APPENDIX J: MITIGATION APPENDIX

Appendix J: General Mitigation Plan

INTRODUCTION

The following are excerpts from Appendix C of the Planning Guidance Notebook (PGN), updated 31 July 2019 by the Office of the Assistant Secretary of the Army for Civil Works in a memo dated 2 August 2019.

The mitigation planning process includes avoiding an impact altogether by not taking a certain action or part of an action; minimizing impacts by limiting the degree or magnitude of an action; rectifying the impact by repairing, rehabilitating or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; compensating for lost non-negligible resources through in-kind mitigation to the extent incrementally justified employing a watershed approach in mitigation planning; and, identifying the features of a mitigation plan and how it will be implemented in the project decision document. All practicable means to avoid and minimize impacts were considered in the proposed plan discussed in Supplemental No. 2 to the 1982 Yazoo Area Pump Project Final Environmental Impact Statement (SEIS No. 2).

To properly evaluate and compare ecological mitigation features, and to determine remaining unmitigated functional losses if any, mitigation planning shall address a range of reasonable alternatives up to the full compensation of significant ecological resource losses. Appropriate units of measure shall be specified in mitigation planning objectives to aid in this evaluation and will be the same units used for determining the unavoidable impacts of the proposed mitigation projects.

The mitigation standards and policies established pursuant to the Corps regulatory program and the procedures established in Appendix C of the PGN for civil works have some overlaps. The following components of a mitigation plan cover both the regulatory and civil works requirements. The mitigation plan will be adapted as project implementation evolves. The components of this general mitigation plan apply to Corps-constructed mitigation projects.

Component 1: Objectives

The objective of this mitigation plan is to evaluate potential mitigation options that could satisfy the mitigation requirement for the proposed plan discussed in the SEIS No. 2. Mitigation alternatives were evaluated in the 2007 Report and the acquisition of frequently flooded agricultural lands was the most cost effective method of mitigation. This mitigation plan is based on field data and model runs in coordination with cooperating and resource agencies. A more robust mitigation plan will be developed during preconstruction engineering and design (PED) and a supplemental NEPA document prepared to evaluate the alternatives and the associated impacts.

CEMVK determined impacts to wetlands, waterfowl, terrestrial wildlife, and aquatic resources. Table 1 is a summary of those proposed impacts. As specific mitigation locations

have not yet been determined, the mitigation impacts will be discussed in the more robust mitigation plan and the supplemental NEPA document developed during PED.

Table 1 Summary of proposed project impacts		
Significant Resource	**Measurement Unit**	**Change**
Wetlands	FCU	-11,498
Waterfowl	DUD	-1,349,228
Terrestrial Wildlife	AAHU	-1,252
Aquatic Resources	AAHU	-1,940

Component 2: Site Selection

A watershed approach to compensatory mitigation seeks to promote sustainable ecological resource functions throughout an entire watershed. Under a watershed approach, mitigation measures are tailored to landscape positions and resource types. The ecological resources landside of the Mississippi River and Tributaries system are in sub- optimal condition due to the general loss of bottomland hardwood habitat and connection with the Mississippi/Yazoo Rivers. Based on the conditions found within project area watershed, the following assumptions were made regarding potential mitigation sites:

- Areas subject to Mississippi/Yazoo River flooding or those that receive a seasonal flood pulse are inherently more valuable than those that are not (Junk et al. 1989). Therefore, compensatory mitigation would focus on areas that remain connected to the Mississippi/Yazoo Rivers and on areas in watershed basins that continue to experience backwater seasonal flood pulses.

- Areas that flood more frequent and for longer periods (i.e., lands located at the lowest elevations) are more valuable for wetlands and waterfowl.

- Areas within the batture, or those within the post-project 14-day consecutive inundation zone are considered to be connected wetlands whose hydrologic conditions are dictated by the Mississippi/Yazoo Rivers.

- Areas adjacent to large tracts of high-value habitat are generally more desirable for mitigation than those that are not (Elliott et al. 2020, Murray and Klimas 2013).

Figure 1, areas shaded red, depicts the areas determined to be available for acquisition and reforestation. Although these areas are much larger than what is needed, it is within these areas that mitigation would be implemented. Figure 2 depicts the potential areas in which the supplemental low flow groundwater wells (SLFGWs) could be located. Should the Corps be unable to secure the necessary compensatory mitigation from these areas then the Corps will look to areas within Zone 3 and the mitigation requirements will be adjusted accordingly.

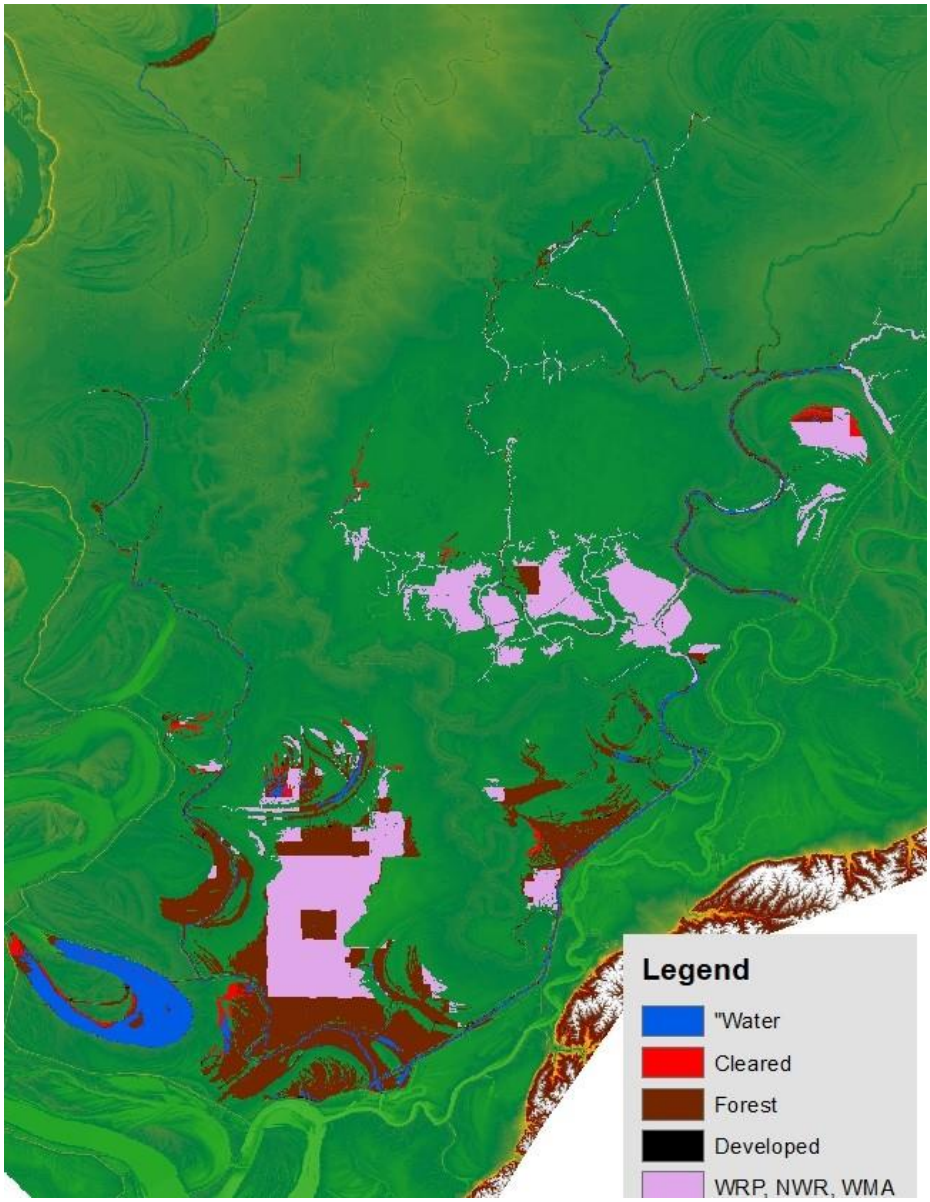

Figure 1 Potential locations of reforestation mitigation sites (Red).

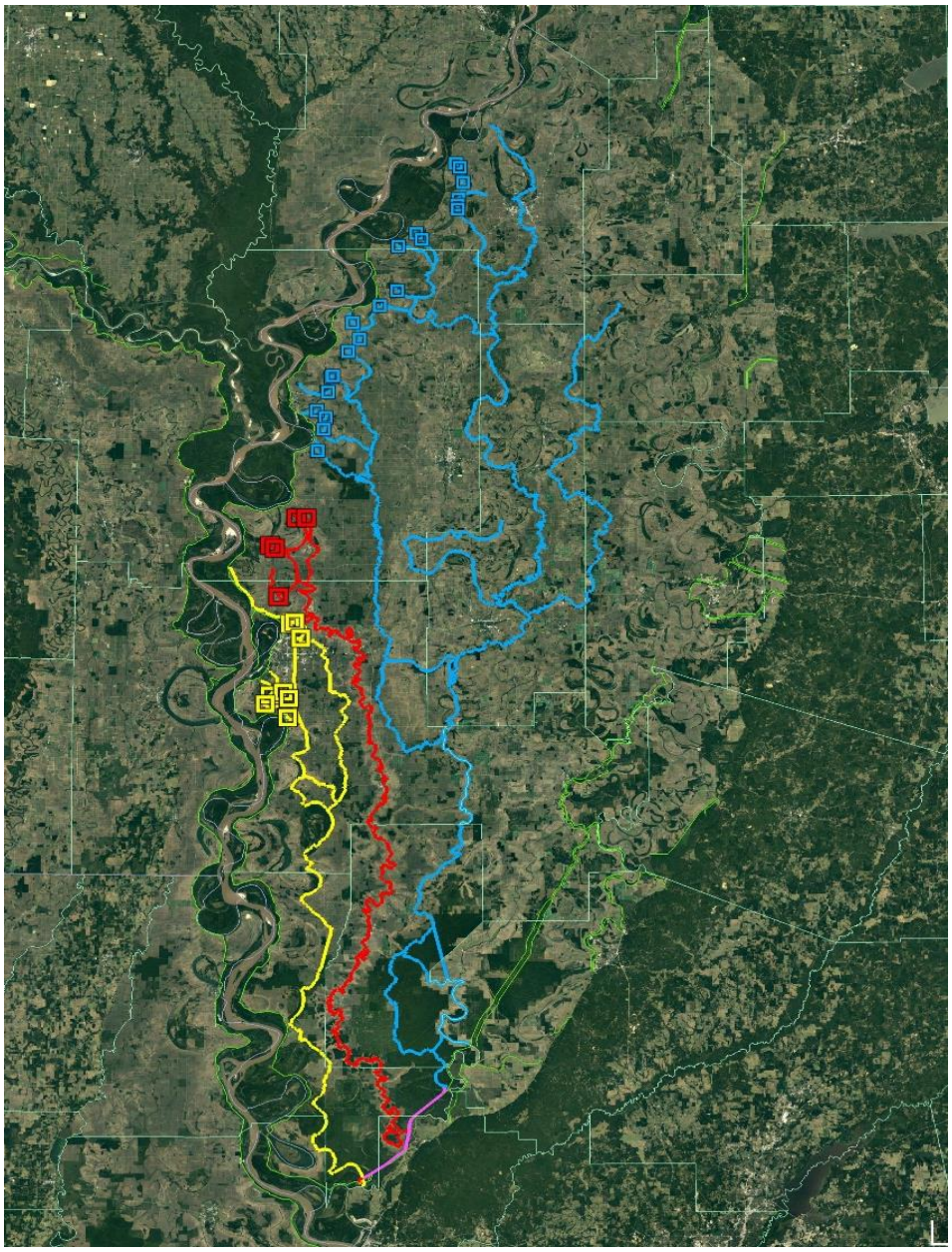

Figure 2 Potential locations for SLFGWs (blue, red, and yellow squares)

Plan selection criteria will be considered when ranking and selecting the mitigation projects. These include:

- Risk & Reliability
- Environmental
- Time
- Cost Effectiveness
- Other Cost Considerations
- Watershed & Ecological Site Considerations

These selection criteria will be considered when ranking the specific mitigation sites when determined. This process will aid in the development of mitigation alternatives and ultimately a recommended mitigation plan. This mitigation plan will be adapted as project implementation evolves. A supplemental NEPA document will be prepared during PED to evaluate the mitigation alternatives and the associated impacts.

Risk & Reliability:

Risk: Is defined as probability multiplied by consequences. An example of risk would be a calculation of the relative chance of saltwater intrusion during the 50-year period of analysis multiplied by magnitude of anticipated plant mortality. Actions can be implemented to reduce risk, but because risk can never be completely eliminated, residual risk will remain.

Reliability: Refers to the chance that a component of the system will fail to perform its intended purpose as a function of the forces placed upon it. Reliability is often displayed using a fragility curve which describes the probability of failure as a function of an applied force. Many separate system components can be combined in an event tree to represent the reliability of a system.

Since these two factors are similar, it is best to consider them as one criterion: Risk & Reliability.

Table 2 identifies the risk and reliability subcriteria that would be applied to each mitigation alternative.

Table 2: Risk and Reliability Subcriteria

Issue	Explanation
Uncertainty Relative to Achieving Ecological Success/Potential Need for Adaptive Management (Contingency) Actions	Sources of *uncertainty relative to achieving ecological success* include: (1) incomplete understanding of the system (environmental or engineering) to be managed or restored (e.g. hydroperiod, water depth, water supply, substrate, nutrient levels, toxic compounds) (2) imprecise estimates of the outcomes of alternative management actions (e.g. proven methodology, project complexity). *Evaluation of Potential Need for Adaptive Management (Contingency) Actions:* (1) Is there sufficient flexibility within project design and operation to permit adjustments to management actions? (2) Is the system (or components) to be restored

Issue	Explanation
	or managed well understood (e.g. hydrology and ecology) and are management outcomes accurately predictable? (3) Do participants generally agree on the most effective design and operation to achieve project goals and objectives? (4) Are the goals and objectives for restoration understood and agreed upon by all parties?
Uncertainty Relative to Implementability	Includes implementability issues that are not captured under other selection criteria. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. However, just because a plan is not the preferred plan of a non-Federal sponsor does not make it infeasible or unacceptable *ipso facto*.
Adaptability	Ability to expand (or otherwise adapt) the measure to achieve/maintain ecological success
Long-Term Sustainability of Project Benefits	For Forested Habitat: Measured by the Habitat Suitability Index Value at TY50, which incorporates the suitability index of all WVA variables in the WVA model.
Self-Sustainability of Project Once Ecological Success Criteria Linked to Notice of Construction Completion are Achieved	(1) Does the project utilize active engineering features (e.g., pumps)? (2) Anticipated OMRR&R Activities (3) Relative difficulty of OMRR&R
Risk of Exposure to Stressors/ Reliability & Resiliency of Design	(1) To what stressors will a given alternative be exposed (e.g. sea level rise, subsidence, saltwater intrusion during storm or drought, long-term salinity shift, herbivory, invasive species, inundation from storm surge,

Issue	Explanation
	damage from storm-induced wave action, runoff from adjacent property which could alter chemical or nutrient balance of soils, altered hydrologic regime which could change habitat type or stress vegetation, non-storm wave energy)? (2) How is the project, as designed, likely to perform relative to stressors and/or how well is the project expected to return to functionality after exposure to stressors?

Environmental: The National Environmental Policy Act (NEPA) and other environmental laws require federal agencies to consider the environmental impacts in their decision-making, identify unavoidable environmental impacts and make this information available to the public. All evaluated alternatives should be investigated with respect to environmental consequences. The NEPA document records this investigation. The SEIS No. 2 documents the impacts due to the proposed plan. While the concepts for the recommended mitigation plan have been identified, a more detail analysis will be included with a supplemental NEPA document developed during PED.

Time: The PDT must analyze the likely implementation schedules for mitigation alternatives. Time metrics account for engineering and design, real estate acquisition, construction, and period to project turn-over. Time metrics include:

- Estimated time to construction contract award (measured from TSP milestone)
- Estimated time to Notice of Construction Complete milestone (measured from TSP milestone)

Cost Effectiveness: Cost effectiveness analysis seeks to answer the question: given an adequately described objective, what is the least-costly way of attaining the objective? In 2007, a mitigation plan was developed and selected in accordance with policy. The resource agencies had concerns about the 2007 selected mitigation plan. The current mitigation plan was developed using models in coordination with the resource agencies to ensure that desired variability in mitigation output was achieved to address the 2007 concerns. The Cost Effectiveness-Incremental Cost Analysis (CE-ICA) tool does not inherently consider any variability associated within the production of the outputs, it simply seeks out the least costly means of achieving the maximum, or required, output. Simply employing the revised project impact evaluations or introducing the agency models that will measure impacts and proposed mitigation measures to offset the impacts, will not provide any assurance that a more acceptable plan will result through an CE-ICA evaluation. As a result, CE-ICA has not been employed as an approach to rectify the agency mitigation concerns and determine the revised mitigation plan.

Other Cost Considerations: In most cases, a contract's Current Working Estimate (CWE) is based on the Programmatic Cost Estimate (PCE), which includes the additional request for funds received in the President's Budget. PDTs should not expect additional appropriations. Therefore, alternatives' costs, excluding escalation and contingency, should

not exceed the Current Working Estimate. Life cycle costs are a consideration when evaluating alternatives, but should not drive plan selection. Cost calculations for projects should include construction, engineering and design, construction supervision and administration, Lands, Easements, Rights-of-way, Relocations, and Disposal Areas (LERRDs), and Operation Maintenance Repair Replacement and Rehabilitation (OMRR&R). Monitoring and adaptive management costs should be added for mitigation projects.

OMRR&R activities are assumed for alternative comparison purposes. These include: monitoring, invasive/nuisance species eradication, maintenance/replacement of supplemental low flow groundwater wells (SLFGWs). Once the recommended mitigation plan is identified, assumptions may be changed for the plan elements to include adaptive management, additional OMRR&R activities, major rehabilitation, etc. in order to sustain ecological success or to address uncertainty. These new assumptions would be reflected in the advanced project design, revised modeling for the recommended plan, and revised recommended plan cost estimates.

Watershed and Ecological Site Considerations: The PDT has added this selection criterion to address unique factors that apply to environmental mitigation projects that were not addressed in the above listed selection criteria. Guidance from 40 CFR Part 230 discusses consideration of a mitigation site's role in the larger landscape and other ecological conditions. The two items below aim to capture this guidance.

Watershed Considerations/Significance within the Watershed:

- 40 CFR Part 230 Compensatory Mitigation for Losses of Aquatic Resources includes guidance regarding the siting of mitigation projects. This guidance directs that mitigation should consider existing watershed plans within the project area. Therefore, the selection criteria considers how a given alternative relates to existing watershed plans within the project area. The Mississippi Watershed Management Organization's Watershed Management Plan 2011-2021 will be considered when screening and ranking mitigation sites.
- Contiguous with or within resource managed area (i.e. Federal, state, private mitigation bank or other restoration projects considered under Future Without Project condition)
- Located in county of impact by habitat-type
- Habitat Linkages (e.g. wildlife corridors)

Ecological Site Considerations not captured in the ecological models:

  - Fragmentation within site boundary
  - Site habitat connectivity to larger surrounding project area considering future land use trends

Component 3: Site Protection Instrument

In an effort to satisfy this component, the USACE would commit to fully undertaking the monitoring, operation, and maintenance responsibilities for the mitigation project. Fee

interest will be acquired in the lands for Corps constructed mitigation projects, thus ensuring that no human activities will be allowed that could result in adverse effects to the constructed mitigation features.

Component 4: Baseline Information

Extending from Memphis, Tennessee, to Vicksburg, Mississippi, the Yazoo Basin covers 13,400 square miles. The surface of the Yazoo Basin consists mainly of an intricate network of meander belt (point bar, abandoned channel, abandoned course, and natural levee) deposits. The point bar deposits within the Yazoo Basin exhibit an undulating surface of ridges and swales partially covered by remnant natural levees. The Yazoo Basin also covers two physiographic subdivisions. One of these leveed alluvial plains is no longer subject to overbank flooding and is referred to as the “Delta”. The other consists of rolling hills which drain into the Delta.

The Yazoo Study Area is approximately 926,000 acres in the lower portion of the Delta. The Yazoo Study Area lies within the Mississippi River alluvial plain and is comprised of forested lands and open fields. Wetlands are an abundant and valuable resource within the Yazoo Study Area comprised of forested ecosystems adapted to soil saturation and flood inundation. Anthropogenic land use changes including logging, conversion of forested areas to agriculture, implementation of flood control projects, and reforestation have altered species composition and created a range of successional forest stands (see Wetlands Appendix). Dominant tree species include Celtis laevigata (Sugarberry), Quercus lyrata (Overcup Oak), Fraxinus pennsylvanica (Green Ash), Liquidambar styraciflua (Sweetgum), Quercus texana (Nuttall Oak), Quercus phellos (Willow Oak), Carya illinoinensis (Pecan), Acer negundo (Boxelder), Ulmus Americana (American Elm), and Populus deltoides (Eastern Cottonwood). More frequently inundated areas and depressional features also feature a number of Taxodium distichum (Bald-Cypress), and Nyssa aquatica (Water Tupelo). Bottomland hardwoods containing Cottonwood (Populus deltoides), Sycamore (Platanus occidentalis), and Black Willow (Salix nigra), Pecan (Carya spp.), Green Ash (Fraxinus pennsylvanica), Sugarberry (Celtis laevigata), Hackberry (C. occidentalis), Oaks (Quercus spp.), and Elm (Ulmus spp.) are another very valuable habitat in the Yazoo Study Area.

Component 5: Determination of Credits

If the project proposes to secure credits from an approved mitigation bank, the Government will include the number and resource type of credits to be secured and how these were determined. Habitat assessment(s) of the mitigation bank(s) utilizing the same USACE certified habitat assessment model(s) used to determine the functional impacts of the proposed action must be completed.

Habitat assessment models were used to determine the functional impacts of the proposed action. Assumptions and calculations regarding mitigation are discussed within the Significant Resources Assessments in Section 5 of the draft supplement and their corresponding appendices. Table 1 summarizes impacts associated with the recommended plan. Habitat assessment(s) will be completed on specific sites, once identified, utilizing the same USACE certified habitat assessment model(s) used to determine the functional impacts of the proposed action.

Component 6: Mitigation Work Plan

The overall ecological value for any mitigation measure depends on the location of the tract within the watershed. For example, lands that are hydrologically connected to the Mississippi/Yazoo Rivers and/or are subjected to frequent floods of high duration are generally more beneficial to fish and waterfowl than hydrologically disconnected lands located at higher elevations. Therefore, to determine reasonable estimates of required mitigation, mitigation zones were established based on the assumptions listed above. Mitigation tracts would be identified and acquired, in any combination that satisfies the mitigation needs, within these zones. Since hydrology is likely the driving variable in determining the "ecological value" of a mitigation site, the following mitigation zones were established for planning purposes based upon hydrologic zones and location within the watershed. If mitigation lands cannot be identified and acquired in the following mitigation zones, a contingency plan would be established and submitted to the inter-agency team for review and comment. Supplemental NEPA documentation would also be prepared, if needed.

Mitigation Zone 1: Riverside frequently flooded Mississippi/Yazoo Rivers connected lands (*e.g.*, batture lands).

Restoration of agricultural lands within the batture area and active floodplain in the vicinity of the project area to bottomland hardwood and/or riverfront forests would provide significant compensatory mitigation benefits. Furthermore, it is anticipated that agriculture land in the batture and lands subjected to frequent backwater flooding would have a high likelihood of acquisition. Once restored through mitigation, flooded bottomland hardwood and/or riverfront forests in the batture would benefit from the Mississippi/Yazoo Rivers flood pulse and could provide quality wetland functions and habitat for many fish and wildlife resources (Junk et al.1989). Batture land is also directly accessible to fish and has heterogeneous habitat suitable for fish spawning and rearing. In many cases batture land is superior for mitigation purposes, especially for fish and wetlands (Battelle, 2012). For example, the Yazoo Backwater Basin is man-made, trees have been cleared from most ditch banks, high turbidity prevails for much of the year, and the floodplain is comprised of mostly agricultural fields. Conversely, batture land is more diverse, experiences a regular flood pulse, and with reforestation of frequently flooded agricultural land, can provide quality wetland functions and habitat for many fish and wildlife resources. For these reasons, USACE believes that mitigation in the batture is suitable to mitigate for impacts incurred in the Yazoo Backwater Basin.

Mitigation Zone 2: Agricultural lands within the 14-day consecutive inundation zone (*e.g.*, frequently flooded and impounded/backwater areas). Similar to the restoration of batture lands, the restoration of agricultural lands to bottomland hardwood and/or riverfront forests within the 14-day consecutive inundation zone within the project area would provide significant compensatory mitigation benefits. Furthermore, it is anticipated that land subjected to frequent flooding would have a high likelihood of acquisition. Once restored through mitigation, flooded bottomland hardwood and/or riverfront forests within the 14-day consecutive inundation zone would be subject to the Mississippi/Yazoo Rivers

seasonal flood pulse and would provide quality wetland functions and habitat for many fish and wildlife resources (Junk et al. 1989).

There are approximately 2,069 acres of agricultural lands at or below the post-project 14-day consecutive inundation zone. Since the condition of lands at and below this elevation would be least altered by construction of the proposed flood risk reduction improvements, and because there a relatively high likelihood flooding would continue to exist in these areas, it was estimated that 70 percent of such lands could be acquired for compensatory mitigation. Therefore, for planning purposes it was assumed 1,860 acres would be available for acquisition within mitigation zone 2.

Mitigation Zone 3: Agricultural lands located above the 14-day consecutive inundation zone but within the future 2-year floodplain (*e.g.*, low lying flooded areas whose hydrologic conditions are dictated by precipitation and landscape position).

The 2-year floodplain serves as an important benchmark to many ecological resources as well as defining the upper limit of optimal fish spawning and rearing habitat associated with flooded bottomland hardwood forest. Although not directly linked hydrologically to the Mississippi/Yazoo Rivers, these areas are often at the lowest lying elevations which are subject to precipitation run-off from large areas and pond water for long durations. Additionally, these areas are adjacent to existing tracts of bottomland hardwoods.

There are approximately 22,398 acres of agricultural lands above the post-project 14-day consecutive inundation zone and below the 2-year floodplain. For planning purposes it was assumed that 11,107 acres would be available for acquisition within mitigation zone 3.

Mitigation Zone 4: Mitigation Bank Credits

In accordance with the Water Resources Development Act of 2016 Section 1163 and implementation guidance issued by the Assistant Secretary of the Army for Civil Works on 16 November 2017USACE, where appropriate, shall first consider the use of mitigation banks if the bank contains sufficient available credits to offset the impact and the bank is approved in accordance with applicable Federal law (including regulations). Therefore, USACE would evaluate the potential to acquire appropriate compensatory mitigation bank credits for impacts to wetlands, bottomland hardwood habitat, aquatic resources, and waterfowl during the development of tract specific mitigation plans from an existing commercial mitigation bank where available and appropriate. Additionally, a habitat assessment of the mitigation bank utilizing the same USACE certified habitat assessment model that was used to determine the functional impacts of the proposed action must be completed per Engineer Regulation 1105-2-100.

Mitigation Zone 5: Supplemental Low Flow Groundwater Wells (SLFGWs)

In addition to bottomland hardwood restoration and consideration of mitigation banks to offset project induced impacts, USACE has determined that the only option available to mitigate for a portion of the unavoidable aquatic loses (attributed to Hypoxia) would be the out of kind mitigation through the installation of 34 SLFGWs. The SLFGWs would

pump groundwater into various headwater agricultural ditches and streams in the upper Big Sunflower and Steele Bayou drainage basins. It is anticipated that the supplemental low flow groundwater wells would provide supplemental flows during the late summer/early fall months when, due to extensive agricultural groundwater withdrawal, monthly discharge rates for systems in this upper basin region are typically at their lowest. Potential ecological benefits for lessening the impacts to hydrologic conditions associated with extensive agricultural practices include, but are not limited to: re-establishing perennial flows for rheophilic fish species in approximately 9,321 acres of streams; avoiding desiccation of established mussel beds; and increasing periodic fish passage. For additional details on potential aquatics benefits, please refer to the Aquatics Appendix F-8 of the SEIS No. 2.

Table 3 Summary of impacts and Compensatory mitigation techniques					
Impact Summary	Forested Acres Impacted -111.7	Wetlands (FCU) -11,498	Waterfowl (DUD) -1,349,228	Terrestrial Wildlife (AAHU)[1] -1,252	Aquatic Resources (AAHU) -1,940
Compensatory Mitigation Benefits by Zone					
BLH-Zone1	545	2,606	794,521	1,495.2	232
BLH-Zone2	1,860	8,892	2,711,577	4,896.5	792
BLH-Zone3	NA	N/A	N/A	N/A	N/A
SLFGWs-Zone 5	N/A	N/A	N/A	N/A	4,288

Section 404 of the Clean Water Act

The preferred alternative would directly impact 84 acres of wetlands (59 forested and 25 farmed wetlands) and indirectly impact 38,774 acres of wetlands, via reduced flood frequency and duration, resulting in a loss of 11,498 wetland functional capacity units (FCU).

Two active reforestation measures are proposed to compensate for the impacts to wetlands.

- Restore vegetated wetlands on 545 acres of cropland riverside of the levees (Mitigation Zone 1).

- Restore vegetated wetlands on 1,860 acres of cropland landside of the levees (Mitigation Zone 2).

Fish and Wildlife Resources

Impacts to fish and wildlife resources are discussed in Section 5 of the draft supplement and applicable appendices. In addition to the two mitigation zones described above, 34

SLFGWs, mitigation zone 5, is proposed to compensate remaining aquatic impacts. Therefore, actively restoring 2,405 acres of agricultural land to bottomland hardwood forest and constructing 34 SLFGWs would fully compensate for impacts to fisheries, waterfowl and terrestrial wildlife resources. The proposed vegetated wetland restoration complies with 33 U.S.C. § 2283(d)(1), which requires in-kind mitigation for impacts to bottomland hardwood forests. Additionally, since the proposed mitigation measure benefits multiple resources, compensating for fish and wildlife resources also compensates for mitigation required pursuant to the Clean Water Act.

Mitigation Zone 5 – Supplemental Low Flow Groundwater Wells

Thirty-four supplemental low flow groundwater wells are proposed to augment stream flows in multiple stream systems within the Big Sunflower-Steele Bayou watershed. Re-establishing perennial flows with the SLFGWs is considered out-of-kind mitigation but offsets high mortality of larvae and juvenile fish in the spring from hypoxia with higher rates of survival of juveniles and adults during autumn. Constructing 34 SLFGW in Mitigation Zone 5 is estimated to provide:

- Approximately 4,288 AAHUs

See appendix F-8 of the SEIS No. 2 for further details of this mitigation feature.

Vegetated Wetland Restoration

Active restoration of vegetation on mitigation tracts involves preparing the site, restoring hydrology to the extent practical (based on projected future hydrology) and reforesting cleared and agricultural areas with naturally-occurring and historically-occurring species. Vegetated wetlands restoration would be accomplished in three areas: 1) in the batture area (mitigation zone 1); 2) within the 14-day consecutive inundation zone (mitigation zone 2); and 3) lands located above the 14-day consecutive inundation zone but within the future 2-year floodplain (mitigation zone 3).

Mitigation Zone 1 – Batture Lands

There are areas in the batture within the project area that could be restored. Active restoration includes bottomland plantings (per the general planting plan in Attachment #1) and creating micro-topography and other site-specific hydrologic restoration as needed. Taking 545 acres of cropland out of production and restoring bottomland hardwoods in mitigation zone 1 is estimated to provide:

- 2,606 wetland FCU
- 1,495.2 AAHU for terrestrial wildlife
- 794,521 waterfowl DUD
- 232 aquatic resources AAHU

Mitigation Zone 2 – Lands within the Post-Project 14-day Consecutive Inundation Zone

For planning purposes, an estimated 1,860 acres would be available for acquisition and reforested within the post-project 14-day inundation limits. Considering the projected future hydrology in these areas, a mixture of bottomland hardwoods would be planted according to site conditions, as well as creating microtopography, providing earthwork, and conducting other hydrologic restorative activities. A general planting plan can be found in Attachment #1.

Restoring 1,860 acres of vegetated wetlands in mitigation zone 2 is estimated to provide:

- 8,892 wetland FCU
- 4,896.5 AAHU for terrestrial wildlife
- 2,711,577 waterfowl DUD
- 792 aquatic resources AAHU

Mitigation Zone 3 – Cleared or agricultural lands located above the 14-day consecutive inundation zone but within the future 2-year floodplain

As stated earlier in this plan, there are approximately 11,107 acres available for acquisition if for some reason Zones 1 and 2 cannot be implemented. For planning purposes, all sites were assumed to meet aquatic and terrestrial wildlife habitat and hydrologic criteria, but not waterfowl habitat suitability nor wetland hydrologic criteria.

Mitigation Zone 4 – Mitigation Bank Credits

During development of tract-specific detailed plans in coordination with the inter-agency team, USACE will evaluate the potential to acquire appropriate compensatory mitigation bank credits for impacts to bottomland hardwoods. It is not possible at this time to determine how many credits might be available at the time of development of the tract specific detailed plans. A search on the Regulatory In-Lieu Fee & Bank Tracking System (RIBITS) indicated that as of current, there are no mitigation banks within the YBW basin with BLH credits available. There is currently only one in-lieu fee program with available aquatic resource credits. At time of implementation, a RIBITS search will be conducted and the opportunity to purchase mitigation bank credits considered.

Component 7: Maintenance Plan

Maintain the project area such that the total average vegetative cover accounted for by invasive species and the total average vegetative cover accounted nuisance species each constitute less than 5% of the total average plant cover each throughout the 50-year project life. The maintenance plan for the SLFGWs will be developed during PED. Maintenance of the mitigation plan would be the responsibility of the USACE-MVK.

Component 8: Performance Standards (Success Criteria)

Below are general guidelines for forested mitigation projects. Site specific success criteria and monitoring plans will be developed after project specific mitigation sites are

identified and the associated mitigation plans developed. For discussion on success criteria and monitoring of the SLFGWs, see Appendix K of the SEIS No 2.

General Construction

Complete all necessary earthwork and related construction activities in accordance with the mitigation work plan and the project plans and specifications. The necessary activities will vary with the mitigation site, but may include clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications or alterations to existing water control structures and surface water management systems; plantings; and eradication of invasive and nuisance plant species.

Topography[1]

Initial Success Criteria

For mitigation features requiring earthwork (grading) to attain desired elevation (excluding areas restored from open water):

a. Following completion of General Construction Criteria but prior to plantings:
   - Demonstrate that at least 80% of the total graded area within each feature is within approximately +0.25 feet of the desired target soil surface elevation[2].

Notes:
[1]Elevation surveys must be taken to document achievement of success criterion. The resulting data and report will be provided to the IET for review.
[2]The desired target elevation for each feature was determined during the final design phase.
[3]There are no intermediate or long-term success criterion for topography.

Native Vegetation[1]

A. Initial Success Criteria (at end of first growing season following the year planting meets construction requirements) –

1. Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.).
2. The surviving plants must approximate the species composition and percentages specified in the initial plantings component of the final planting plan[2] found in the project plans and specifications.
3. These criteria will apply to the initial plantings, as well as any subsequent re-plantings necessary to achieve this initial success requirement.

B. Intermediate Success Criteria (3 growing seasons following attainment of Native Vegetation A.) –

1. Achieve a minimum average density of 269 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
2. Achieve a minimum average density of 135 (50% of 269) living hard-mast producing species in the canopy stratum (planted trees and/or naturally recruited

native canopy species). The remaining trees in the canopy stratum must be comprised of soft-mast producing native species.

3. This hard mast criteria will thereafter remain in effect for the duration of the overall monitoring period. Modifications to these criteria could be necessary for reasons such as avoidance of tree thinning if thinning is not warranted and the long-term effects of sea level rise on tree survival. Proposed modifications must first be approved by the USACE in coordination with the IET. For BLH-Wet habitats only -- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. Plant community must exhibit characteristics and diversity indicative of a viable native forested wetland community, i.e. vegetation community where more than 50% of all dominant species are facultative (FAC) or wetter.

C. Long-Term Success Criteria (Within 6 growing seasons following attainment of B. and maintained for the duration of the remaining 50-year monitoring period)[3] --

1. Attain a minimum average canopy cover of 80% by planted and/or naturally recruited native canopy species.
2. Achieve a minimum average density of 135 (50% of 269) living hard-mast producing species in the canopy stratum (planted trees and/or naturally recruited native canopy species). The remaining trees in the canopy stratum must be comprised of soft-mast producing native species.
3. For BLH-Wet habitats only -- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. The plant community must exhibit characteristics and diversity indicative of a viable native forested wetland community, i.e. vegetation community where more than 50% of all dominant species are facultative (FAC) or wetter.

Notes:
[1]There are no success criteria for midstory or understory species; however, data will be collected concurrently with scheduled monitoring throughout the 50-year project life.
[2] Greater flexibility for species composition may be allotted after multiple years of not meeting initial success criteria.
[3]The requirement that the above criteria remain in effect for the duration of the overall monitoring period may need to be modified later due to factors such as the effect of sea level rise on vegetative cover. Proposed modifications must first be approved by the USACE in coordination with the IET. If doesn't meet 80% 6 Years Following Completion of 2.C, the IET would meet and discuss path forward. Greater flexibility for species composition may be allotted after multiple years of not meeting initial success criteria.

Invasive and Nuisance Vegetation

Maintain the project area such that the total average vegetative cover accounted for by invasive species and the total average vegetative cover accounted nuisance species each constitute less than 5% of the total average plant cover each throughout the 50-year project life. The list of invasive and nuisance species is found in Appendix A and will be tailored to reflect specific site needs.

Note:

[1]Yearly inspections to determine the need for invasive/nuisance control would be conducted until the long term success criteria for vegetation is achieved. After it is achieved, the frequency of inspections to determine the need for invasive/nuisance control would be adjusted based on site conditions.

Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the IET, may determine that thinning of the canopy and/or mid-story strata is warranted to maintain or enhance the ecological value of the site. This determination will be made approximately 15 to 20 years following successful completion of plantings (General Construction A or B.). If it is decided that timber management efforts are necessary, the USACE will develop a Timber Stand Improvement/Timber Management Plan, and associated long-term success criteria, in coordination with the IET. Following approval of the plan, the USACE will perform the necessary thinning operations and demonstrate these operations have been successfully completed. Timber management activities will only be allowed for the purposes of ecological enhancement and maintenance of the mitigation site.

Hydrology

A. Intermediate and Long-term Success Criteria

4 years after successful completion of plantings, site hydrology will be assessed to determine that the site meets the wetland criterion as described in the USACE Wetland Delineation Manual and applicable regional supplement. (USACE 2010)

Component 9: Monitoring Requirements

Baseline Monitoring Report (First Monitoring Report)

Within 90 days of completion of all final construction activities (e.g. eradication of invasive and nuisance plants, planting of native species, completion of earthwork, grading, surface water management system alterations/construction, etc.) associated with General Construction, a “baseline” monitoring report will be prepared. Information provided will typically include the following items:

- A detailed discussion of all mitigation activities completed.
- A description of the various features and habitats within the mitigation site. Various qualitative observations will be made to document existing conditions and will include, but not be limited to, potential problem zones, general condition of native vegetation, and wildlife utilization as observed during monitoring.
- A plan view drawing and shapefiles of the mitigation site showing the approximate boundaries of different mitigation features including planted areas, planted rows, areas involving eradication of invasive and nuisance plant species, surface water management features, access rows, proposed monitoring transects locations, sampling plot locations, photo station locations, and if applicable, piezometer and staff gage locations.

- Initial and final construction surveys for areas having had topographic alterations, including elevations of all constructed surface water drainage features, drainage culverts, and/or water control structures. The initial and final construction surveys should also include cross-sectional surveys of topographic alterations involving the removal of existing linear features such as berms/spoil banks, or the filling of existing linear ditches or canals. The number of cross-sections must be sufficient to represent elevations of these features. The initial and final construction surveys must include areas where existing berms, spoil banks, or dikes have been breached.
- A detailed inventory of all canopy and midstory species planted, including the number of each species planted and the stock size planted. In addition, provide an itemization of the number of each species planted and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.
- Photographs documenting conditions in the project area will be taken at the time of monitoring and at permanent photo stations within the mitigation site. At least two photos will be taken at each station with the view of each photo always oriented in the same general direction from one monitoring event to the next. The number of photo stations required and the locations of these stations will vary depending on the mitigation site. The USACE will make this determination in coordination with the IET and will specify the requirements in the project-specific Mitigation Monitoring Plan. At a minimum, there will be 4 photo stations established. For mitigation sites involving habitat enhancement/earthwork only, permanent photo stations will primarily be established in areas slated for planting of canopy and mid-story species, but some may also be located in areas where plantings are not needed.
- Multiple baseline reports may need to be submitted if additional plantings are required by the contractor to meet planting survival acceptance criteria. Each revision will be updated to incorporate information regarding the re-planting.

Additional Monitoring Reports

All monitoring reports generated after the Baseline Monitoring Report will be called Initial, Intermediate or Long-Term Success Criteria Monitoring Reports and shall be numbered sequentially based on the year in which the monitoring occurred (i.e. Initial Success Criteria Monitoring Report 2019). All Monitoring Reports shall provide the following information unless otherwise noted:

- All items listed for the Baseline Monitoring Report with the exception of: (a) the topographic/construction surveys, although additional topographic surveys are required for specific monitoring reports (see below); and (b) the inventory and location map for all planted species.
- A brief description of maintenance and/or management and/or mitigation work performed since the previous monitoring report along with a discussion of any other significant occurrences.
- Quantitative plant data collected from (1) permanent monitoring plots measuring approximately 90 feet X 90 feet in size or from circular plots having a radius of approximately 53 feet, or (2) permanent transects sampled using the point-centered

quarter method with a minimum of 20 sampling points established along the course of each transect, or; (3) permanent belt transects approximately 50 feet wide and perpendicular to planted rows. The number of permanent monitoring plots and transects, as well as the length of each transect will vary depending on the mitigation site. The USACE will make this determination prior to the first monitoring event in coordination with the IET and will specify the requirements in the Mitigation Monitoring Plan. Data recorded in each plot or transect will include:

First monitoring report after a planting event

- number of living planted canopy species (excluding recruited) present and the species composition;
- number of living planted midstory species present and the species composition
- average density of living planted canopy species (i.e., the total number of each species present per acre) and the species composition (transect methods)
- average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species;
- average percent cover by native species in the midstory stratum;
- average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined).

Subsequent monitoring reports

- number of living native canopy trees by species;
- average density of all native species in the canopy stratum, and the wetland indicator status of each species;
- average percent cover by native species in the canopy stratum;
- average diameter at breast height (DBH) for trees (measured 10 years after successful completion of plantings) in the midstory and upper strata;
- number of living native midstory species present and the species composition
- average density of all native species in the midstory stratum, the total number of each species present, and the wetland indicator status of each species;
- average percent cover by native species in the midstory stratum;
- average percent cover accounted for by invasive plant species (all vegetative strata combined); average percent cover accounted for by nuisance plant species (all vegetative strata combined).

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from sampling quadrats. These sampling quadrats will be established either along the axis of the belt transects discussed above, or at sampling points established along point-centered quarter transects discussed above, depending on which sampling method is used. Each sampling quadrat will be approximately 1 meter X 1 meter in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the IET and will be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native understory species; composition of native understory

species and the wetland indicator status of each species; average percent cover by invasive plant species; and average percent cover by nuisance plant species.

- Photographs will be taken to document conditions at each permanent monitoring plot and along each permanent monitoring transect. Two photos at each station will be taken, one facing north and one facing south.
- For BLH-Wet and Swamp habitats: A summary of rainfall data will be collected during the year preceding the monitoring report based on rainfall data recorded at a station located on or in close proximity to the mitigation site. Once all hydrology success criteria have been achieved, reporting of rainfall data will no longer be required.
- In addition, various qualitative observations will be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations will include: general estimates of the average percent cover by native plant species in the canopy, midstory, and understory strata; general estimate of the average percent cover by invasive and nuisance plant species;
    - general estimates concerning the growth of planted canopy and mid-story species;
    - general observations concerning the colonization by volunteer native plant species;
    - general observations made during the course of monitoring will also address potential problem zones, general condition of native vegetation, trends in the composition of the plant communities, wildlife utilization as observed during monitoring, and other pertinent factors.
- For mitigation features restored from existing open water areas: Provide a topographic survey of all such mitigation features one year immediately following final construction activities. No additional topographic surveys will typically be required following this survey. However, if this survey indicates topographic success criteria have not been achieved and that supplemental topographic alterations are necessary, then another topographic survey may be required following completion of the supplemental alterations. This determination will be made by USACE in coordination with the IET.
- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.
- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or mid-story strata) have been approved by the USACE in coordination with the IET, monitoring will be required in the year immediately preceding and in the year following completion of the timber management activities (i.e. pre-timber management and post-timber management reports). These reports must include data and information

that are in addition to the typical monitoring requirements. The proposed Timber Stand Improvement/Timber Management Plan must include the proposed monitoring data and information that will be included in the pre-timber management and post-timber management monitoring reports. The proposed monitoring plan must be approved by the USACE in coordination with the IET prior to the monitoring events and implementation of the timber management activities.

Monitoring Reports Following Re-Planting Activities

Re-planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include:

- an inventory of the number of each species planted and the stock size used;
- a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area;
- documented GPS coordinates for the perimeter of the re-planted area. If single rows are replanted, then GPS coordinates should be taken at the end of the transect; and
- all requirements listed under "Additional Monitoring Reports" of the Mitigation Monitoring Guidelines.

Mitigation Monitoring Schedule and Responsibilities

Monitoring will be dependent upon site conditions but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring reports submitted as soon as possible but no later than December 31 of that year.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports throughout the 50 year project life:

1. General Construction
2. Topography
3. Native Vegetation
4. Invasive & Nuisance Vegetation

If the initial survival criteria for planted canopy species are not achieved (i.e. the initial success criteria specified in native vegetation success criteria, the IET will convene to decide by consensus between two remedial actions. 1) Complete replant or supplemental replant or 2) Wait one growing season, monitor for initial success again, and reconvene with the IET to discuss results and determine path forward. If a replant is selected, a monitoring report will be required for each consecutive year until two annual sequential monitoring reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). If the IET decides not to replant, then after one growing season another initial monitoring report will be prepared and the IET will reconvene to determine path forward. The USACE will be responsible for conducting this additional monitoring and preparing the monitoring reports. The USACE will also be responsible for the

purchase and installation of supplemental plants needed to attain the initial success criterion, subject to the provisions mentioned in the Introduction section.

If the native vegetation success criteria specified in the Native Vegetation section are not achieved, a monitoring report will be required for each consecutive year until two annual sequential reports indicate that these criteria have been satisfied.

If timber management activities are conducted, additional monitoring and monitoring reports would be necessary for such activities (e.g. one monitoring event and report in the year immediately preceding timber management activities and one monitoring event and report in the year that timber management activities are completed). Management activities conducted should be documented in the monitoring report.

Twenty years following completion of initial plantings, the number of monitoring plots and/or monitoring transects that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as anticipated.

Component 10: Long-term Management Plan

The USACE shall commit to prevent damage to the mitigation site and be responsible for maintaining the mitigation site(s) in perpetuity.

Component 11: Adaptive Management Plan

Introduction

This Adaptive Management (AM) Plan is for the conceptual mitigation plan for the Proposed Plan in the SEIS No. 2. The Water Resources Development Act (WRDA) of 2007, Section 2036(a) and U.S Army Corps of Engineers (USACE) implementation guidance for Section 2036(a) (CECW-PC Memorandum dated August 31, 2009: "Implementation Guidance for Section *2036 (a) of the Water Resources Development* Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetland Losses") require adaptive management be included in all mitigation plans for fish and wildlife habitat and wetland losses. See appendix K of the SEIS No. 2 for details on the adaptive management of the SLFGWs.

It should be noted that even though the proposed mitigation actions include the potential purchase of credits from a mitigation bank, this section only details the Adaptive Management planning for constructible mitigation features for the project. In the event that mitigation bank credits are purchased the mitigation management and maintenance activities for the mitigation bank credits will be set forth in the Mitigation Banking Instrument (MBI) for each particular bank. The bank sponsor (bank permittee) will be responsible for these activities rather than the USACE. USACE Regulatory staff reviews mitigation bank monitoring reports and conducts periodic inspections of mitigation banks to ensure compliance with mitigation success criteria stated in the MBI.

Adaptive Management Planning

Adaptive management planning would be conducted and the planning elements would include: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management plan is a living document and will be refined as necessary as new mitigation project information becomes available.

Conceptual Ecological Model (CEM)

A conceptual CEM identifies the major stressors and drivers affecting the proposed mitigation projects under the YBW project. The CEM (Table 4) does not attempt to explain all possible relationships of potential factors influencing the mitigation sites; rather, the CEM presents only those relationships and factors deemed most relevant to obtaining the required AAHUs/DUDs/FCUs. Furthermore, this CEM represents the current understanding of these factors and will be updated and modified, as necessary, as new information becomes available.

Table 4 Conceptual Ecological Model

Issues/Drivers	Zone 1	Zone 2	Zone 3	Zone 4
Runoff	+/-	+/-	+/-	*
Vegetative Invasive Species	-	-	-	*
Herbivory	-	-	-	*
Hydrology	+/-	+/-	+/-	*

Key to Cell Codes:
- = Negative Impact/Decrease
+ = Positive Impact/Increase
+/- = Duration Dependent
*Issues and drivers assumed to be addressed in the Mitigation Bank Instrument

Sources of Uncertainty and Associated Risks

A fundamental tenet underlying adaptive management is decision making and achieving desired project outcomes in the face of uncertainties. The project delivery team (PDT) identified the following uncertainties during the planning process.

A. Climate change, such as drought conditions
B. Water level trends at mitigation sites
C. Uncertainty Relative to Achieving Ecological Success:
    - Water, and nutrient requirements
    - Magnitude and duration of wet/dry cycles

- Nutrients required for desired productivity
- Growth curves based on hydroperiod and nutrient application
- Tree litter production based on nutrient and water levels
- Tree propagation in relation to management/regulation of hydroperiod

D. Loss rate of vegetative plantings due to herbivory

E. Long-Term Sustainability of Project Benefits

Adaptive Management Evaluation

As part of the YBW project, the mitigation sites will be further evaluated and planned using the screening criteria to develop a project with minimal risk and uncertainty. The items listed below will be incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) plans to minimize project risks.

- Specified success criteria (i.e., mitigation targets)
- Detailed planting guidelines
- Invasive species control
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet hydrologic success as required (contingency)

Subsequently, as part of the adaptive management planning effort, the mitigation project features will be re-evaluated against the CEM and sources of uncertainty and risk will be identified to determine if there is any need for additional actions and costs under the adaptive management plan to ensure that the project meets the required success criteria. Based on the uncertainties and risks associated with the project implementation, contingency actions may be identified for implementation if needed to ensure the required AAHUs/DUDs/FCUs are met.

1. Potential Action #1. Additional vegetative plantings as needed to meet identified success criteria.
    - Uncertainties addressed A,B,C,D, E

2. Potential Action #2. Revise the pump station operation plan to accommodate BLH vegetative success and maintenance.
    - Uncertainties addressed: A,B,C,E

3. Potential Action #3. Revise the operation of the water control structures at Little Sunflower and/or Steele Bayou to accommodate BLH vegetative success and maintenance.
    - Uncertainties addressed: A,B,C,E

4. Potential Action #4. Construct ditches, culverts, and/or other small water control features within the BLH mitigation areas.

    - Uncertainties addressed: A,B,C,E

5. Potential Action #5. Invasive species control to ensure survival of native species and meet required success criteria.
    - Uncertainties addressed: E

Actions 1 and 5 are not recommended as separate adaptive management actions since they are already built into the mitigation plan and success criteria. In the event that monitoring reveals the project does not meet the identified vegetation, or hydrologic success criteria, additional plantings or construction activities would be conducted under the mitigation project.

Action 2 is potentially a very controversial action. If it is determined that the project benefits are significantly compromised because of pump station operation, revised operations would be considered. Due to the potential impacts to flood risk reduction by revised operations of the pump station, this action may not be a viable remedial action.

Action 3 would likely be the most acceptable and appropriate corrective action. However, revisions to these water control structures are limited to times when the conditions are just right. Condition are usually only right in the fall, and therefore this action may not offer enough environmental benefits to remediate the mitigation shortfalls.

Action 4 has been considered in past projects and has been determined to be costly and doesn't provide much environmental benefits.

Before implementing any such actions, the Corps would coordinate with the IET to determine if other actions, such as purchasing of credits in a mitigation bank, increasing the size of the existing mitigation project, or building additional mitigation elsewhere, would be more acceptable options to fulfill any shortfalls in the overall project success. However, such options would have to undergo further analysis in a supplemental NEPA document. The USACE would be responsible for performing any necessary corrective actions.

The USACE would be responsible for the proposed mitigation construction and would monitor the project for the full 50 year project life. The USACE would the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. If after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, the USACE would consult with the IET to determine the appropriate management or remedial actions required to achieve ecological success. The USACE would retain the final decision on whether or not the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If structural changes are deemed necessary to achieve ecological success, the USACE would implement appropriate adaptive management measures in accordance with the contingency plan, availability of funding, and current budgetary and other guidance.

Component 12: Financial Assurances

Financial assurances are required to ensure that the compensatory mitigation project would be successful. In this case, the USACE-MVK must operate and maintain the mitigation project for the full 50 year project life.

Appendix J Attachment #1

PLANTING GUIDELINES FOR BOTTOMLAND HARDWOOD (BLH) HABITATS

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 18-foot centers (average) to achieve a minimum initial stand density of 134 seedlings per acre. Stock will be at least 1 year old, at least 2 feet in height, have a minimum root collar diameter of 3/8 inch, have a root length of at least 8 to 10 inches with at least 4 to 8 lateral roots, and must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events such as spring flooding may delay plantings until late spring or early summer. The seedlings will be installed in a manner that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

Species for Wet Bottomland Hardwood Habitats (BLH-Wet Habitats)

The canopy species installed will be in general accordance with the species lists provided in Tables 1A and 1B. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 60% hard mast-producing species (Table 1A) and approximately 40% soft mast-producing species (Table 1B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 1A and 1B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 1C. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table 1A: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (60% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Nuttall oak	*Quercus nuttalli, Q. texana*	30% - 40%
Willow oak	*Quercus phellos*	30% - 40%
Water oak	*Quercus nigra*	5%
Overcup oak	*Quercus lyrata*	10% - 20%
Swamp chestnut oak	*Quercus michauxii*	10% - 20%
Water hickory	*Carya aquatica*	10% - 20%

Table 1B: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (40% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	15% - 25%
Sugarberry	*Celtis laevigata*	15% - 25%

Green ash	*Fraxinus pennsylvanica*	15% - 25%
Sweetgum	*Liquidambar styraciflua*	10% - 20%
American elm	*Ulmus americana*	10% - 20%
Bald cypress	*Taxodium distichum*	5% - 15%

Table 1C: Preliminary Planting List for Wet Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Saltbush	*Baccharis halimifolia*	TBD
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Mayhaw	*Crataegus opaca*	TBD
Green hawthorn	*Crataegus viridis*	TBD
Common persimmon	*Diospyros virginiana*	TBD
Honey locust	*Gleditsia triacanthos*	TBD
Possumhaw	*Ilex decidua*	TBD
Dahoon holly	*Ilex cassine*	TBD
Red mulberry	*Morus rubra*	TBD
Wax myrtle	*Myrica cerifera*	TBD

TBD = To Be Determined

Species for Dry Bottomland Hardwood Habitats (BLH-Dry Habitats)

The canopy species installed will be in general accordance with the species lists provided in Tables 2A and 2B. Plantings will be conducted such that the total number of plants installed in a given area consists of approximately 50% hard mast-producing species (Table 2A) and approximately 50% soft mast-producing species (Table 2B). The species composition of the plantings for each of the two groups of canopy species (e.g. hard mast species and soft mast species) should mimic the percent composition guidelines indicated in Tables 2A and 2B. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in these tables. In general, a minimum of 3 hard mast species and a minimum of 3 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 2C. Plantings will consist of at least 3 different species. The species used and the proportion of the total midstory plantings represented by each species (percent composition) will be dependent on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability.

Table 2A: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Hard Mast-Producing Canopy Species (50% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Nuttall oak	*Quercus nuttalli* or *Q. texana*	10%
Willow oak	*Quercus phellos*	10%
Water oak	*Quercus nigra*	20%
Live oak	*Quercus virginiana*	20%
Cherrybark oak	*Quercus pagoda*	5%
Sweet Pecan	*Carya illinoensis*	20%
Southern red oak	*Quercus falcata*	5%
Cow oak	*Quercus michauxii*	10%

Table 2B: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Soft Mast-Producing Canopy Species (50% of Total Canopy Species)

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	10%
Sugarberry	*Celtis laevigata*	15%
Green ash	*Fraxinus pennsylvanica*	15%
Sweetgum	*Liquidambar styraciflua*	20%
American elm	*Ulmus americana*	10% - 20%
Common persimmon	*Diospyros virginiana*	15%
Red mulberry	*Morus rubra*	5 - 10%
American sycamore	*Platanus occidentalis*	0 - 5%
River birch	*Salix nigra*	0 - 5%
Honey locust	*Gleditsia triacanthos*	0 – 5%

Table 2C: Preliminary Planting List for Dry Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Roughleaf dogwood	*Cornus drummondii*	TBD
Mayhaw	*Crataegus opaca*	TBD
Green hawthorn	*Crataegus viridis*	TBD
Deciduous holly	*Ilex decidua*	TBD
Yaupon	*Ilex vomitoria*	TBD
Palmetto	*Sabal minor*	TBD
Southern wax myrtle	*Morella cerifera*	TBD
Southern magnolia	*Magnolia grandiflora*	TBD
Southern crabapple	*Malus angustifolia*	TBD
Eastern red cedar	*Juniperus virginiana* var. *virginiana*	TBD
Elderberry	*Sambucus canadensis*	TBD

TBD = To Be Determined

Deviations from Typical Planting Guidelines

Proposed mitigation features that involve restoration will commonly require planting the entire feature using the prescribed planting guidance addressed in the preceding sections. In contrast, mitigation features that involve enhancement will often require adjustments to the typical plant spacing/density guidelines and may further require adjustments to the guidelines pertaining to species composition.

Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The initial enhancement actions involved within a particular mitigation site could include a variety measures such as the eradication of invasive and nuisance plant species, topographic alterations (excavation, filling, grading, etc.), and hydrologic enhancement actions (alterations to drainage patterns/features, installation of water control structures, etc.). These actions may result in areas of variable size that require planting of both canopy and midstory species using the typical densities/spacing described previously. There may also be areas where several native canopy and/or midstory species remain, thus potentially altering the general guidelines described as regards the spacing of plantings,

and/or the species to be planted, and/or the percent composition of planted species. Similarly, areas that must be re-planted due to failure in achieving applicable mitigation success criteria may involve cases where the general guidelines discussed above will not necessarily be applicable.

Given these uncertainties, initial planting plans specific to enhancement features will be required and must be specified in the Mitigation Work Plan for the mitigation site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared in cooperation with the Interagency Team prior to re-planting.