
- obtain a CUA from the USDA-NRCS that allows for the Project to operate per the intent of this plan for the entire remaining duration of the 30-year WRP conservation easement;
- provide the Illinois DOT a primary contact to conduct any necessary maintenance on the designated highway easement;
- obtain an easement or an agreement from the TDL D to construct, operate and maintain, repair, replace and rehabilitate Project features installed on the levee, which is under the responsible control of the TDL D;
- grant the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon land which the NFS owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project;

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- keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project to the extent and in such detail as would properly reflect total Project costs for a minimum of three years after completion of the accounting for which such books, records, documents, and other evidence are required;
- perform, or cause to be performed, any investigations for hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for construction, operation, and maintenance of the Project; except that the non-Federal Sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Federal Government determines to be subject to the navigation servitude without prior specific written direction by the Federal Government;
- assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA-regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines are necessary for construction, operation, and maintenance of the Project;
- agree that, as between the Federal Government and the NFS, the NFS shall be the operator of the Project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the Project in a manner that would not cause liability to arise under CERCLA;
- prevent obstructions of, or encroachments on, the Project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the aquatic ecosystem restoration, hinder its O&M, or interfere with the proper function such as any new development on Project lands or the addition of facilities that would degrade the benefits of the Project;
- comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, including those required for relocations, the borrowing of material, or disposal of dredged or excavated material, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;
- comply with all applicable Federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army”; and all applicable Federal labor standards requirements, including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c);
- provide the non-Federal share of that portion of the costs of data recovery activities associated with historic preservation that are in excess of the 1 percent of the total amount authorized to

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be appropriated for the Project, in accordance with the cost sharing provisions of the Project Partnership Agreement;

- not use Federal funds to meet the NFS's share of total Project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized; and
- participate with the District in monitoring and adaptively managing the finished Project to assure the Project meets its environmental restoration goals. Table 21 outlines the monitoring responsibilities of each agency.

XIII. COORDINATION, PUBLIC VIEWS, AND COMMENTS

Coordination has been made throughout the planning process with the following State and Federal agencies:

Illinois Department of Natural Resources
Illinois State Historic Preservation Office
Illinois Department of Transportation
Dickson Mounds Museum
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. Department of Agriculture – Natural Resources Conservation Service

A. Coordination Meetings

Numerous coordination meetings were held with Project cooperators to discuss potential enhancement features and project considerations. The following meetings demonstrated ongoing coordination:

- July 08, 2009. Partnership meeting with the District, the NRCS, TNC, and IWR
- June 18, 2010. Coordination meeting with the District and TNC to discuss real estate and legal issues. Coordination was conducted via teleconference.
- September 03, 2010. Coordination meeting with the District and TNC to discuss real estate and legal issues. Coordination was conducted via teleconference.
- March 21, 2011. Coordination meeting with the District, SHPO, DOT, NRCS, Dickson Mounds State Museum and TNC to discuss potential cultural resources impacts.
- July 08, 2013. CUA and Partnership meeting with the District, TNC and NRCS.
- April 16, 2014. Open House held at Dickson Mounds Museum in Fulton County, Illinois, to discuss Project features and receive comments from the general public and other interested parties.
- May 6, 2014. Coordination meeting with the District and USFWS to discuss the Coordination Act Report.
- May 9, 2014. CUA and Partnership meeting with the District, TNC and NRCS.
- May 30, 2014. Coordination meeting with the District, TNC, NRCS, USFWS and elected officials. This recent coordination meeting with NRCS and other Federal partners was chaired by IL Senator Richard Durbin. Also in attendance was staff from Senator Kirk's office and

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congressional staff from representative Aaron Shock and representative Cheri Bustos offices. This coordination meeting resulted in a verbal commitment that a 10-yr CUA may be provided prior to execution of the Project Partnership Agreement once ecological decision points are identified by the multi-agency AMT and captured in the compatible use document.

- June 11, 2014. CUA and Partnership meeting with the District, TNC and NRCS.
- June 20, 2014. Adaptive Management Planning Kick-off meeting with seven state and Federal agencies, academia, and two nongovernmental organizations. The group discussed the basics of adaptive management (AM), the agencies' goals with the Project planning, project constraints, risks and uncertainties, the annual plan review process, key ecological attributes and their roll in AM, the AMT's roll and responsibilities, and AM as part of the CUA.

B. Coordination by Correspondence. The following letters can be found in Appendix A, *Correspondence*:

- June 10, 2005. Letter of intent from TNC to serve as project sponsor.
- August 17, 2005. Preliminary Restoration Plan Approval Memo from MVD
- March 28, 2011. Letter from State of Illinois to USFWS to request Emiquon designation as wetland of international significance
- March 24, 2011. Letters from TNC related to real estate and legal requirements
- March 26, 2011. NHPA coordination letter submitted to the IL SHPO
- April 26, 2011. Endangered Species Act and Fish and Wildlife Coordination Act coordination letter submitted to the USFWS
- May 02, 2011. Letter from DOT about maintenance of roadway slopes due to inundation associated with WLMP
- October 20, 2011. Endangered Species Act concurrence from USFWS of *No Adverse Effect* on *B. Decurrens*.
- December 17, 2012. Phase I Cultural Resources coordination letter from NRCS to IL SHPO
- March 26, 2013. Phase I Cultural Resources coordination letter from the district to IL SHPO
- April 12, 2013. Letter from SHPO to the district concurring with *No Effect* determination
- August 13, 2013. Project support / CUA letter from NRCS
- August 09, 2013. Letter from Fulton County supporting TNC as the NFS
- April 23, 2014. Letter from the ILDNR
- May 12, 2014. Agency Review comments provided by US EPA
- June 17, 2014. USFWS's Draft Fish & Wildlife Coordination Act Report with recommendations
- June 25, 2014. USFWS concurrence letter
- July 21, 2014. USFWS Final Fish & Wildlife Coordination Act Report with recommendations

C. Public Views and Comments

The *Draft DPR with Integrated Environmental Assessment* was distributed for a 30-day public, state, and agency review on March 21, 2013. During the public review the District received comments from

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the US EPA, US FWS, and ILDNR. These agencies had several concerns with the report and Project. Through subsequent meetings and discussions, many of their concerns were resolved. See Appendix A for more details on their comments and the District's responses.

During the public review period the District and TNC held an open house on April 16, 2014, at the Dickson Mounds Museum, near Lewiston, Illinois. Representatives from the District and TNC were present to talk one-on-one with attendees about the draft Tentatively Selected Plan and to gather public input. Maps of the Recommended Plan and copies of the report were arranged around the room. In addition, hand-outs of the Executive Summary, a project map, and a comment sheet were available for each attendee. Twenty members of the public attended the evening session. Only 1 comment sheet was returned. Respondents indicated they use the area for recreation, fishing, boating, and hunting. The most common response from the open house was uncertainty about the water control gate management and allowing Illinois River water to enter the preserve.

During the public review period, the District received the following emails and letters from the public. Each email and letter is found in Appendix A, *Correspondence*:

April 17, 2014. Letter from Kendall W. Miller
April 17, 2014. Email from John Wisher
April 18, 2014. Letter from Dr. Stephen Havara
April 30, 2014. Email from Brad Rolando
April 30, 2014. Email from John Graham
May 12, 2014. Letter from Mike Conlin
May 13, 2014. Letter from Brent Manning
May 14, 2014. Email from David Hill
May 16, 2014. Email from Gary Lutterbie
May 16, 2014. Email from Larry Cruse
May 16, 2014. Phone call from John Tranquilli
May 18, 2014. Email from Bill & Sue Boyd
May 19, 2014. Letter from Donald Koch
May 29, 2014. Email from Rudy Stinauer
May 29, 2014. Email from Stan Etter
June 17, 2014. Email from Dr. Stephen Havara

D. Response to Public Comments

Since TNC began managing Emiquon, the results have been phenomenal, but without water control this high quality habitat will decline. This Project is one tool TNC could use to maintain Emiquon as a high quality wetland.

The TNC will be tasked to monitor and assess the risks and uncertainties of invasive species, sedimentation, turbidity, and water temperatures. The AMT will assist TNC with interpreting the monitoring results and together, create a management scheme to boost the Preserve's habitat benefit for the long term.

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With the lessons learned from Hennepin/Hopper as well as other Illinois River backwater management sites like Banner Marsh, Chautauqua, and Swan Lake, the District and TNC are taking a cautious approach to future management at Emiquon. Through the implementation of an exhaustive monitoring plan/adaptive management plan, TNC has taken the steps beyond the norm to protect the existing resources and protect future resources.

Presently, Emiquon has carp; without the Project, carp will eventually proliferate and there will be no way of controlling them other than reset the system with dewatering, conducting a major fish kill, and then have a dead fish removal problem. With the Project and adaptive management, TNC will have the ability to control carp populations effectively and economically.

Actions to Date

Based on the public comments the District received during the public comment period, the District took several actions. The District extended the 30-day public comment period to 70 days, and in fact, received and accepted comments 17 days after the 70-day period. The District initiated the Project's adaptive management process prior to the initiation of the PED phase. This includes formation of an AMT and an initial kick-off meeting. The District anticipates additional AMT meetings prior to the PED phase when AMT meetings generally start.

E. Response to Agency Comments

1. Response to ILDNR April 23, 2014 letter

Comment: The Department concurs with the USFWS that this species should be searched for before disturbing the construction area given this plant's ability to colonize new areas each year. If the plant is found in the construction footprint, measures should be taken to avoid or mitigate impacts to this listed species. The Department concurs that this Project is not likely to negatively affect decurrent false aster.

District Response: The District updated this DPR, Section IX.B.5, *Endangered Species* to explain the measures the District proposed to implement before, during, and after construction to protect and enhance *Boltonia decurrens* populations and habitat.

Comment: The state-endangered black-crowned night heron is known to occur in the Project vicinity. This bird builds its nest in standing aquatic vegetation in wetland habitats. Nesting occurs from late April to early June. While the probability of a nest occurring in the construction vicinity is slight, efforts should be taken to avoid disturbance, including noise, if a nesting black-crowned night heron is discovered in the vicinity of construction. If avoidance is not possible, please contact the Department to discuss other mitigation options.

District Response: Concur. The District also contends the island construction may provide black-crowned night heron nesting habitat when trees begin to grow on the islands. Likewise, the 10:1 island slopes may also provide habitat for other species of concern like the black-legged stilt and other migrating shorebirds.

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Comment: The state-endangered Blanding’s turtle and smooth softshell may occur in the Project vicinity. The ILDNR recommends the construction area be searched for these species each day before the start of work and when transporting equipment. If one is encountered, wait for the turtle to leave the area or contact Michelle Simone with the ILDNR’s Natural Heritage Division at 309-202-3438.

District Response: The District will add a note on shop drawings during plans and specification phase of this Project with the ILDNR’s request. The District also added this stipulation to this DPR in Section IX.B.5, *Endangered Species*.

Comment: “...the starhead topminnow appears to be thriving, with the key to its success being the submerged aquatic vegetation (SAV), now abundant at Emiquon. The Department stresses the need to maintain high quality and abundant SAV in Emiquon as these habitats are rare to non-existent in floodplain lakes where connectivity to the Illinois River exists. Reasons for SAV destruction in floodplain lakes connected to the river include high sediment loads, turbidity, fluctuating water levels, and non-native carps that will be introduced during flood pulses. Maintaining SAV after reconnection may be challenging, yet is of utmost importance to mitigate for any negative impacts to the starhead topminnow and many other species that have come to rely on this unique and valuable habitat at Emiquon.”

District Response: The District concurs with the ILDNR concerning the need to maintain high quality and abundant SAV at Emiquon. The partnership between the District, TNC, ILDNR, FWS and NRCS developed an AMT who is committed to ensuring the continued high quality wetland values and functions at Emiquon for the life of the Project. Like all wetland systems, environmental conditions are not static; the AMT will advise TNC’s on their water level management to optimize the wetland quality, quantity, and function to reach the Project goals. Details on the AMT, its role, and contribution to the Project are outlined in Appendix O.

While the construction period of dewatering may have short term impacts to this species, the overall construction benefits along with adaptive management, will have long term project benefits and a net positive effect on the species.

2. Response to USEPA May 12, 2014 letter

US EPA Letter Dated May 12, 2014 Response

ALTERNATIVES/PROJECT JUSTIFICATION/IMPACT ANALYSIS

Recommendation: The Final Definite Project Report/Environmental Assessment (hereafter: Final EA) should clearly articulate the Project purpose and need.

District Response: The Emiquon East Project (Project) is the District’s 55th Upper Mississippi River Environmental Management Program Definite Project Report/Environmental Assessment addressing habitat restoration and enhancement projects over the last 25 years. The format of the report and planning process remains consistent over the life of the program. Please read Section I. C, *Resource Problems and Opportunities* for a brief introduction to the Purpose and Need requirements normally found in a NEPA document. Other sections in Chapters I, II, and III provide a more in-depth look at why habitat restoration and enhancement is needed at Emiquon.

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Recommendation: The final EA should clearly articulate how each identified alternative measure (those carried forward for study) does, or does not, meet the Project purpose and need. Additionally, specific impacts associated with each action alternative carried forward (LR0, W1, W2, W3, P0, P2, S0, S1, S4, S5, L0, I0, I1, I2) should be quantified, and include all impacts associated with that specific proposal. This information should be clarified and included in the Final EA.

District Response: The District determined the alternatives carried forward for feasibility had similar environmental impacts as the preferred plan. The District determined the alternatives carried forward for analysis would not pose any additional or significant environmental impacts beyond the Recommended Plan. The District selected this plan based on its high level of habitat benefits, ability to meet the Project's goals, and it was the "best buy" alternative. The District added a paragraph to the beginning of Section IX, *Environmental Effects* explaining this.

Recommendation: The Final EA should clearly discuss all project proposals, including those activities proposed that relate to project goals of educational and recreational access, and quantify all impacts associated with these proposed activities.

District Response: The District added a footnote in Section III. D.4, *Illinois River Reach Objectives*, stating that educational and recreational activities are part of the NFS goals and outside of the UMRR-EMP program authorization; therefore, they will not be covered as part of this Project.

WETLAND AQUATIC RESOURCE IMPACTS

Recommendation: As previously stated above, specific wetland impacts associated with each action alternative, including 10, 11, 12, must be quantified in the final EA.

District Response: The District quantified island construction benefits in Appendix C, *Habitat Evaluation and Quantification*. Please see tables C-5 and C-12 for the comparison between constructing 5 islands versus 10 islands. The islands construction would not alter the acreage or types of wetlands, except for the 10' wide above water section. On the tops of the islands, wetland vegetation promoting colonial nesting birds should naturally revegetate. If not, TNC staff will actively plant the island with bottomland tree species. Based on the benefits of topographic diversity, and vegetation, the District determined there would be little to no wetland benefit loss.

Recommendation: The Draft EA did not include a 404(b1) analysis. The Final EA should be modified to include the following information:

- Clarification if a Section 404 permit is required and clarification if TNC will be the permit applicant;
- A robust discussion about how sequencing established by the Clean Water Act Section 404(b)1 guidelines has been applied, namely, avoidance first, then demonstration of impact minimization, then mitigation for unavoidable minimized impacts; and
- A 404(b)1 analysis.

District Response: Since this action falls under a general permit, the District followed Corps of Engineer guidelines, Engineer Regulation 1105-2-100. Nationwide and regional permits fall under the

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category of general permits. A general permit is issued subject to the Section 404(b)(1) Guidelines and to any conditional standards pursuant to Section 404(e) of the Clean Water Act. The conditions of a general permit shall be used in lieu of this regulation for those Federal activities which the District Commander determines to be applicable.

The District updated this DPR and Appendix B, *Clean Water Act Compliance* to reflect this Project is in compliance with the 404(b)1 guidelines for general permits based on its compliance with the NWP #27 conditions. In Appendix B, the District documented the compliance with the NWP #27 conditions which were used in lieu of the standard 404(b)1 guidelines. No formalized 404(b)1 analysis is required.

Recommendation: The Final EA should include written concurrence from USACE Regulatory Branch staff that NWP 27 is applicable to this Project.

District Response: Concur. The District added the Rock Island District Regulatory Branch coordination in Appendix B, *Clean Water Act Compliance*.

Recommendation: While Nationwide Permit 27 is still for Aquatic Habitat Restoration, Establishment, and Enhancement Activities, language referencing the applicability of the Nationwide Permits should be corrected in the Final EA to refer to the current 2012 Nationwide Permits.

District Response: Concur. The District updated the final report in the appropriate locations.

WATER QUALITY

Recommendation: The Final EA should provide additional information on the current impairments listed for the Illinois River, and describe how implementation of the proposed project could potentially affect the waterbody (with regard to specific listed impairments).

District Response: The District added the appropriate discussion in Section III, K. *Water Quality*, and Section IX. F. *Water Quality*. The District anticipates the Project would not impact any Illinois impaired water body.

THREATENED/ENDANGERED SPECIES

Recommendation: EPA recommends that USACE continue to coordinate with USFWS and the ILDNR to determine if any of the proposed activities would or could detrimentally affect any federally- or state-listed species of their critical habitat. The Final EA should include correspondence from the USFWS and IDNR confirming if the proposed project will, or will not, affect any federally- or state-listed threatened or endangered species.

District Response: Appendix A, *Correspondence*, includes coordination letters from the ILDNR and USFWS both concerning threatened and endangered species information. Elsewhere in this section, there are the District's responses to the ILDNR and USFWS comments.

Recommendation: EPA recommends that USACE continue coordination efforts with USFWS and state wildlife agencies as appropriate to meet the conditions of the Fish and Wildlife Coordination Act

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(FWCA). Correspondence to and from coordinating agencies regarding FWCA coordination should be included in the final EA.

District Response: The USFWS's Draft Coordination Act Report, as required by the FWCA, is included in Appendix A, *Correspondence*. The District's response to the Draft Coordination Act Report is included in this Section. Due to time constraints, the District and USFWS are continuing the appropriate level of FWCA coordination. The USFWS provided their Final Coordination Act Report on July 21, 2014 and is included in Appendix A, *Correspondence*.

Recommendation: The Final EA should clarify what effects the proposed project will have either positively or negatively, on *Boltonia decurrens*.

District Response: The District updated this DPR Section IX.G.5, *Endangered Species* to include a detailed discussion of the anticipated impacts to *B. decurrens*.

Recommendation: The Final EA should specifically state all avoidance measures to be taken to avoid impacts to *B. decurrens*, explain how these measures will be incorporated into project plans and bid documents, and be committed to in the Finding of No Significant Impact (FONSI).

District Response: The District updated this DPR Section IX.G.5, *Endangered Species* to include a discussion of the avoidance measures the District would require during Project construction and operation. Specific sheets or plates will also contain information as part of all bid packages. Specific locations and certain drawing notes are part of the final report (per the Freedom of Information Act) are not part of the plates. The avoidance measures are part of this final document, therefore avoidance measures are part in parcel to the FONSI; they are not detailed specifically in the FONSI but referenced back to the final report.

Recommendation: The Final EA should include information on the BA, what it is being prepared for, and copies of all correspondence to and received from the USFWS regarding the status of the BA and its review by USFWS.

District Response: At the time the District completed the Project draft report, it had correspondence dated October 20, 2011, from the USFWS stating the USFWS concurred the Project would not likely adversely affect Decurrent false aster (*Boltonia decurrens*). That is why the report did not have any reference to the BA the USFWS requested during the public comment period. Further, since the populations of *B. decurrens* are experimental at Emiquon, a biological assessment (BA) is not required. The District prepared Section 10(j) conference documentation in the form of a BA. The District updated this DPR Section IX.G.5, *Endangered Species* to include a discussion of the conference documentation/BA the District prepared for this Project.

INVASIVE SPECIES

Recommendations: The Final EA should be amended to include a robust discussion on the potential for invasion of the Project by Asian and other carp, in addition to invasive wetland vegetation (such as reed canary grass, common reed, cattail, and purple loosestrife). Information on all aspects noted above as lacking in the Draft EA should be added to the Final EA.

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District Response: The District, TNC, and most Project partners recognize the introduction of invasive species as the Project's biggest concern. The District feels the appropriate recognition of these concerns is in the feasibility stage of this Project. The District has enhanced the discussion concerning invasive species impacts in several locations in the report (see *Executive Summary*; Section II.H, *Invasive Species*; Section III.B.1, *Problems*; and Section IX.C. 6, *Invasive Species*). As the Project engineers fine tune the Project's Recommended Plan with detailed plans and specs during the Project's PED phase, so too will the AMT come together and fine tune the adaptive management plan.

The AMT will analyze the potential impacts of invasive species on all aspects of the Project and create a strategy to reduce invasive species impacts. This team met on June 20, 2014, and the District is confident adaptive management is especially true with this Project given the time and efforts the USFWS, NRCS, TNC, ILDNR, and District have already devoted to creating an AMT to carry out sound management decisions.

The proposed Project is in compliance with EO 13112. The ILDNR Fish sampling in 2013 captured 92 Common Carp in 2013, higher than the 62 caught in 2012, but less than the record high of 146 in 2011. As the 2013 flood overtopped the Emiquon levee, TNC observed Asian carp species (Bighead and Silver Carp) entering the preserve (personal communication between J. Jordan and Emiquon Preserve Mgr D. Blodgett). The carp are there and will continue to be there with or without the Project. Given this fact, the proposed Project, through adaptive management, will reduce the impacts of invasive species better than having no project at all. The District added additional compliance language to this DPR concerning EO 13112.

HISTORIC PRESERVATION

Recommendation: The Final EA should clarify how the 2004 PA relates to current SHPO consultation efforts undertaken for the activities proposed in the Draft EA.

District Response: The NRCS PA was not fully implemented and therefore not in compliance with Section 106 and the WRP, since the Emiquon pumping station quit working and the reserve naturally inundated/flooded. During the Corps development of the EA, the Corps Emiquon team viewed the flooded Emiquon reserve as existing conditions and Project related alternatives, features/measures avoided all existing sites within the APE. The SHPO concurred with the Corps determination on April 12, 2013. Page 89 of the Project report explains that time would be allowed for NRCS testing of three archeological sites to fully implement their Programmatic Agreement during EMP Project construction after the reserve is dewatered for island construction and prior to Project completion.

Recommendation: The Final EA should clarify the status of the Phase II study, including dates when the Phase II study will be or was undertaken.

District Response: Phase II testing will be completed by the NRCS as the lead federal agency for WRP and PA following the EMP Project dewatering/island construction.

ADAPTIVE MANAGEMENT AND MONITORING

Recommendation: This should be clarified in the final EA.

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District Response: This Recommendation refers to Appendix O, *Adaptive Management/Monitoring Plan* and who is responsible for assessment of whether or not success criteria/performance measures are being met. The level of detail addressing the success criteria/performance measures is appropriate for the feasibility phase of project planning. Once the Project enters the PED phase, the AMT will address the levels of success as an interagency, interdisciplinary team. To the District and project partners' credit, they have already met to discuss adaptive management and the way forward before the PED phase has begun. The AMT will develop success criteria/performance measures to assist TNC's on short term and long term management decisions.

Recommendation: Additional clarification on which objectives are short-, medium-, or long-term, and further discussion on when to stop or continue monitoring to meet these objectives, should be included in the Final EA.

District Response: Again the level of detail addressing short-, medium-, or long-term objectives is appropriate for the feasibility phase of project planning. Once the Project enters the PED phase, the AMT will address the short-, medium-, or long-term objectives.

Recommendation: USACE should reconsider and evaluate applicable success criteria and performance objectives that take into account invasive aquatic plant and animal species, particularly the exclusion of, treatment for, these species. Revised success criteria should be added to the final EA.

District Response: The AMT is currently discussing how to measure invasive species risk and uncertainties and the management scenarios that will reduce these risks. The AMT will specifically address monitoring regimes and results to help in make management decisions to reduce the effects of invasive species. This information is not complete; more detailed information on the effects of invasive species is being developed by the Project's interagency AMT during the PED phase of this Project. The team is looking at the ecological criteria, or triggers behind each management regime to reduce the impacts of invasive species while at the same time optimizing the Project features' benefits.

Recommendation: The Final EA should clarify the definition of "success" as it relates to project closeout. EPA recommends that project success be defined as meeting all performance expectations for at least two consecutive years. Modified objectives should be updated in the Final EA.

District Response: In the USEPA's letter they cite text from Appendix O, *Project Closeout*. Their citation failed to include the beginning of the sentence where it states the "*Closeout of the Project would occur when the AMT determines* (emphasis added)..." One of the roles of the AMT (with which the EPA has become a welcomed participant) is to help define success. During the PED phase of Project the AMT will formalize success expectations, not necessarily define success end points.

The AMT may determine the status quo is successful in any particular year. If there is a change in the present condition, they may determine a water level change is in order. The AMT should not be bound to a consecutive 2-year period of success. This arbitrary length of time limits the ability of the AMT and TNC to capitalize on opportunities and can limit their ability for long term success. This Project is predicated on six management scenarios. The Project cannot achieve all the Project goals in any 2-year period.

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The District is bound by Corps regulations and Federal law (WRDA 2007) only allowing the Corps to monitor or take an active role in adaptive management for 10 years after construction. At that time the Corps has to close out its construction time frame. The 10 years is not the end of the Project; it is the end of the Corps construction period. It will be up to TNC to continue monitoring after the 10 years and to ensure the Project success. During the first 10 years of monitoring the AMT may determine TNC is adequately managing the Project and the AMT may not take as active role in the year to year management. After 10 years, TNC will continue to monitor the 40+ ecological criteria they current use to gage their success and will employ adaptive management practices throughout the life of the Project.

CLARIFICATIONS

Recommendation: The Final EA should include updated information on the status of coordination with USDA-NRCS towards receipt of a CUA.

District Response: The TNC and NRCS have gone through extensive coordination of their CUA since the District distributed the DPR for public review. Both parties are continuing those discussions. The District anticipates TNC and NRCS will have an agreed upon CUA by the time the District and TNC sign a Project Partnership Agreement.

Recommendation: The Final EA should include an updated schedule with corrected dates for public outreach (including noting the public meeting held in April 2014), and timeframes for submittal for, and receipt of, required permits.

District Response: The District has updated Table 16 to reflect the most accurate dates.

Recommendation: EPA recommends that page numbers be added to all appendices.

District Response: Concur. All the appendices have page numbers.

OTHER ISSUES

Recommendation: The Final EA should discuss further implications of site water level management should inadvertent site excavation reach groundwater and should discuss measures to ensure this does not occur.

District Response: Concur. Protecting the underlying aquifer from intrusion is very important in the construction of all features for the Emiquon Project in order to be able to provide water level management. While there were numerous areas in the DPR outlining we were aware of this concern, we decided to consolidate and summarize these concerns and path for ensuring the shallow aquifer is not pierced.

The District used lessons learned from numerous HREP projects in developing this site in addition with industry engineering practices in wind wave fetch analysis and borrow site evaluations. Borrow depths to avoid piercing the groundwater were outlined in the report, to address needs at this site but also understanding areas where this has happened previously (Bay Island HREP).

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Changes to the plates to clarify some of these concerns and to the DPR main report under the Recommended Plan were made. Changes to the report are generally as follows:

This measure consists of constructing 10 interior islands. Islands will provide topographic diversity for this backwater area. The recommended design is for 10 islands to be strategically placed throughout the Project area to prevent resuspension of sediment due to wind generated waves, this reducing turbidity. The islands will not completely eliminate sediment resuspension. Island construction helps by reducing wind fetch length and forcing wind generate waves to break while the protection of shallow areas is achieved through seasonal drawdowns and recruitment of moist soil vegetation.

A detailed hydraulic analysis was performed for this wind/wave fetch analysis for this specific report (using Automated Coastal Engineer System Modeling Software and ASCE publications). A geotechnical analysis, including constraints for borrow and excavation depths, was performed. Information regarding the design was also obtained from experience as outlined in the *UMRR Environmental Design Handbook* as well as lessons learned from various HREPs.

Criteria for island design included the following:

- reducing wind fetch length which in turn will reduce wave height and sediment resuspension;
- breaking wind generated waves to reduce wave height and sediment resuspension;
- protecting shallow areas which are more susceptible to sediment resuspension;
- allowing the islands to be functional for most water levels predicted in the WLMP;
- avoiding and protect environmentally sensitive and cultural areas;
- using existing topographic features to reduce fill quantities; and
- maintaining sufficient layer of clay over the underlying aquifer for all borrow sites (do not puncture the lake pan).

Island orientations chosen were based on the prevailing wind direction. During plans and specifications, analysis of wind fetch from directions other than the primary wind direction will be performed to develop the final island layout. Lessons learned from the Peoria Island HREP Initial Performance Evaluation Report (specifically the barrier island) outline the importance of considering various wind directions and site specific wind data for final layouts.

An iterative process for island placement occurred to provide the optimum island locations in order to reduce wave height. The island crown elevations were selected to prevent overtopping by wave run up. These elevations are similar to the existing elevations observed at the Old Norris Farm Pump House Road.

The construction of islands would require borrow from adjacent land. Geotechnical borings would be required in these areas to ensure that the borrow depth would not penetrate the surface clay layer resulting in a point in the Project interior that would be directly connected to the groundwater. This type of connection could result in an additional intrusion of water

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during low water periods, or unwanted drainage of water during high water periods. . . Lessons learned from other ecosystem projects (such as the Bay Island HREP) outline the need that the shallow aquifer be protected to ensure effective water level management within the complex. If it is not possible to protect the aquifer at any of the island locations shown, the island locations will be updated to optimize the reduction of wave heights while protecting the underlying aquifer. Shallow borrow areas are shown adjacent to each island location. These can be seen in the typical section shown and in the plan views for each island on the attached drawings. Borrow areas would be kept as close to the constructed feature as possible in order to minimize construction costs. During construction, close monitoring of all borrow activities will be required to ensure that excavation depths do not pierce the underlying aquifer.

Final island design and layout will consider recommendations from the AMT and will incorporate lessons learned from projects such as Swan Lake.

In order to construct the islands, the interior could be drained by the newly constructed pumps. Any drawdown recommended for construction purposes should be consistent with the NRCS CUA. If the area could not be drawn down, equipment that can work in wet and submerged conditions would be used.

For further detail, refer to Appendix Q, Plates 10 to 16, Appendix H, *Hydrology and Hydraulics*, and Appendix G, *Geotechnical Considerations*.

Recommendation: References to boulder placement should be amended to discuss that they are part of the design, not that they may be part of the design. Construction plan sheet notes should be amended as well to reflect the certainty of boulder placement. Additionally, EPA requests that construction plan sheet (a detail sheet) be created to show the fish passage boulders within the proposed access channel. This detail sheet should include boulder sizing, including the proposed D50 or average weight of the boulders.

District Response: The District agrees that providing specific locations, spacing, and sizing on construction drawings is appropriate. However, these drawings show a feasibility level of design. The Note on Sheet S-102 will be changed to read similar to as follows “Boulder sizing and placement within the concrete channel will be finalized in the design phase.”

Additional clarification to the description of the Recommended Plan will also be added to the DPR. Words will be added similar to as follows “The structure developed for this DPR to meet the proposed WLMP includes a 7-foot water control structure is a U-shaped reinforced concrete channel with a sheet pile cutoff wall. The proposed channel invert elevation is 428 feet with a top of structure elevation of 455 feet to match adjacent levee top elevations and allow for vehicular transport across the top of the structure. The 7-foot opening is spanned with heavy duty grating to provide access across the water control structure for maintenance vehicles. Light duty grating spans the structure on each side of the heavy duty grating to provide an operating platform for the sluice gate and access to the stoplog slots. One purpose of this structure is to allow for fish passage which could be allowed by the placement of boulders embedded into the bottom of the structure to allow for resting areas for fish passage.

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An 84" x 154" steel sluice gate would be installed on the landward side of the levee. The gates would remain out of the water during periods when fish passage is desired in order to assure no impact on passage of paddlefish. The sluice gate could be operated by an electric motor gate lift operator that is controlled manually at the elevated outdoor rated motor control center.

Stop log structures would be installed to allow the NFS to close off the structure to do repair work on the gate or do other water control manipulations. The stoplog material would be evaluated during plans and specification, but could consist of timber, plastic or another non-metallic material. The stoplog channels could be vinyl coated prior to installation in order to account for paddlefish sensitivity to metal. Once the water control feature is opened, it forms a connection to the IWW in which fish passage may occur. The fish would be attracted to this opening when a high attracting velocity is detected. However, the velocities may be too high to allow the fish to pass through. Boulder placement within the water control structure was discussed during feasibility to provide resting areas for fish during these high velocity periods. For feasibility design, it was assumed that we would have rows of 5-foot diameter boulders which would be embedded to about 25 percent of their depth, at a spacing to reduce velocities to match fish burst swimming capabilities. Further design is required for boulder spacing and placement during plans and specifications."

3. Response to USFWS June 17, 2014 Letter

Comment Page 3, paragraph 2: We understand that the project sponsor and the COE are now under significant time constraints due to their respective funding cycles, but feel that the DPR would benefit from information updates. Such updates would include recent hydrographic data, effects of the 2012 drought and 2013 flood on Emiquon resources and infrastructure, and other UMRR-EMP HREP Performance Evaluation Review data from Illinois River projects or projects with features similar to those proposed.

District Response: The District agrees updated data could lead to a more informed decision. However, the District feels hydraulic data from two extreme years would not provide additional information that would change the recommended plan. By all means, the 2 years of hydraulic data on during these two years and the resulting effects a on the Illinois River Valley's backwater habitat complexes are extremely important to the District and the AMT. The AMT will use this data to make an informed decision on developing the details of an adaptive management plan and evaluating TNC's management activities.

Comment Page 3, paragraph 3: Typically, formulation of HREP project alternatives is a collaborative process among the project stakeholders. Project structural measures (e.g. pump station, water control outlet) were formulated in alternative sizes and capabilities and then compared to one another, but only one six-year water management cycle was presented. Other alternative water management regimes should be considered. We understand that there is an existing Emiquon Advisory group, but it has not been convened recently. We recommend that this group or a similar group of interagency and interdisciplinary scientists and engineers be convened to review the proposed 6 year management cycle and identify other potential management cycles that could be implemented to meet stated project objectives. This group serving as the Adaptive Management Team (AMT) would determine the best/optimum management regime to implement following construction. Any future changes to the management regime would be informed by monitoring results and evaluation by the AMT and could vary widely from the analyzed six-year recommended cycle. We recommend that

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the COE take special consideration during the PED (Project Engineering and Design) phase of the project to incorporate AMT recommendations and considerations.

District Response: Concur. The District supports the adaptive management concept for the Emiquon East Project. The management cycle was developed to look at a variety of management cycles, specifically 6 different annual cycles. The District updated the main report and appropriate appendices changing the 6 “year” management cycle to a management cycle with 6 “scenarios.”

The PDT analyzed the cycles as “years” to better understand the pump sizing and habitat benefit evaluation. However, as noted in Section III.D.4, *Illinois River Reach Objectives*) and in Appendices C, H, and O, the six-year cycle would be used as a guide and not as a regimented management plan. The AMT will consider the detailed management cycles outlined in the plan and will possibly develop additional cycles depending on the monitoring, and meeting the project objectives.

Comment Page 3, paragraph 4: The anticipated effects of gravity flow development on Emiquon's aquatic and wetland systems are the subject of much debate. The effects of this proposed project feature need additional analysis and investigation. Each step of the proposed water management cycle should be analyzed with regard to anticipated objectives and possible negative effects (e.g. invasive species, sediment, and contaminants). In particular, an impact analysis that addresses the likelihood of exotic carp invasion and predicted consequences should be completed. The adaptive management plan/strategy should include measures (e.g. an invasive species control plan) that can address invasive species.

District Response: Concur. At the June 20, 2014, Emiquon AM Planning Kick-off meeting, the AMT identified invasive species impacts as one of the most critical risks to the success of the Emiquon project. The District anticipates the AMT members, including the District and USFWS, will make invasive species one of their highest priorities for monitoring and management. The AMT also discussed sediment and contaminants as risks and uncertainties. The adaptive management plan will have specific objectives focusing on sedimentation and water quality.

Likewise, the AMT should look at the positive effects the project and management on dealing with a carp problem. The AMT should develop contingency plans for dealing with Asian carp, common carp, and grass carp before they become a problem. In addition to other functions, perhaps the gate could serve as a management tool to get rid of a tremendous amount of biomass while avoiding a massive fish kill.

Comment Page 4, paragraph 1: Multiple objectives have been proposed for this project, making the preparation of a long term management plan a complex task requiring contribution from multiple disciplines. For example, although improving native fish species passage into and out of the project is desirable, it appears to be in conflict with the necessity to exclude exotic carp species. Nutrient export and denitrification is also desirable, but there is limited evidence presented to suggest that it will be significant or even measureable compared to the nutrient load of the Illinois River.

and

Comment Page 4, last sentence: An adaptive management strategy, like the one recently initiated by the project stakeholders is the best way to address and alleviate some of the inherent risks and uncertainties.

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District Response: Concur. The District recognizes there are risks and uncertainties with this project. As Appendix O points out, *The District would address uncertainties in the PED phase in the detailed monitoring and adaptive management plan, including a detailed cost breakdown.* (Section II, *Project Adaptive Management Planning*). Additionally, there are risks and uncertainties associated with no project and limited management capabilities. Some Key Ecological Attributes (developed with the 40-plus member Emiquon Science Advisory Council) remain in the poor range and others have been declining.

While there is limited evidence presented to suggest nutrient export and denitrification will be significant or even measureable compared to the nutrient load of the Illinois River, it does not mean it is not important or desirable and it should not be considered in management decisions. In fact, on http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_006911.pdf, the Natural Resources Conservation Service states “Lands enrolled in WRP ... decrease flood damages, (and) **improve water quality**” (emphasis added).

Likewise at <http://www.fws.gov/budget/2013/PDF%20Files%20FY%202013%20Greenbook/8.%20National%20Wildlife%20Refuge%20System.pdf> and <http://www.fws.gov/budget/2013/PDF%20Files%20FY%202013%20Greenbook/8.%20National%20Wildlife%20Refuge%20System.pdf>, the Fish and Wildlife Service states “The Refuge System also provides major societal benefits through ecosystem services such as improving air and **water quality**” (emphasis added).

Bottomline: We need to look at risks and uncertainties and gauge them against ecosystem benefits.

Comment Page 5, paragraph 1: Incorporation of “lessons learned” from other restoration efforts along the Illinois River could only improve and strengthen the planning and management of the Emiquon Preserve. Including individual managers from other *sites* along the Illinois River valley on the AMT would ensure that the most recent knowledge of ecological responses to management actions be incorporated.

District Response: Concur. The District has taken into consideration the results of many of the preceding HREP projects lessons learned and integrated them into this Project’s the planning process. The AMT met on June 20, 2014, with other refuge managers on hand to contribute their wealth of knowledge on regional collaboration ventures, and for their “boots on the ground” experience with project operations. The AMT governance will include other Illinois River land/resource managers on the team to ensure its success.

Comment Page 5, paragraph 3, Water Control. ... we recommend that a hydrologic analysis be conducted to inform the adaptive management plan and managers as to the frequency and efficiency of using the structure for those purposes (i.e., how often during the target drawdown periods is the Illinois River water level expected to be below the water levels within the Emiquon Preserve).

District Response: Appendix H, figure H-8 (reproduced below) illustrates the relationship between the median Illinois River water levels and the desired WLMP. Based on median Illinois River water levels, July drawdowns in Scenarios 4 and 6 are the only opportunities to use primarily gravity drainage to meet the desired WLMP; therefore, there are few opportunities to use interior gravity drainage to meet the WLMP. This indicates the TNC would have to use pumps to complete most of the desired drawdowns (described in Appendix H, page H-13). The AMP (Appendix O) states the

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TNC would capitalize on gravity flow opportunities whenever possible to meet the Project's objectives.

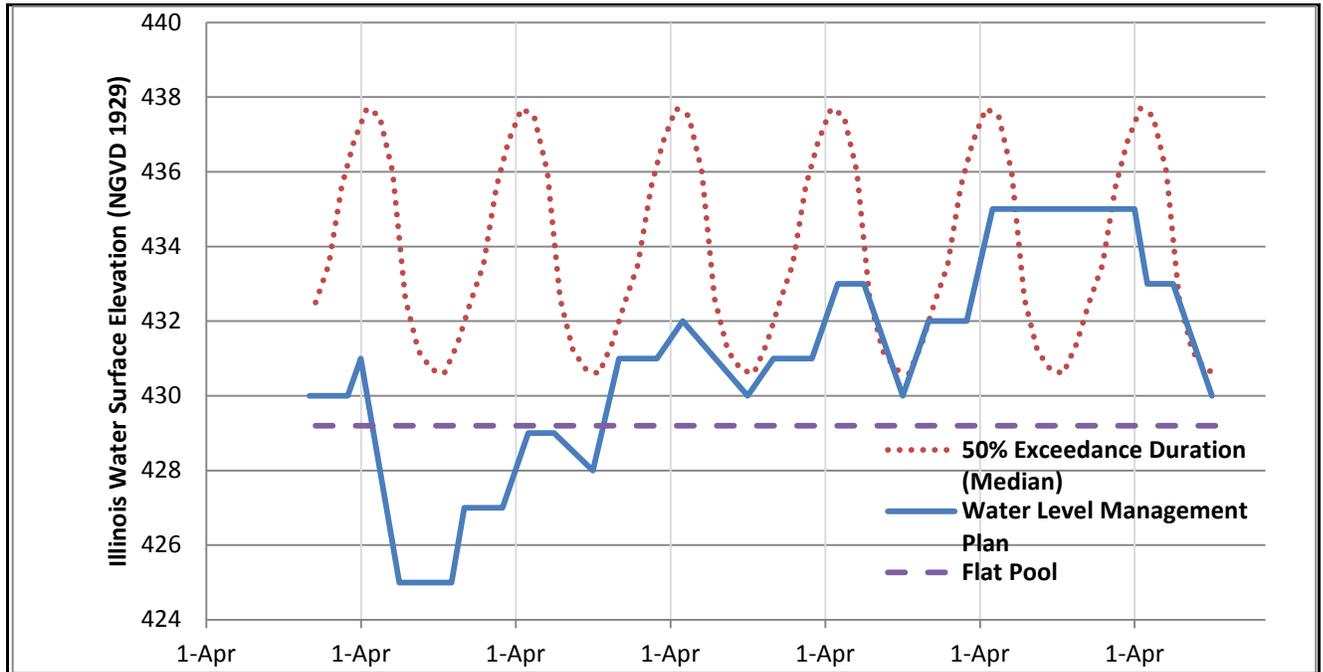


Figure H-8. Water Level Management Plan and Median River Elevation at RM 123.4

Comment Page 5, paragraph 5: We recommend all woody vegetation control measures be considered within the alternative analysis.

District Response: Maintaining high water for a period of time is an economical way of controlling woody vegetation. This method saves manpower and chemical costs. It is a successful technique use by wildlife refuges in the Illinois River Valley. While this is the preferred method of controlling willows, the AMT should include in their plan other methodologies successfully used at other large restoration sites.

Comment Page 6, paragraph 1: It is not clear why groundwater seepage and annual average rainfall is not adequate for the management objectives of the Emiquon Preserve. We recommend that the COE analyze possible groundwater seepage and compare it to the identified 6 year management regime and consider it within the alternatives analysis.

District Response: The feasibility study qualitatively considered groundwater contributions to the Emiquon interior-managed water levels. Wehrmann et al. (2009) suggest estimates for a stable, pre-development (nonpumping) groundwater level of 432 and perhaps as much as 435 ft (NAVD 88). However, the rate of groundwater recovery is highly uncertain and the rate of groundwater flow to the site is variable based on surface water elevations. However, data collected at Emiquon more recently suggest little if any groundwater influences on the hydrology of Emiquon. Because of uncertainties

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with the contributions of groundwater (both inflow and outflow), the reliance on surface water to meet the desired water level management scenarios reduces water level management risk. The TNC would use any ground water contributions to their maximum benefit albeit a minor source of water.

Comment Page 6, paragraph 2 Islands: Other floodplain restoration efforts within the Illinois River valley have inadvertently punctured the “lake pan” and compromised the sites ability to hold adequate (or desired) water levels. We recommend that the COE evaluate potential borrow sites to ensure water retention is not compromised.

District Response: The District concurs protecting the underlying aquifer from intrusion is very important in the construction of all features for the Emiquon project in order to be able to provide water level management. While there were numerous areas in the DPR outlining the District was aware of this concern, the District decided to consolidate and summarize these concerns and described their avoidance measures to ensure the shallow aquifer is not pierced (Section VI.B.3., *Islands*).

Comment Page 6, paragraph 3: The construction of ten artificial islands would be a radical landscape change and is incongruent with the historical landscape of Thompson and Flagg Lakes.

District Response: The intent of this project is **not** to rebuild the historical landscape of Thompson and Flagg Lakes. A 21-foot ag levee, 20 miles of ditches, and a 5,000+ acre lake are not historic features either. The Project wants to restore some historic function to this system.

Comment Page 6, paragraph 3: Islands could potentially attract nesting Canada geese. Herbivory from high numbers of geese can lead to declines in aquatic vegetation (e.g. as seen at Peoria Lake). A high local goose population may compete with more desirable species of migratory birds.

District Response: While the islands may provide some nesting habitat for geese, the islands’ primary habitat value is for pelican and geese loafing sites, shorebird foraging areas, aquatic habitat diversity, and potential colonial bird nesting habitat in naturally grown trees, or actively planted trees. After monitoring the resident goose population, TNC and AMT should put in a management plan in place before the geese become a problem.

Comment Page 6, paragraph 3: Final island design and location should be informed through input from the AMT (during COE PED) of project planning to ensure that the best available science be incorporated.

District Response: Concur. Island construction, configuration, timing, and location were all topics at the first AMT meeting on June 20, 2014. The AMT will be an integral part of this project feature during the Project PED phase.

Comment Page 7, paragraph 2: We recommend that consideration be given to a phased construction plan for islands that is guided and informed by the AMT and/or Emiquon Science Advisory team. Following a period of post-construction monitoring, islands could be built in problem locations if necessary.

District Response: Final island design and layout will consider recommendations from the AMT and incorporate lessons learned from projects such as Swan Lake, Peoria Lakes, and the UMR.

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Comment Page 7, paragraph 2: ...we recommend that the AMT include professional scientists from the ILDNR, the Illinois Natural History Survey, and other wetland scientists.

and

Comment Page 7, paragraph 3: An expanded AMT should collaborate on the development of quantifiable "ecological trigger points" to guide management actions.

District Response: Concur. The District has updated Appendix O, *Adaptive Management/Monitoring Plan*, to include a section titled, *Plan Implementation to Date*. This section documents the June 20 AM meeting participants (from seven state and Federal agencies, academia, and two NGOs), and the discussion that took place. Among the topics the group discussed included the key ecological attributes the team may consider in their management decisions.

Comment Page 7, paragraph 4 Habitat Evaluation: ... the WHAG neglects to account for the likely introduction of invasive species. We recommend that the AMT analyze and evaluate the potential detrimental effects of invasive species. In the absence of necessary species models for inclusion into the WHAG, we recommend that a core team of fisheries experts be formed to estimate the possible impacts of invasive species as they relate to the adaptive management plan and ecological triggers.

District Response: Concur. Through the AM process, specific duties of the AMT and TNC could be to evaluate the risks and uncertainties of invasive species, and make specific recommendations on how to manage the project so the level of risk and uncertainty.

Comment Page 7 Conclusions: Due in part to the compressed schedule and abbreviated review time, significant gaps were made in the planning process that should be addressed before proceeding. One significant gap is the lack of invasive species impact analysis in almost every project aspect. The DPR Problem Identification Section does not mention invasive species and their potential impacts on project objectives. Only relatively recently invasive species (including non-native or naturalized carp species) have emerged to redefine the context of our overall restoration mission under the UMRR-EMP. Therefore, we feel it is appropriate that project objectives should be reexamined and prioritized using the most current hydrographic and sediment transport information on this highly altered system.

Some objectives (fish passage and nutrient export) appear to be in direct conflict with other possibly higher priority objectives. A draft agenda for the AMT meeting on June 20, 2014, identifies significant time being allocated to discussion of this specific topic. We are confident that the AMT using adaptive management principles will further refine the objectives.

District Response: Concur. The District updated the main report in several places (see *Executive Summary*; Section II.H, *Invasive Species*; Section III.B.1, *Problems*; and Section IX.C.6, *Invasive Species*) but this is not enough to address the risk and uncertainties of the Project's invasive species issues. The District is confident the AMT will help guide the project's management decisions so the invasive species issues are minimized as practical.

The Project objectives may be in conflict, yet natural systems are in conflict at times. A natural system is a balance of biological and natural forces that are always evolving. The District believes objective prioritization should not be completed, but a balanced approach is more ecologically desirable. The District is relying on the project partners in the form of an AMT to craft effective

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adaptive management/monitoring criteria to find a balance approach between the Project objectives. One way the AMT could look at it, is to prioritize ecological processes. For example, one management plan for a particular year would be to create a more natural hydrograph.

Comment Page 8, paragraph 2: The Service is committed to engaging this process and is confident that the adaptive management principles can be used to identify solutions for implementation and reduce inherent risks and uncertainties.

District Response: Concur. The District appreciates the USFWS's candor and collegiately and willingness to support this Project's AM process.

Recommendations

1. An AMT should be organized to provide science and management guidance to project managers. The roles and responsibilities of this team should be mandated and described in the Project Partnership Agreement (PPA).

District Response: Concur. The District, TNC, USFWS, and NRCS are committed to establishing an AMT that will assist with Project management decisions. The Project requirement of adaptive management will be part of the Project Partnership Agreement

2. Additional water level management regimes should be considered and outlined by the AMT (including the proposed six-year cycle) and then analyzed during the PED phase for their relative benefits and costs. This effort should recognize that optimal regimes may vary widely from the 6 year cycle and would be informed heavily by the AMT, monitoring and local conditions.

District Response: The District, TNC, USFWS, and NRCS are committed to establishing an AMT to assist with project management decisions at Emiquon East HREP. There are already program level coordination bodies (EMPCC and RRCT) providing science and management guidance to project managers. The District will add text to the Project Partnership Agreement to identify the need for an AMT to assist in Project management decision making. The roles and responsibilities will be developed as part of the design and construction phase of the project. The AMT will fully analyze each management proposal to optimize the Project's short- and long-term habitat benefits.

3. Ecological trigger or decision points should be developed for each project objective and linked to specific management actions.

District Response: Concur. The District, TNC, USFWS, and NRCS are committed to establishing an AMT that will assist with Project management decisions including the consideration of alternate water level management regimes.

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4. The detrimental effects of invasive species should be assessed in response to the proposed management actions.

District Response: Concur. The District, TNC, USFWS, and NRCS are committed to establishing an AMT that will assist with Project management decisions including those associated with detrimental effects of invasive species. The AMT will consider invasive species effects based on the proposed management actions for any given year as part of the AMT decision making process.

5. The benefits of island construction should be analyzed further and reconsidered for phased implementation.

District Response: Concur. The District, TNC, USFWS, and NRCS are committed to establishing an AMT that will assist with Project management decisions including input on the design and location, and timing of the islands based on collected water quality data and engineering wind fetch analysis.

6. Project objectives should be re-examined and prioritized in consideration of stakeholder input.

District Response: Concur. The District, TNC, USFWS, and NRCS are committed to establishing an AMT that will assist with Project management decisions including analyzing the project objectives and prioritize the objectives based on a balanced adaptive management paradigm.

XIV. CONCLUSIONS

Full realization of the potential habitat value in Emiquon East has been hindered by the lack of a managed floodplain connection with the Illinois River and an unreliable pumping system to manage interior water levels. Infrastructure improvements and hydrologic alterations have changed flow regimes due to impoundment which has led to the loss of diverse backwater aquatic/wetland habitats. Restoring off-channel areas containing reliable aquatic/wetland habitat and establishing floodplain areas that would support survival and lifecycle needs of river fish would allow the Project Area to realize the highest combined benefit to fish and migratory birds.

The Recommended Plan restoration features for Emiquon East (7-foot water control structure, 60,000 GPM Pumping System and 10 interior islands) are designed to meet the Project's objectives of restoring and protecting aquatic habitat and restoring floodplain connectivity to the Illinois River.

Assessment of the future with-Project scenario shows definite increases in total habitat units over the 50-year period of analysis for the target species, as well as a majority of other aquatic and wetland dwelling species. These increases represent quantification of the Projected outputs: improved habitat quality and increased preferred habitat quantity.

This Project is consistent with and fully supports the overall goals and objectives of the UMRR-EMP, the Illinois River Comprehensive Plan, the North American Waterfowl Management Plan, and the Ramsar designation as a wetland of international importance.

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XV. LITERATURE CITED

- 1996 Flood Repair Report, Lake Chautauqua Rehabilitation and Enhancement Project, Upper Mississippi River System, Environmental Management Program, La Grange Pool, Illinois Waterway, River Miles 124-128, Mason County, IL, March 1997
- Bay Island Habitat Rehabilitation and Enhancement Project, Initial Performance Evaluation Report, Upper Mississippi River System, Environmental Management Program, Pool 22, Mississippi River Miles 311-312, Marion County, Missouri, December 1999.
- Bay Island Habitat Rehabilitation and Enhancement Project, 2002 Performance Evaluation Report, Upper Mississippi River System, Environmental Management Program, Pool 22, Mississippi River Miles 311-312, Marion County, Missouri, March 2002.
- Bay Island Habitat Rehabilitation and Enhancement Project Inspection of Completed Works: Trip Report, August 2012.
- Definite Project Report with Integrated Environmental Assessment, Lake Odessa Rehabilitation and Enhancement Project, Upper Mississippi River System, Environmental Management Program, Pools 17 and 18, Mississippi River, RM 434.5 - 441.5, Louisa County, Iowa, April 2005
- Definite Project Report with Integrated Environmental Assessment, Lake Chautauqua Rehabilitation and Enhancement Project, Upper Mississippi River System, Environmental Management Program, La Grange Pool, Illinois Waterway, River Miles 124-128, Mason County, IL, June 1991
- Misganaw Demmisie, A. Wehrman, Y. Lian, G. G. Amenu, S. Burch, and W. Bogner, *Hydrologic and Hydraulic Considerations for the Ecological Restoration of the Emiquon along the Illinois River*. 2005 World Water and Environmental Resources Congress, Anchorage, Alaska. May 2005
- Galat, David L, J. Barko, S. Bartell, M. Davis, B. Johnson, K. Lubinski, J. Nestler, and D. Wilcox, *Environmental Science Panel Report. Establishing System-wide Goals and Objectives for the Upper Mississippi River System*. UMRS Navigation and Ecosystem Sustainability Program, NESP ENV Report 6, Rock Island, IL 2007.
- Hajic, Edwin R, 2006. *Geomorphology, Geoarchaeology, and Landscape and Wetland Evolution of the Emiquon Basins, Lower-Middle Illinois River Valley*. Prepared for The Nature Conservancy. Published by the author, Santa Fe, NM.
- Hajic, Edwin R, 2000. *Landform Sediment Assemblage (LSA) Units in the Illinois River Valley and the Lower Des Plaines River Valley*. Prepared by Illinois State Museum Society Archaeological Services, Springfield, IL (Illinois State Museum Quaternary Studies Program Technical Report No. 99-1255-16, Vol. I May and Vol. II June), under Contract No. DACW25-93-D-0014, Delivery Order No. 0025, for USACE, Rock Island, IL.

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Definite Project Report with Integrated EA

Emiquon East
Habitat Rehabilitation and Enhancement Project
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- Harn, Alan, D. and Sally McClure. 2012. *Six Hundred Generations There: Archaeological and Historical Perspectives on Life at Emiquon The Nature Conservancy and U.S. Fish and Wildlife Service Properties Fulton County, Illinois*, Illinois State Museum Reports of Investigations, No. 57, Springfield, Illinois.
- Havera, Stephen P; Roat, Katie E; Anderson, Lynn L. 2003. *The Thompson Lake/Emiquon Story. The Biology, Drainage, and Restoration of an Illinois River Bottomland Lake*. Prepared by Illinois Natural History Survey. Champaign, IL. Illinois Natural History Survey Special Publication 25
- Hoover, Jan J., Larry W. Southern, Alan W. Katzenmeyer, and Nicky M. Hahn. 2012. *Swimming Performance of Bighead carp and Silver carp: Methodology, Metrics, and Management Applications*. ANSRP Technical Notes Collection. ERDC/TN ANSRP-12-3. Vicksburg, MS: US Army Engineer Research and Development Center.
- Lake Chautauqua Rehabilitation and Enhancement Project, Initial Performance Evaluation Report, Upper Mississippi River System, Environmental Management Program, La Grange Pool, Illinois Waterway, River Miles 124-128, Mason County, IL, July 2005
- Mathias, Dean, Thomas B. Hardy, K. Jack Kilgore, and Joseph W. Jordan. 1996. *Aquatic Habitat Appraisal Guide User's Manual*. Prepared for the U.S. Army Engineer District, Rock Island. U.S. Army Engineer Waterways Experiment Station. Environmental Laboratory (U.S. Army Engineer Waterways Experiment Station). V. Series: Instruction Report (U.S. Army Engineer Waterways Experiment Station); EL-96-1.TA7 W34i no.EL-96-1. 68pp
- Mettler-Cherry, Paige and Marian Smith. 2009. *Saving a species, one river at a time: The return of *Boltonia decurrens* to Emiquon*. Emiquon Science 2009: Rebirth of Emiquon Scientific Conf. March 12, 2009. Dickson Mounds Museum
- Roberts, Timothy E., Claire F. Martin, Edwin R. Hajic, Christy S. Rickers, Erich K. Schroeder, James S. Oliver and Michael D. Wiant, 1999(a). *The Historic Properties Management Plan for the Illinois Waterway System, Rock Island District, Corps of Engineers: Volumes I and II*. Prepared by Illinois State Museum Society Archaeological Services, Springfield, IL (Illinois State Museum Quaternary Studies Program Technical Report No, 98-1182-7, February), under Contract No. DACW25-93-D-0014, Delivery Order No. 0021, for USACE, Rock Island, IL.
- Roberts, Timothy E., David D. Kuehn, and Barbara J. Henning. 1999(b). *Phase I Cultural Resources Investigation of three Proposed Dredged Material Placement Area Between Illinois Waterway River Miles 105.5 and 123, Fulton and Schuyler Counties, Illinois*. Prepared by Illinois State Museum Society Archaeological Services, Springfield, IL (Illinois State Museum Quaternary Studies Program Technical Report No, 99-1257-08, July), under Contract No. DACW25-93-D-0014, Delivery Order No. 0024, for USACE, Rock

UMRS-EMP
Definite Project Report with Integrated EA

Emiquon East
Habitat Rehabilitation and Enhancement Project
Fulton County, IL

- Stafford, Joshua D., M. M. Horath, A. P. Yetter, R. V. Smith, C. S. Hine, *Historical and Contemporary Characteristics and Waterfowl Use of Illinois River Valley Wetlands*, Society of Wetland Scientists, 2010
- The Nature Conservancy. 1998. *Illinois River Site Conservation Plan for the Illinois Nature Conservancy*. 8pp
- Key Attributes and Indicators for Illinois River Conservation Targets at The Nature Conservancy's Emiquon Preserve*. 2006
- Urich, David L., John P. Graham, and Edward A. Gaskins. 1984. *Habitat appraisal of private lands in Missouri*. *Wildlife Society Bulletin* 12:350-356
- US Army Corps of Engineers, Rock Island District, *PL84-99 Eligibility Inspection Report, Thompson Drainage and Levee District (TDL), Illinois River, Fulton County, IL*, January 1990
- Operation and Maintenance Manual, TDL, Local Flood Protection, Illinois River, Fulton County, IL*, December 1995
- Non Federal Flood Control Works Pump Station Inspection Report, TDL, 1997*
- A River That Works and a Working River. A Strategy for the Natural Resources of the Upper Mississippi River System*. Upper Mississippi River Conservation Committee, Rock Island District, Rock Island, IL, 2000
- Upper Mississippi River System Habitat Needs Assessment. Summary Report 2000*. St. Louis District, St. Louis, MO, 2000
- Non-Federal Flood Control Works Inspection Report, TDL, 2000*
- Peoria Lake Habitat Rehabilitation and Enhancement Project, Initial Performance Evaluation Report, Upper Mississippi River System, Environmental Management Program, Peoria Pool, Illinois River Miles 178.5 – 191.1, Woodford County, Illinois*. Rock Island District, Rock Island, IL, 2001
- Non-Federal Flood Control Works Inspection Report, TDL, 2002*
- Post Construction Performance Evaluation Report, Bay Island Habitat Rehabilitation and Enhancement Project, Upper Mississippi River System, Environmental Management Program, Pool 22, Mississippi River Miles 311-312, Marion County, Missouri*, Rock Island District, Rock Island, IL, April 2002
- Upper Mississippi River System Flow Frequency Study*. Rock Island District, Rock Island, IL, January 2004
- Final Integrated Feasibility Report and Programmatic Environmental Impact Statement for the UMR-IWW System Navigation Feasibility Study*. Rock Island, St. Louis, St. Paul Districts, 2004

*UMRS-EMP
Definite Project Report with Integrated EA*

*Emiquon East
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2004 Report to Congress, Upper Mississippi River System Environmental Management Program. Rock Island District, Rock Island, IL

Operation and Maintenance Manual, Lake Chautauqua Rehabilitation and Enhancement Project, Upper Mississippi River System, Environmental Management Program, La Grange Pool, Illinois Waterway, River Miles 124-128, Mason County, IL. Rock Island District, Rock Island, IL, April 2005

Emiquon East Habitat Restoration Project Preliminary Restoration Plan, Fulton County, IL, Section 206 Preliminary Restoration Plan. Rock Island District, Rock Island, IL, March 2006

Illinois River Basin Restoration Comprehensive Plan With Integrated Environmental Assessment, March 2007

Thompson Drainage and Levee District, Project Modification Letter, July 2008

Quiver Island Dredged Material Management Plan. Rock Island District, Rock Island, IL, April 2008

Upper Mississippi River Comprehensive Plan. Rock Island District, Rock Island, IL, 2008

Upper Mississippi River Restoration Ecosystem Restoration Objectives, 2009

2010 Report to Congress, Upper Mississippi River Restoration Environmental Management Program. Rock Island District, Rock Island, IL

Upper Mississippi River Restoration Environmental Management Program, Environmental Design Handbook, December 2012

Wehrmann, H. Allen, and Stephen L. Burch. 2009. *Assessment of Groundwater Conditions at the Emiquon Project Area, Fulton County, Illinois*. Center for Groundwater Science Prepared for the Great Rivers Area Illinois Chapter, The Nature Conservancy.

Wiant, Michael D. (2001). *Phase I Geomorphological and Archaeological Survey for Historic Properties for the Grand Island Reach Dredged Material Management Plan, Dredged Material Placement Site 2 Expansion, Fulton County, Illinois*. Prepared by Illinois State Museum Society Archaeological Services, Springfield, IL (Illinois State Museum Quaternary Studies Program Technical Report No, 2001-1492-18, December), under Contract No. DACW25-98-D-0017, Delivery Order No. 0012, for USACE, Rock Island, IL.

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ENVIRONMENTAL MANAGEMENT PROGRAM**

**EMIQUON EAST
HABITAT REHABILITATION AND ENHANCEMENT PROJECT**

**DEFINITE PROJECT REPORT
WITH
INTEGRATED ENVIRONMENTAL ASSESSMENT**

RECOMMENDATIONS

I have weighed the outputs to be obtained from the full implementation of this restoration Project against its estimated cost and have considered the various alternatives proposed, impacts identified, and overall scope. In my judgment, this Project, as proposed, justifies expenditure of Federal funds. I recommend that the Mississippi Valley Division Engineer approve the proposed Project to include construction of a 7-foot wide gated water control structure and associated channels and structures to manage water levels; a pumping station with pumping capacity of 60,000 gpm and 10 berms/islands for wind fetch reduction and improved wetland habitat. This alternative addresses the Project goals and provides 47,322 AAHUs of aquatic and wetland habitat.

This Project will be constructed on lands owned by The Nature Conservancy. Implementation will be cost shared 65 percent by the Federal government and 35 percent by the non-Federal Sponsor, The Nature Conservancy. Total Project costs subject to cost sharing are \$18,626,000. This total includes construction of the Project features, planning, engineering and design, construction management, monitoring and adaptive management and real estate. It is the Sponsor's responsibility to provide the necessary real estate and conduct the operation and maintenance after construction. The operation and maintenance of the Project is estimated to cost approximately \$67,556 annually.

Jan 15 2015

Date

Mark G. Deschenes

Mark G. Deschenes
Colonel, US Army
District Engineer

UPPER MISSISSIPPI RIVER RESTORATION
ENVIRONMENTAL MANAGEMENT PROGRAM

EMIQUON EAST
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

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FINDING OF NO SIGNIFICANT IMPACT

I have reviewed the information provided by this Environmental Assessment, along with data obtained from Federal and state agencies having jurisdiction by law or special expertise, and from the interested public. I find that the proposed Emiquon East HREP would not significantly affect the quality of the human environment. Therefore, it is my determination that an Environmental Impact Statement is not required. This determination may be reevaluated if warranted by further developments.

An array of potential features and alternatives were considered for habitat enhancement. Features evaluated in detail were:

- No Federal Action
- Reinforced Levee Spillway
- Water Control Structure
- Levee Removal
- Pumping Station
- Berms/Islands

The preferred alternative consists of constructing: a 7-foot wide gated water control structure and associated channels and structures to manage water levels; a pumping station with pumping capacity of 60,000 gpm and 10 berms/islands for wind fetch reduction and improved wetland habitat.

The following factors were considered in determining that an EIS was not required:

- A. The Project is anticipated to produce a net increase in the value of the Emiquon Preserve area for migratory and resident birds, fish, and wildlife species.
- B. Aside from temporary disturbance during construction periods, no long-term significant adverse effects to natural resources are anticipated. No state or Federal endangered or threatened species would be adversely affected by the proposed action.
- C. The Project is in compliance with Sections 401 and 404 of the Clean Water Act.
- D. No significant economic or social impacts are expected to occur in the Project area.

Jan 15 2015

Date

Mark J. Deschenes

Mark J. Deschenes
Colonel, US Army
District Engineer

