UPPER MISSISSIPPI RIVER RESTORATION FEASIBILITY REPORT WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

GREEN ISLAND HABITAT REHABILITATION AND ENHANCEMENT PROJECT

POOL 13, UPPER MISSISSIPPI RIVER
RIVER MILES 545.9 THROUGH 548.7
JACKSON COUNTY, IOWA

APPENDIX I
MONITORING AND ADAPTIVE MANAGEMENT PLAN

UPPER MISSISSIPPI RIVER RESTORATION FEASIBILITY REPORT WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

GREEN ISLAND HABITAT REHABILITATION AND ENHANCEMENT PROJECT

APPENDIX I
MONITORING AND ADAPTIVE MANAGEMENT PLAN

TABLE OF CONTENTS

Editor will doublecheck page numbers after all reviews are complete.

FIGURES AND TABLE

GREEN ISLAND
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

APPENDIX I
MONITORING AND ADAPTIVE MANAGEMENT PLAN

The Habitat Evaluation Team (HET) chose forestry, fish, bird, and mammal species to evaluate the effect of the proposed Project's dredge work, pump, gates, timber stand improvement (TSI), and vegetation management. These models allowed the HET to analyze changes in habitat.

1. INTRODUCTION

This appendix presents the feasibility level monitoring and adaptive management plan for Green Island Habitat Rehabilitation and Enhancement Project (HREP; hereinafter the Project). This plan identifies and describes monitoring and adaptive management activities proposed for the Project and estimates associated costs and duration. The USACE, Rock Island District (District) would further develop the plan in the planning, engineering, and design (PED) phase as specific details are made available.

1.1. Authorization. Implementation guidance for Sections 2036 and 2039 of WRDA 2007 and Section 1161 of Water Resource Development Act (WRDA 2016) requires ecosystem restoration projects to either include appropriately scoped monitoring and adaptive management plans or provide sound justifications for why adaptive management is not warranted. Under adaptive management, decisions are based on the best available (yet often incomplete and imperfect) scientific data, information, and understanding, recognizing uncertainties that introduce risks to the achievement of goals and objectives. Revision to management actions based upon information derived from ongoing monitoring and evaluation is possible (Fischenich et al. 2019).

At the programmatic level for Upper Mississippi River Restoration (UMRR), knowledge gained from monitoring one HREP can be applied to other HREPs. Opportunities for this type of adaptive management are common within the UMRR, which builds upon lessons learned from other HREP projects and Long-Term Resource Monitoring (LTRM) element.

1.2. Procedure: Drafting the Plan. The UMRR Coordinating Committee collaborated to establish a general framework for adaptive management to be applied to all UMRR Projects as part of the Implementation Issues Assessment. The 2007 WRDA, Section 2039, established the District's current framework for adaptive management. The UMRR adaptive management framework includes systemic, set-up, and implementation phases (Figure I-1).

1.3. Adaptive Management Team (AMT) Structure. To execute a systemic adaptive management strategy for the UMRR, a communication structure has been identified (Figure I-2). The structure establishes clear lines of communication and data exchange between UMRR Management, HREP Planning and Sequencing Framework Teams, LTRM, Project Delivery Teams (PDT), and stakeholders. Successful implementation will require the right resources being coupled at the right time to support the framework components.

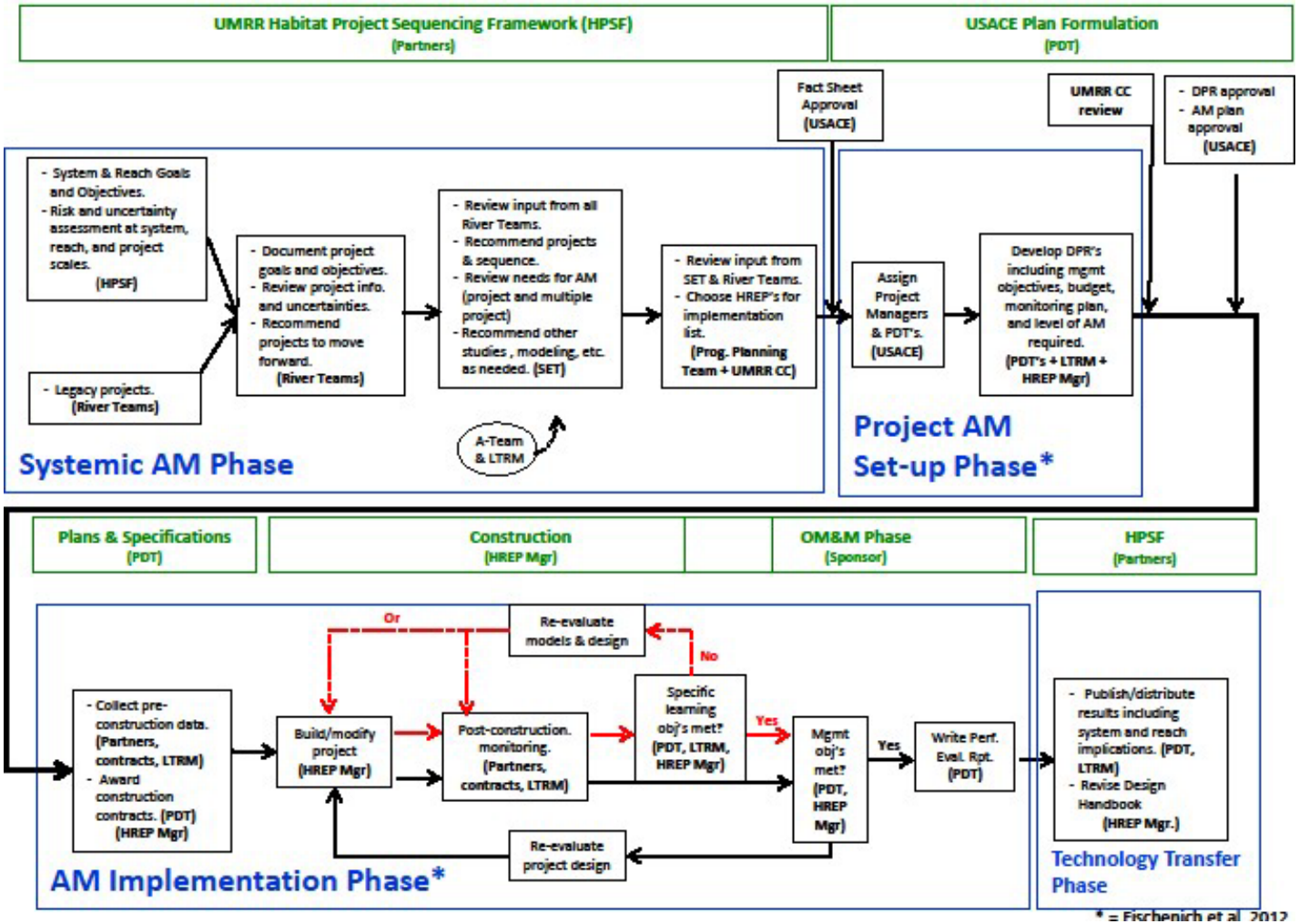

Figure I-1. UMRR HREP Adaptive Management Planning Flowchart

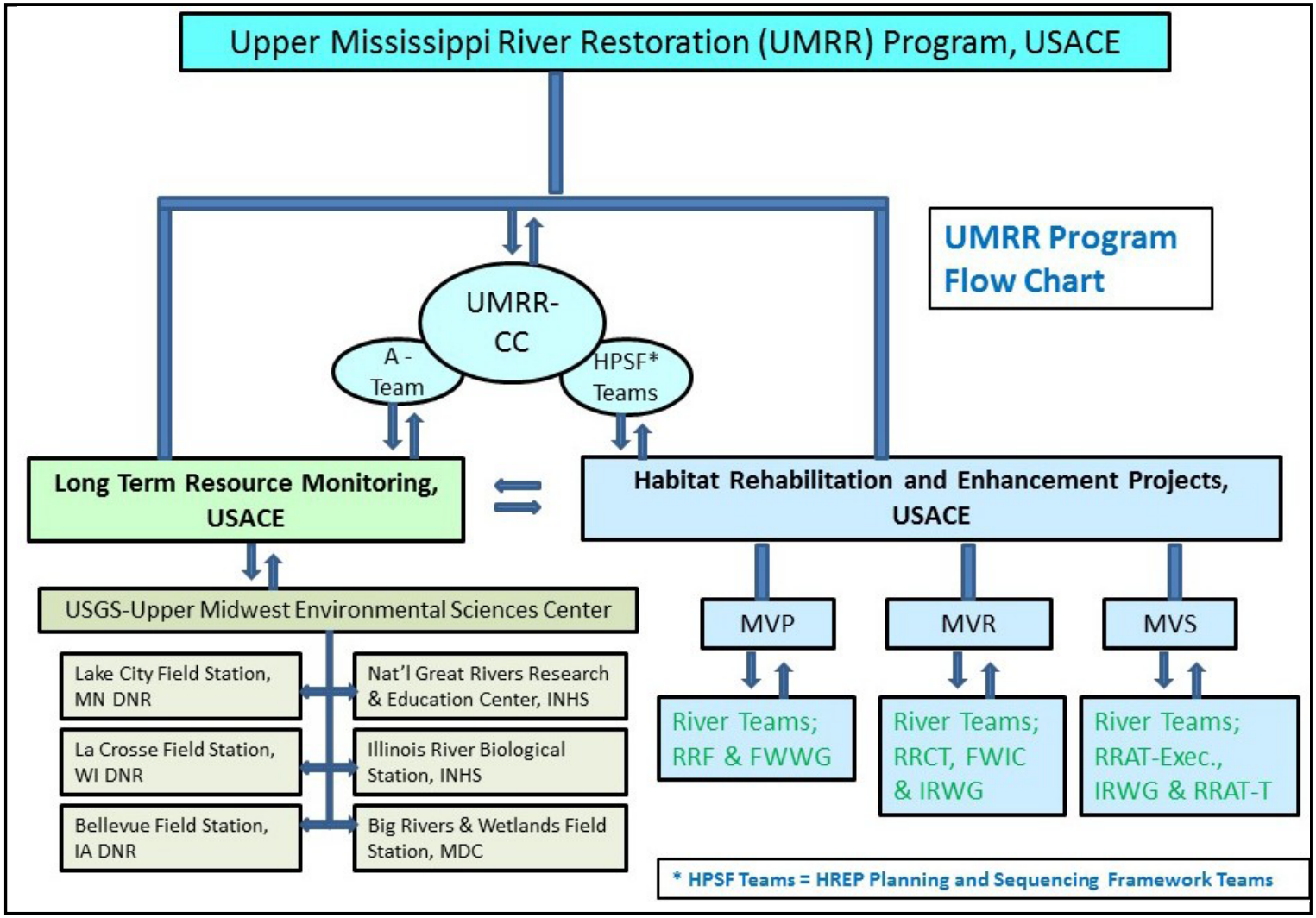

Figure I-2. UMRR Communication Structure

2. PROJECT ADAPTIVE MANAGEMENT PLANNING

The adaptive management plan identifies how the District and stakeholders would conduct adaptive management and who would be responsible for specific adaptive management actions. The developed plan outlines how results of the Project-specific monitoring program would be used to adaptively manage the Project, including specification of conditions defining Project success.

The Adaptive Management Plan reflects a level of detail consistent with the feasibility report. The primary intent was to develop monitoring and adaptive management actions appropriate for the Project's restoration goals and objectives. Specified management actions permit estimation of adaptive management program costs and duration. This section of the Adaptive Management Plan:

- identifies the restoration goals and objectives;
- presents a conceptual ecological model that relates management actions to desired outcomes; and
- lists sources of uncertainty that would recommend the use of adaptive management.

Subsequent sections describe monitoring, assessment, and decision-making in support of adaptive management. The level of detail in this plan is based on currently available data and information developed during plan formulation as part of the feasibility study. Uncertainties remain, concerning exact Project features, monitoring elements, and adaptive management opportunities. Components of the monitoring and adaptive management plan, including costs, were similarly estimated using currently available information.

2.1. Project Goals and Objectives. Recommended features are interconnected to restore not just certain habitat types but the natural system processes within Green Island. Goals are to maintain, enhance and restore quality habitat for native and desirable plant, animal, and fish species and maintain, enhance, restore, and emulate natural river processes, structures, and functions for a resilient and sustainable ecosystem. The objectives identified to meet these goals over the period of analysis are:

Primary

- Mimic historic hydrologic fluctuation range

Secondary

- Restore the quality, quantity, and diversity of vegetation
- Improve sediment management across the Green Island study area
- Increasing the quality and quantity of aquatic habitat
- Restore bathymetric and topographic diversity

The strategic locations and design of features included for each objective work together to restore the missing characteristics of the Project. The water level management (WLM) strategy is the pivotal tool pulling many of the features together to meet Project success. Water level manipulation is required for optimal emergent vegetation growth, submerged aquatic vegetation, and migration habitat. The recommended timber stand improvement would improve the timber's age structure and species diversity.

The Project would improve emergent and submersed vegetation and result in improved fall migration food production.

2.2. Sources of Uncertainty. Adaptive management provides a coherent process for making decisions in the face of uncertainty. Scientific uncertainties and technological challenges are inherent with any ecosystem restoration project. Following is a list of uncertainties associated with restoration of WLM and floodplain forest habitat improvements:

- **Water Level Management.** The District evaluated the level of uncertainty and risk with WLM and determined the risks are low with reliable infrastructure and timely management. However, uncertainty may result from the following ways:
    - WLM plan does not reach desirable emergent and submerged aquatic vegetation growth
    - Invasive species impacts
    - Outside water quality influences
    - Migration benefits derived from the Project area to the overall Mississippi Flyway does not occur

- **Floodplain Forest Habitat.** Again, with reliable infrastructure improvements, uncertainty and risk are low with managing hard mast-producing trees within the floodplain forest. The following conditions may arise within the Project's forest improvements:
    - species specific water inundation and duration tolerances
    - species specific herbivory tolerance
    - interaction of optimal tree size and optimal planting elevation
    - Invasive species impacts

Potential climate change issues, such as growing season lengths, ice cover, and waterfowl migration patterns, are significant scientific uncertainties for all UMRS Projects. These issues were incorporated in the plan formulation process and would be monitored by gathering data on water levels. These data would inform adaptive management actions, but future climate change projections remain highly uncertain at this time.

In the future, the AMT should investigate at least three important biological improvements resulting from this Project:

- Emergent and submersed aquatic vegetation are known to benefit migrating ducks. Migratory birds such as ducks are important to the Green Island Management team. Being able to increase beneficial aquatic vegetation in relation to attracting more migratory species is a priority. A study measuring an increase in aquatic vegetation should be used.

- The Project should improve overwintering habitat for fish. A study should demonstrate increase in size structure of state endangered species and desirable recreational fish in the system over time. Green Island has been plagued with fish kills (both winter and summer). According to local Department of Natural Resources (DNR) personnel, there have been about 5 total fish kills in the past 10 years. A reduction in fish kills could measure improved habitat.

- Through WLM, there should be excellent opportunity for migratory waterfowl

feeding and nesting habitat. Because of the variety of water levels and the location of the preserve in the migration flyway, studies should include what species are utilizing specific water level regimes for feeding and migration conditioning, and what species are staying for nesting/rearing habitat through the fluctuating WLM.

2.3. Conceptual Model. Figure I-3 shows the conceptual ecological model demonstrating drivers, stressors, attributes, and ecological effects on the area. The conceptual model is used to demonstrate what goes into each of the ecological effects and how they might change the area.

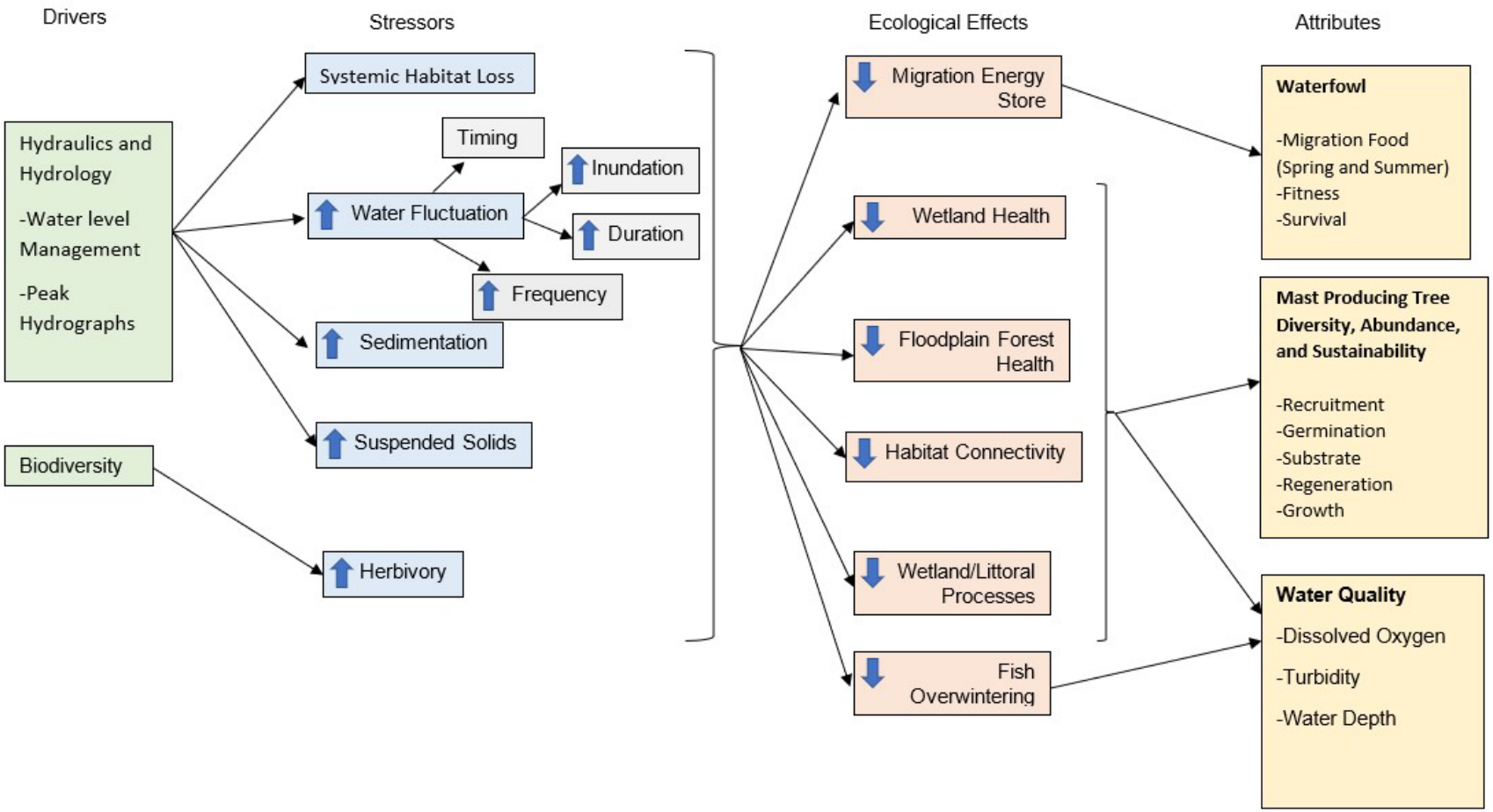

Figure I-3. Conceptual Ecological Model

3. 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 establishing feedback between continued project monitoring and corresponding project management.

Objective 1. Use dredged areas for fish overwintering habitat.

Performance Measure. The Project would provide deeper water throughout the Project area allowing for 305 acres of more overwintering locations for fish. These areas would allow for fish to survive winter conditions and grow to a reproductive size. A reliable food source includes the proper vegetation and invertebrates in an adequate quantity to accommodate each season. This food source would be diverse and with diverse physical conditions.

Desired Outcome. Increase in number of fish that reach sexual maturity and size class. In addition, higher quality aquatic habitats are utilized as feeding sites and nurseries by fish and other aquatic life.

Monitoring Design. Monitoring of water quality parameters will demonstrate how suitable the area is for overwintering habitat. Water depth (>4ft), low velocity (<1cm/sec), high dissolved oxygen concentration (>5mg/L), and increased water temperature (>1^{o}C) would all provide better overwintering habitat. In addition, Iowa DNR samples the area in the spring to monitor fish size structure.

Objective 2. Restore submersed aquatic and emergent vegetation for migratory waterfowl (feeding)use during the spring and fall migration periods, as measured in acres.

Performance Measure. Provide adequate water level conditions for optimal aquatic vegetation growth. Emergent vegetation quantity and quality would. Managing water levels should result in preferred habitat outcomes. The Adaptive Management Team (AMT) would use the 5-year WLM Cycle as the primary goal for management. Where managers would draw down Green Island at least 1 time every 5 years. This 5-year cycle is one reasonable representation of how IA DNR might manage given a corresponding set of potential or even likely physical conditions and biotic responses.

Desired Outcome. Monitoring should determine the level of the following aquatic ecological conditions:

- Adequate water depths to meet a wide range of duck feeding strategies.
- Balanced duck community with an adequate food availability.

Monitoring Design. Aquatic habitat monitoring should include, but is not limited to:

- Duck surveys will be completed to determine whether or not ducks are using the area during migration as well as how they are using the area (loafing and feeding).
- Every 5 years, drone surveys would determine emergent vegetation changes and SAV would be sampled each year using stratified random sampling already in place with LTRM element.

Water level management would allow for the IA DNR to better manage the area and return the area to a more historic hydrologic cycle.

Objective 3. Increase areal coverage, as measured in acres, of forest stands with hard mast-producing trees as a dominant or component species in floodplain forest areas.

Performance Measure. The Project would increase species diversity and abundance as well as areal coverage of native mast producing tree species, which would provide adequate structure and reliable food source for resident and migratory species. Additionally, the Project would provide recruitment of natural regeneration of bottomland hardwood species to ensure sustainable forest structure into the future.

Desired Outcome. The AMT would like to see the hard mast component improve to become a viable forest element, mimicking pre-settlement conditions. Hard mast trees such as oak, hickory, and walnut, would be planted to increase the amount of nuts, which is a preferred food for many bottomland hardwood dwellers. This activity would increase the areal coverage; however, natural regeneration and expansion is preferred.

Monitoring Design. Standard forest survey methods would measure the number of trees planted and the amount of natural regeneration taking place.

4. DOCUMENTATION, IMPLEMENTATION COSTS, RESPONSIBILITIES, AND PROJECT CLOSE-OUT

4.1. Documentation, Reporting, and Coordination. The PDT will document each of the performed assessments and communicate results to the UMRR program manager and project partners. Periodic reports will be produced by the Performance Evaluation Report team to measure progress towards the Project goals and objectives as characterized by the selected performance measures.

4.2. Costs. 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 exact features, monitoring elements, and adaptive management opportunities, the estimated costs in Table -1 will need refinement in PED during the development of the Detailed Monitoring and Adaptive Management Plans.

4.3. Responsibilities

- **Forest Plot Survey.** Feasibility and PED activities are limited to one pre-construction evaluation of the existing forest characteristics. Monitoring would be conducted annually for the first 5 Years and then in Year 10. Responsibility for these features will be a coordinated effort between the District, and IADNR.

- **Wetland Monitoring.** Feasibility and PED activities are limited to one pre-construction evaluation of the existing wetland characteristics. Monitoring would be conducted over 10 years. Responsibility for these features will be coordinated by Iowa DNR personnel.

4.4. Project Close-Out. Project Close-out would occur when the PDT determines the Project has been successful or when the maximum 10-year monitoring period has been reached. Success is considered to have been achieved when Project objectives have been met or when it is clear they would be met based upon the trend for the site conditions and processes. Project success would be based on the following:

- Predictable water conditions are creating suitable habitat for migrating waterfowl.
- Adequate vegetation growth and control for migratory bird use has been achieved.
- Suitable hard mast has been established and regeneration is taking place.
- Quantity submersed and emergent vegetation is reaching desirable coverage and quality.

There may be issues related to the Project's sustainability requiring some monitoring and management beyond achieving the Project objectives. Due to the variable nature of the Mississippi River hydrology, the monitoring baseline may change during the period of analysis. Consequently, it may be appropriate to consider extending Project-specific monitoring and adaptive management beyond 10 years in which case, the Iowa DNR would design and implement.

5. LITERATURE CITED

Fischenich, Craig J., Sarah J. Miller, and Andrew J. LoSchiavo. 2019. A Systems Approach to Ecosystem Adaptive Management. USACE Technical Guide: ERDC/EL SR-19-9.

Table I-1. Estimated Adaptive Management and Post-Construction Monitoring Costs ($)

				Post-Construction Years										
Objective	**Work Category**	**Activity**	**PED**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Improve overwintering habitat	Monitoring and Analysis	Electrofishing	$6,000	$6,000	$6,000		$6,000		$6,000		$6,000		$6,000	$42,000
	AM	Alter WLMP[1]				$5,000		$5,000		$5,000			$5,000	$20,000

[1]Added pumping costs if needed

Overwintering Habitat Monitoring Subtotal: $62,000

				Post-Construction Years										
Objective	**Work Category**	**Activity**	**PED**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Increase areal coverage of forest stands with hard mast-producing trees	Monitoring, Analysis, Reporting	Timber Stand VegSurvey	$5,000	$5,000			$5,000						$5,000	$20,000
		Data Analysis	$5,000	$5,000			$5,000						$5,000	$20,000
	AM	Tree Replanting						$20,000					$20,000	$40,000

Increase areal coverage of forest stands with hard mast-producing trees Subtotal: $80,000

				Post-Construction Years										
Objective	**Work Category**	**Activity**	**PED**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Restore submerged vegetation for migratory waterfowl	Monitoring, Analysis, Reporting	Submergent veg	$8,000	$8,000		$8,000				$8,000			$8,000	$40,000
		Data Analysis												
	AM	Alter WLMP[1]			$5,000		$5,000	$5,000					$5,000	$20,000

[1]Added pumping costs if needed

Restore submergent and emergent vegetation for migratory waterfowl Subtotal: $60,000

				Post-Construction Years										
Objective	**Work Category**	**Activity**	**PED**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Water Quality	Monitoring, Analysis, Reporting		$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$80,000

Water Quality Monitoring Subtotal: $80,000

				Post-Construction Years										
Objective	**Work Category**	**Activity**	**PED**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
Emergent Vegetation	Monitoring, Analysis, Reporting	Drone survey						$20,000					$20,000	$40,000

[1]Added pumping costs if needed

Emergent Vegetation Monitoring Subtotal: $40,0000

TOTAL $322,000