# UPPER MISSISSIPPI RIVER RESTORATION
# FEASIBILITY REPORT
# WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

## GILEAD SLOUGH
## HABITAT REHABILITATION AND ENHANCEMENT PROJECT

**POOL 25, UPPER MISSISSIPPI RIVER MILES 253-248**
**CALHOUN COUNTY, IL**

Appendix E: Monitoring and Adaptive Management

US Army Corps of Engineers
St. Louis District

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Upper Mississippi River Restoration
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## 1. INTRODUCTION

The 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662) authorized implementation of ecosystem restoration projects to ensure the coordinated development and improvement of the Upper Mississippi River System. Section 2039 of WRDA 2007 requires that when conducting a feasibility study for ecosystem restoration, the proposed project includes a plan for monitoring the success of the ecosystem restoration. Additionally, paragraph (3)(d) of Section 2039 states that "an adaptive management plan will be developed for ecosystem restoration projects…appropriately scoped to the scale of the project." The implementation guidance for Section 2039, in the form of a CECW-PB Memo dated 31 August 2009, also requires that an adaptive management plan be developed for all ecosystem restoration projects.

Adaptive management "prescribes a process wherein management actions can be changed in response to monitored system response, so as to maximize restoration efficacy or achieve a desired ecological state" (Fischenich et al. 2012).

At the programmatic level, knowledge gained from monitoring one project can be applied to other projects. Opportunities for this type of adaptive management are common within the UMRS. Using an adaptive management approach during project planning enabled better selection of appropriate design and operating scenarios to meet the Gilead Slough HREP project objectives. Lessons learned in designing, constructing, and operating similar restoration projects within the UMRS have been incorporated into the planning and design of this HREP to ensure that the proposed plan represents the most effective design and operation to achieve project goal and objectives.

The adaptive management for the Gilead Slough HREP describes and justifies whether adaptive management is needed in relation to the proposed project management alternatives identified in the project feasibility study. This appendix outlines how the results of the project-specific monitoring plan would be used to adaptively manage the project, including monitoring targets which demonstrate project success in meeting project objectives. The District's intent was to develop monitoring and adaptive management actions appropriate for the project's goal and objectives.

## 2. GOALS AND OBJECTIVES

The primary goal of the Gilead Slough HREP is to restore and improve the quality and diversity of aquatic and wetland ecosystem resources within the Project Area. Full realization of the potential habitat value in the Gilead Slough project area has been hindered by loss of side-channel flow and depth diversity within side channel habitat, excessive sedimentation that has resulted in poor water quality, shallow depths, and loss of connectivity among project backwater areas with the main channel of the Mississippi River, loss of sandbars and islands due to inundation caused by impoundment, and the subsequent degradation of aquatic resources. Additionally, the loss of topographic and hydrologic diversity reduces vegetative community composition and wildlife resources on

the remaining floodplain areas. Establishing connectivity between the backwater and main channel would contribute to spawning, rearing, and overwintering fish habitat as well as feeding areas for migratory wildlife; providing bathymetric diversity and flow within Gilead Slough project area would increase habitat complexity and broaden the range of flow velocities to further bolster important lotic habitat within Pool 25; and restoring the historic island-side channel complex would allow the Project Area to realize the highest benefit to fish and wildlife. The objectives identified to meet the project goal are to:

- Enhance depth, flow and substrate diversity and connectivity of aquatic habitat throughout study area.
- Manage the sediment inputs in the side channel and slough areas.
- Restore topographic and bathymetric diversity and improve desired vegetative community composition throughout the project area.

The following restoration measures, also described in detail in Section 4.1 of the main report, were considered to achieve the Project goal and objectives:

- Shoreline Protection with GSR
- Excavation At Varying Depths
- Moist Soil Unit Creation with Pump (Active Management)
- Moist Soil Unit Creation with Overflow (Passive Management)
- Scour Structures
- Hard Points
- Backwater Excavation (EPM)
- River Connection Starting at Gilead
- Island Creation
- Barbs
- Sediment Deflection Dike
- Bank Protection
- Substrate Diversity

## 3. SOURCES OF UNCERTAINTY

Adaptive management provides a process for making decisions in the face of uncertainty. The primary incentive for implementing an adaptive management plan is to increase the likelihood of achieving desired project outcomes given the identified uncertainties, which can include incomplete description and understanding of relevant ecosystem structure and function; imprecise relationships among project management actions and corresponding outcomes; engineering challenges in implementing project alternatives; and ambiguous management and decision-making processes. Below is a list of uncertainties associated with the lotic and wetland habitat in the Gilead Slough HREP.

### 3.1 Side Channel and Main Channel Border Habitat

Substrate enhancements, bank protection, and GSR habitat features are all placed stone to provide substrate heterogeneity, and stable microhabitats throughout the aquatic project area. There is a small risk that these project features may move or shift under

future flood pulses, however, the PDT discussed the outcome of this potential shift of placed stone under high flow events, and decided that it would be an acceptable outcome, as it would mimic the existing variation found within the river naturally.

Hard points, barbs, scour structures, and channel excavation are measures intended to improve flow patterns within the side channel. Should the flows and velocities not actualize the intended ranges, some modification to hard points, or existing river training structures within the project area may be required, based on observed flows post-construction.

### 3.2 Backwater Habitat

Backwater excavation at the southern end of Gilead Slough project area will target elevations that would provide conducive conditions to the EPM drawdown program. There is minor risk that those elevations will miss the mark, in which the emergent vegetative response is not desirable. A re-excavation event or re-manipulation of elevations may be warranted if the vegetative response does not produce the desired outcome.

It is expected that overwintering and summer habitat in the dredged backwaters will not be limited by dissolved oxygen, flow, or depth. However, uncertainty still remains in the accuracy of predicted sedimentation rates. If monitoring demonstrates that conditions of the interior backwater are not performing as anticipated, then an adaptive management measure of re-excavation would be implemented. This would have an impact on project costs and schedule.

### 3.4 Wetland Habitat

It is expected the implementation of the wetland and MSU restoration will increase the vegetative community health in the Project Area; however, there is some uncertainty as to whether the areas will revegetate with the desired community. If monitoring demonstrates that the vegetative response is not adequate, supplemental plantings with an emergent seed mix may be warranted. This could have an impact on project costs and schedule.

### 3.4 Island Habitat

It is expected the implementation of the island building will become permanent features in the Project Area; however, there is some uncertainty as to whether the islands will naturally establish with early successional forest species, or become established with invasive vegetation, such as Japanese hops. If monitoring demonstrates that invasive vegetation is becoming problematic for island habitat, the invasive vegetation would be removed and then planted with trees. This could have an impact on project costs and schedule.

# 4. MONITORING OF OBJECTIVES TO DETERMINE PROJECT SUCCESS AND ADAPTIVE MANAGEMENT MEASURES

The power of a monitoring program developed to support determinations of project success and inform adaptive management lies in the establishment of feedback between continued project monitoring and corresponding project management. Performance indicators to the above objectives were developed with the best available knowledge. They were developed to be specific, measurable, attainable, realistic, and timely. Performance indicators, monitoring targets, and Adaptive Management measures are summarized in Section 4.1 below. The conceptual monitoring schedule and estimated costs are provided in Table 1.

## 4.1 Monitoring and Adaptive Management Features

- **Flow Diversity:** Bathymetry and ADCP surveys will be conducted upon completion of the project to determine baseline conditions and construction compliance. Comparison surveys will be conducted at years 5 and 10 to evaluate performance and changes within the project area over time. Monitoring is intended to measure an increase in flow diversity and feature placement, as evidenced by multibeam survey and flow profiles across side channel and main channel border habitat.

  ***Success Criteria:***

| Monitoring Target | Management Measure Objective |
|---|---|
| Increase flow diversity over baseline flow profiles throughout side channel and main channel border. | Provide variation in flows found throughout side channel to increase overall range of available habitat types (i.e., riffle, run, pool). |

  ***Adaptive Management Measure:*** Should surveys show lack of flow enhancements, several options would be available, up to, but limited to: Modifying, Supplemental stone placement, and/or Reconfiguring the Hard Points, Barbs, Scour Structures, and GSR.

- **Overwintering Habitat:** Bathymetry surveys will be conducted upon completion of the project to determine baseline conditions and construction compliance. Comparison surveys will be conducted at year 9 to evaluate performance and changes within the project area over time. Monitoring is intended to measure an increase in depths that would be conducive to providing thermal refugia to overwintering fish.

  ***Success Criteria:***

| Monitoring Target | Management Measure Objective |
|---|---|
| Increase in quantity and quality of deep water thermal refugia in the lacustrine backwaters of Gilead Slough over baseline values. | Provide ample deepwater habitat area within the riverine backwaters that provide adequate thermal refugia to overwintering fishes. |

***Adaptive Management Measure:*** Should surveys show lack of suitable depths (50% or greater loss in depth from as-built), the AM feature of re-excavation may be implemented.

- **EPM Backwaters:** Onsite vegetation monitoring would be conducted annually, following the IWMM protocol in mid to late summer to assess the vegetative response to EPM drawdowns in Pool 25. Vegetation would be primarily assessed for herbaceous cover as an indicator of success, as opposed to woody stem encroachment or high open water percent cover. Herbaceous vegetation would indicate appropriate grade elevations conducive to a desired vegetative response during EPM drawdowns. A multiyear average may be required to determine whether or not it is necessary to make grade elevation manipulations as an adaptive management feature.

***Success Criteria:***

| Monitoring Target | Management Measure Objective |
|---|---|
| Increase in quantity and quality of herbaceous vegetative cover, utilizing the IWMM protocol. | Vegetation would be primarily assessed for herbaceous cover as an indicator of success, as opposed to woody stem encroachment or high open water percent cover. Herbaceous vegetation would indicate appropriate grade elevations conducive to a desired vegetative response during EPM drawdowns |

***Adaptive Management Measure:*** Should surveys show inadequate herbaceous vegetative response (disproportionate amount of open water or woody encroachment), the AM measure of re-excavation, or grade elevation manipulation may be implemented.

# 5. DOCUMENTATION, IMPLEMENTATION COSTS, RESPONSIBILITIES, AND PROJECT CLOSE-OUT

**5.1 Documentation, Reporting, and Coordination.** The Project Delivery Team will document each of the performed assessments and communicate the results to the UMRR program manager. Performance Evaluation Reports will be produced at years 5 and 10 to measure progress towards the Project goals and objectives as characterized by the selected performance measures.

**5.2 Cost.** The costs associated with implementing monitoring and adaptive management measures were estimated based on currently available data and information developed during plan formulation as part of the feasibility study. Because uncertainties remain as to the exact Project measures, monitoring elements, and adaptive management opportunities, the estimated costs in Table 2 will need refinement in PED during the development of the Detailed Monitoring and Adaptive Management Plans. Construction costs associated with any required Adaptive Management features would be a responsibility of USACE.

**5.3 Responsibilities.** The Corps will be responsible for collecting bathymetric and ADCP surveys and providing the data analysis for those surveys. The sponsor will conduct the annual site inspections and visual observations needed to conduct everyday operation and maintenance of the site.

**5.4 Project Close-Out.** Close-out of the Project would occur when construction of all measures has been completed. Any additional expenditures under Adaptive Management would be handled under a separate “Performance Evaluation” period, in which the project is evaluated for successfully meeting the Project success criteria described above. Success is considered to have been achieved when the Project objectives have been met, or when it is clear that they will be met based upon the trends for the site conditions and processes. Project success would be based on the following:

- Success criteria met,
- Continued site inspections to determine continued Project performance,
- and Continued OMRR&R into the future.

*Table 2. UMRR Gilead Slough HREP conceptual monitoring schedule and estimated monitoring costs. Construction completion is set to year 0.*

| | | Target Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Habitat Restoration Measures | Survey, Monitoring, Analysis, & Reporting | Site Inspections, Stoplog Maintenance | x | x | x | x | x | x | x | x | x | x | $13,550 |
| | | Bathymetry Survey (Multi-beam) and ADCP Flow Surveys | | | | | x | | | | | x | $2,515 |
| | | Performance evaluation report | | | | | x | | | | | x | $10,000 |
| Subtotal | | | | | | | | | | | | | $16,065 |

| | | Target Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Habitat Restoration Measures | AM Feature | Reconfigure Hardpoints, Barbs, Scour Structures | | | | | | | | x | | | $476,466 |
| | | Re-Dredging the Deep-Water Pockets | | | | | | | | x | | | $2,524,210 |
| | | Re-excavation of the EPM Backwaters | | | | | | | | x | | | $334,339 |
| | | Modifying or Reconfiguring the Shoreline Protection with GSR | | | | x | | | | x | | | $137,408 |
| Subtotal | | | | | | | | | | | | | $3,482,423 |
| Overall MAM Total | | | | | | | | | | | | | $3,498,488 |

## 6. REFERENCES

Fischenich, C., C. Vogt, and others. 2012. The application of adaptive management to ecosystem restoration projects. ERDC TN-EMRRP-EBA-10 April 2012, Vicksburg, MS: U.S. Army Corps of Engineers Ecological Management and Restoration Research Program.