APPENDIX J: MITIGATION

COMPENSATORY MITIGATION

Presented in this document is a proposed plan for mitigating and monitoring the foreseeable effects of the proposed action. The plan is the first part of a two phased mitigation approach that begins with: mitigation alternative plan formulation and development.; refinement of tract-specific measures and monitoring parameters; and continues, as needed, as determined on a tract by tract basis with additional long-term monitoring and adaptive management measures.

The information presented in this document serves as a compensatory mitigation plan according to the requirements of the Mitigation Rule, as set forth in Compensatory Mitigation for Losses of Aquatic Resources, 33 CFR part 332. Although the Mitigation Rule requires mitigation for impacts to aquatic resources, as per section 404 of the CWA, mitigation is also proposed for impacts to fish and wildlife resources in non-jurisdictional areas, as per USACE policy (Engineer Regulation 1105-2-100).

Instead of a reforestation plan that solely bases mitigation on an overall acreage or location, a flexible mitigation strategy is recommended for a variety of reasons. First, a single mitigation measure does not compensate for all resources in which impacts were quantified. For example, land side reforestation may not provide compensatory benefits, as determined by ecological models, to waterfowl or aquatic resources. Second, site-specific mitigation tracts have not been identified. Once sites are selected and acquired, decisions on the implementation of mitigation measures described below would be made based upon tract-specific parameters such as soil conditions, anticipated hydrology, elevation, etc. These tract-specific parameters would influence the overall mitigation credit determination and determine appropriate types of vegetation that could be planted (*e.g.*, cypress trees are more flood tolerant than red oaks). Lastly, flexibility is required to address site-specific issues that may arise, such as whether or not the intended mitigation is functioning as designed, as well as to make future adaptive management decisions. Adaptive management is discussed in greater detailed later in this document.

The overall mitigation requirements are based on the impacts described in the draft supplement and the anticipated gains from mitigation measures that are discussed below and in applicable environmental appendices. Many factors can influence the overall amount of mitigation credit that any one specific tract can provide. For example, areas that flood more frequently and for longer durations provide greater benefits to waterfowl. These areas generally occur at the lowest elevations within the project area. Therefore, the following approach defines the overall amount of mitigation based as habitat or functional units and not on overall acreages. Likewise, there are many different soil types found in the project area. Different soil types provide varying mitigation opportunities, such as whether or not the site could hold water for long durations, which would influence the different types of vegetation that could be planted.

Once potential mitigation tracts are identified, a site-specific, detailed mitigation plan comprising the mitigation measures recommended below would be developed in coordination with the interagency team consisting of the USFWS, EPA, MDWFP and MDEQ. Mitigation benefits would be quantified on a tract-by-tract basis, and mitigation would not be considered complete until all impacted habitat/functional units have been compensated. Mitigation sites would be monitored to verify mitigation benefits, and USACE is committed to adaptively managing the project should initial restoration efforts be determined unsuccessful.

Mitigation Plan Formulation

The preferred alternative incorporates environmental design features which reduce anticipated impacts to aquatic, terrestrial, wetland, and waterfowl resources. However, unavoidable impacts to significant resources remain. These impacts require the development of a compensatory mitigation plan. An array of mitigation alternatives were analyzed to determine a recommended mitigation plan as part of the overall preferred alternative.

Amongst the array of mitigation alternatives considered (*i.e.*, no-action, natural succession, active reforestation, mitigation banks and supplemental low flow groundwater wells), active reforestation in combination with GPW was identified as the proposed mitigation plan.

Compensatory Mitigation Measures

Constructing flood risk reduction improvements may affect a variety of resources, though the scope and scale of impact would depend on several factors including underlying land use, flood frequency, and flood duration. As some proposed flood risk reduction features have potential to affect multiple resources, some mitigation measures have potential to compensate for multiple resources. Mitigation that compensates for impacts to multiple resources is usually of greater incremental value than that which does not. However, not all mitigation measures compensate for impacts to multiple resources. Table 1 synopsizes the expected benefits from several mitigation measures.

Table 1. Compensatory mitigation benefits by restoration measure

Restoration Measure	Wetlands	Terrestrial Wildlife	Waterfowl	Fisheries
Riverside Vegetated Wetland Restoration	X	X	X	X
Frequently Flooded/Hydrologically Connected Landside Vegetated Wetland Restoration	X	X	X	X
Moderately Flooded Landside Vegetated Wetland Restoration		X		X
Mitigation Bank Credit	X	TBD	TBD	TBD
Supplemental Low Flow Groundwater Wells	TBD	TBD	TBD	X

In addition to the measures depicted in Table 6.1, preserving high-value ecological resources may be appropriate on a case-by-case basis. The Mitigation Rule allows for preservation under the following circumstances:

- the resources to be preserved provide important physical, chemical, or biological functions for the watershed;

- the resources to be preserved, as shown by the results of quantitative assessments, contribute significantly to the ecological sustainability of the watershed;

- preservation is appropriate and practicable;

- the resources are under threat of destruction or adverse modifications; and

- the preserved site would be permanently protected through an appropriate real estate or other legal instrument

Mitigation tracts with potential to be preserved would be screened using these five criteria. Although the Mitigation Rule states that higher mitigation ratios are generally required for preservation, preservation for this project would be based on the same ecological models that were used to determine project impacts. Should preservation be considered, the inter-agency team would be engaged in the site selection process and in determining the appropriate number of mitigation credits for each site.

Vegetated Wetland Restoration

The vegetative restoration on agricultural tracts involves preparing the site, restoring site-specific hydrology (*e.g.*, plugging farm drains, plugging ditches, etc.) as needed, and reforesting cleared/agricultural areas with species that naturally occur or historically occurred within the project area. Tract-specific conditions are required to be known prior to determining specific details such as species of trees to be planted. However, these sites would exhibit hydric soils and would be planted with a mixture of hydrophytic saplings associated with high wetland habitat values described in Smith and Klimas (2002). This mixture would include a minimum of fifty percent hardwood species. Likewise, site-specific tracts are required to be known to refine compensatory mitigation benefits of any particular mitigation tract. Restoration includes the following:

- Reestablishment of micro/macrotopography – Project area lands have often been laser leveled/graded to promote drainage. Reestablishment of land heterogeneity is accomplished by excavating areas within the mitigation tract and side casting the material to create topographical variation, such as ridge and swale complexes. The overall topography restoration design depends on site specific conditions and geomorphological characteristics.

- Site-Specific Hydrologic Restoration – Farm fields within the project area have often undergone past hydrologic modifications to promote drainage. These modifications include but are not limited to ditches, culverts/farm drains, perimeter levees, water control structures, sluice gates, etc. These structures would receive hydrologic restoration including removal/capping to promote water detention/retention.

- Deep Disking/Sub-soiling – Depending on soil conditions, sites could be sub-soiled prior to tree planting to promote growth. Sub-soiling is necessary in some areas due to the results of decades of agricultural practices that have created a hard-pan layer that is problematic for root development.

- Tree Planting – Trees would be planted by using a variety of techniques but could include direct seeding/acorns, seedlings, or natural regeneration. The species of trees, as well as the appropriate planting method, would be described in the detailed tract-specific mitigation plans as approved by the interagency team. However, for the

purposes of mitigation benefit determinations, a general assumption that all mitigation tracts would be composed of a minimum of fifty percent mast producing species was used.

Herbaceous wetlands could also be restored on a portion of some tracts to the extent practicable. For example, planting trees and restoring topographical features may not be necessary due to expected flood durations; therefore, herbaceous wetlands would be allowed to regenerate naturally in these areas.

Although unlikely to be implemented, preservation of bottomland hardwoods could also be considered for compensatory mitigation in exceptional circumstances, and in concert with the inter-agency team. However, mitigation determination assumptions discussed below assume no preservation credits would be provided.

Mitigation Banks and In-Lieu-Fee Programs

When appropriate and applicable, USACE shall consider the purchase of credits from approved mitigation banks and in-lieu-fee programs in the impacted watershed to be a reasonable compensatory mitigation alternative. Therefore, 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 should the cost of proposed mitigation methods exceed those from an available commercial mitigation bank.

Establishment of Watershed Mitigation Zones

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, with the exception of a few isolated, relatively small patches of bottomland hardwoods.

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).

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 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:

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

- Mitigation Zone 2: Agricultural lands within the 14-day consecutive inundation zone (*e.g.*, frequently flooded and impounded/backwater areas).

- 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).

- Mitigation Zone 4: Mitigation Bank

- Mitigation Zone 5: Supplemental Low Flow Groundwater Wells

In the event that 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.

<u>Mitigation Zone 1:</u> 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 2,658 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 15,868 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 Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (60 Fed. Reg. 58605), USACE, 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 and bottomland hardwood habitat 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 Engineering Regulation 1105-2-100.

Mitigation Zone 5: Supplemental Low Flow Groundwater Wells

In addition to bottomland hardwood restoration and consideration of mitigation banks to offset project induced impacts, USACE has determined that a portion of the unavoidable aquatic loses (attributed to Hypoxia) could be offset by out of kind mitigation through the installation of 34 GPW. The GPW 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; increasing periodic fish passage; and riparian buffer zone establishment on as much as 650 miles of agricultural ditches and streams in the upper Big Sunflower and Steele Bayou drainage basins. For additional details on potential fisheries benefits, please refer to the Aquatics Appendix.

Mitigation Implementation

Following a project decision, USACE would acquire mitigation lands in accordance with Federal law. It is anticipated that lands would be acquired from willing sellers. Landowners would be queried in the project area regarding their willingness to sell. Once suitable tracts available to be acquired are identified, preliminary information (*e.g.*, landscape position, hydrology, etc.) would be gathered to implement the most beneficial and practicable means of restoration. For example, based on the preliminary information, a determination would be made whether or not to restore micro-topography, plant a certain percentage of mast species, or develop the site to herbaceous marsh/riverfront forest mix.

Upon acquisition, a draft, tract-specific mitigation plan would be developed in coordination with and disseminated for review to the inter-agency team, in accordance with the overall concepts described in this draft supplement with tract-specific refinements. Applicable levee and drainage districts and other applicable landowners would also be coordinated with during the completion of each tract-specific detailed mitigation plan. The tract-specific mitigation plans would contain baseline information, planned earthwork activities, hydrologic restoration features, and anticipated compensatory mitigation benefits quantified in a consistent manner in which impacts were quantified. Additional information is found in the following sections. Following an opportunity for the interagency team to comment and any issue resolution on the draft plan, a final plan for each tract would be formally submitted for purposes of any water quality certification requirements. Mitigation will progress prior to or concurrent with construction. Larger tracts of land and lands adjacent to large forested blocks will be targeted due to the increased habitat value and long-term management considerations (Elliott et al. 2020, Murray and Klimas 2013). USACE will develop and maintain a database of identifying its mitigation needs, approved mitigation plans, and construction-related impacts.

Identification and treatment of historic properties, in compliance with NHPA, will be included in the development of tract-specific detailed mitigation plans. USACE will consult with federally recognized Tribes, the State of Mississippi SHPO, and other interested parties. Mitigation sites will be surveyed to determine whether mitigation proposals will affect historic properties. Protection of cultural resources sites that may be identified will be incorporated into the natural resources mitigation plan and long-term management of mitigation lands(s).

HTRW site assessments would also be conducted on any potential mitigation tract to gather and evaluate data regarding the existence or potential for encountering HTRW. USACE is obligated under Engineer Regulation (ER) 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all HTRW contamination within the vicinity of proposed actions. ER 1165-2-132 identifies that HTRW policy is to avoid the use of project funds for HTRW removal and remediation activities.

Additionally, mitigation bank options will be pursued if applicable and as described above during detailed mitigation plan development. However, for the purposes of mitigation determinations described below, no mitigation banking credits are assumed. Should mitigation bank credits be purchased to offset project impacts, credit determination would be assessed and overall project mitigation requirements adjusted accordingly.

Determination of Mitigation Credits

Assumptions and calculations regarding mitigation are discussed within the Significant Resources Assessments in Section 5 of the draft supplement and their corresponding appendices. Tables 2 and 3 summarize impacts and required mitigation associated with the recommended plan.

Table 2 Summary of proposed project impacts

Significant Resource	Measurement Unit	Change
Wetlands	FCU	-11,498
Waterfowl	DUD	-1,349,228
Terrestrial Wildlife	AAHU	-267.6
Aquatic Resources	AAHU	-1,940

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] -267.6	Aquatic Resources (AAHU) -1,940
Compensatory Mitigation Benefits and Anticipated Required Acreage by Zone					
BLH-Zone1	545.0	2,606	794,521	1,495.2	2,405
BLH-Zone2	1,860	8,892	2,711,577	4,896.5	
BLH-Zone3	N/A	N/A	N/A	N/A	
GPW-Zone 5	N/A	N/A	N/A	N/A	9,321

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 GPW, mitigation zone 5, is proposed to compensate remaining aquatic impacts (Table 7.3). Therefore, actively restoring 2,405 acres of agricultural land to bottomland hardwood forest and constructing 34 GPW would fully compensate for impacts to fisheries 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.

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).

<u>Mitigation Zone 1 – Batture Lands</u>

There are areas in the batture within the project area that could be restored. Active restoration includes bottomland plantings 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

- 387 aquatic resources AAHU

<u>Mitigation Zone 2 – Lands within the Post-Project 14-day Consecutive Inundation Zone</u>

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.

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 should the cost of proposed mitigation methods exceed those from an available commercial mitigation bank. 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.

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 supplemental low flow groundwater wells 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 GPW in Mitigation Zone 5 is estimated to provide:

- Approximately 1,678 AAHUs

Compliance with Mitigation Rule

USACE and EPA regulations on Compensatory Mitigation for Losses of Aquatic Resources (collectively “the Mitigation Rule”) prescribe that mitigation plans for compensatory mitigation projects shall contain the following twelve elements: (1) objectives; (2) site selection criteria; (3) site protection instruments (e.g., conservation easements); (4) baseline information (for impact and compensation sites); (5) credit determination methodology; (6) mitigation work plan; (7) maintenance plan; (8) ecological performance standards; (9) monitoring requirements; (10) long-term management plan; (11) adaptive management plan; and (12) financial assurances. See 33 C.F.R. § 332.4(c) and 40 C.F.R. § 230.94(c).

Each of the twelve criteria is discussed in order. Please note that if mitigation banks or in-lieu-fee credits are pursued during later phases, the mitigation plan only requires the baseline information and credit determination methodology for the purposes of purchasing credits, per 33 C.F.R. § 332.4.

1. Objective

The objective of mitigation is to avoid, minimize, and compensate environmental impacts. It is the policy of the USACE Civil Works program to avoid and minimize impacts to terrestrial and aquatic resources to the extent practicable, and that unavoidable impacts are compensated. A variety of measures to avoid and minimize impacts are described in the draft supplement. Compensatory mitigation for unavoidable impacts is described in this section and the other resource-specific appendices. Although mitigation ratios are commonly used for USACE-permitted activities, a more rigorous function- and habitat-based assessment was used to determine what and how much mitigation would be appropriate in this case. Each ecological model used in this case underwent independent review; all were determined to be suitable. The models use a temporal lag that considers the amount of time necessary to achieve habitat and function replacement. In 33 C.F.R. § 332.2(f), it states:

> *If the district engineer determines that compensatory mitigation is necessary to offset unavoidable impact to aquatic resources, the amount of required compensatory mitigation must be, to the extent practicable, sufficient to replace lost aquatic resource functions. In cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used.*

Table 2 shows the unavoidable impacts reasonably likely to occur if the preferred alternative is implemented. Thus, the overall objective of mitigation is to compensate for impacts provided in Table 2 using methods outlined in Table 3.

Within the overall framework of active reforestation through bottomland hardwood planting, tract-specific objectives will be developed for each tract-specific mitigation plan containing species planting recommendations and densities. Since some mitigation measures benefit multiple resources, the mitigation objectives for each to-be-acquired tract would reflect this by clearly stating the anticipated benefits for each resource.

2. Site Selection Criteria

As previously stated, site-specific mitigation tracts have not yet been identified or acquired. Should a Record of Decision be signed implementing the preferred alternative, landowners in the proposed mitigation zones would be surveyed to identify willing sellers. Preliminary information would then be gathered on each prospective tract including hydrological conditions, elevation, soil characteristics, habitat connectivity, compatibility with adjacent land uses, geomorphic setting, adjacent drainage patterns, and proximity and relation to other desirable tracts, and then each tract would be assessed for suitability and sustainability, and prioritized accordingly for acquisition. These tract-specific parameters would influence the specific types of vegetation that would be planted. It is reasonable to presume that this process would take

several years before all needed lands are identified and purchased and all compensatory mitigation is satisfactorily accomplished. Because the undertaking would be long and complex and would be coordinated with the inter-agency team, USACE would build flexibility and adaptability into the process to, among other things, adjust to changes in the willingness of prospective sellers to convey property to the Government. Therefore, landowners would be periodically surveyed on their amenability to sell land.

3. Site Protection Instruments

Federal policy permits several different real estate acquisition methods for the Federal Government to procure interests in real estate. Interests that may be acquired, all of which are intended to be perpetual, include fee title, third-party conservation easements, and restrictive covenants.

All compensatory mitigation lands retained in private ownership, but subject to third-party conservation easements, would be inspected on an annual basis according to the terms and conditions of the easement. Supplemental or corrective action would be taken, as needed.

Details on the real estate mechanism(s) needed for each site would be incorporated into each tract's site-specific mitigation plan.

4. Baseline Information

Information on the most recent conditions pertaining to each prospective mitigation site would be acquired and assessed as part of the process of preparing tract-specific detailed mitigation plans. This would include project future (without mitigation) hydrology, soil types, elevations, delineation of waters of the United States (if applicable), and geomorphologic characteristics. In addition, where practical, historic conditions (*i.e.*, prior to large-scale ditching) would also be described. Finally, any information on historical and cultural resources, as well as any hazardous contamination, would also be included.

5. Credit Determination Methodology

The amount of compensatory mitigation credits provided for each resource would be calculated for each specific compensatory mitigation tract using the same models and assumptions employed to determine impacts. Additional information regarding impact analyses and calculations used in mitigation determinations are discussed in Section 5 of the draft supplement and each resource-specific appendix.

6. Mitigation Work Plan

Mitigation features are discussed throughout the draft supplement and each resource specific appendix. However, the mitigation work plan would be refined for each tract-specific mitigation plan. Each tract-specific work plan would include the following information:

- Geographic boundaries of the site
- Mitigation implementation methods, sequencing, and timing of implementation

- Hydrologic sources including projected future flood frequency elevations and site specific additional sources (*e.g.*, plugging farm drains, perimeter levee degradation), connections, durations, depths, timing, and fish access measures

- Detailed plantings (*e.g.*, natural regeneration, 10-12-foot center seedlings plantings, direct seeding)

- Proposed grading plans, including the establishment of micro-topography and sub-soiling

- Soil management and erosion control measures

7. Maintenance Plan

In 33 C.F.R. § 332.7(b), it states the following: "mitigation projects should be designed, to the maximum extent practicable, to be self-sustaining once performance standards have been achieved. This includes minimization of active engineering features (*e.g.*, pumps) and appropriate siting to ensure that natural hydrology and landscape context would support long-term sustainability. Where active long-term management and maintenance are necessary to ensure long-term sustainability (*e.g.*, prescribed burning, invasive species control, maintenance of water control structures, easement enforcement), the responsible party must provide for such management and maintenance. This includes the provision of long-term financing mechanisms where necessary".

The proposed bottomland hardwood reforestation sites are anticipated to be maintenance-free and self-sustaining once established. USACE would be responsible for any routine maintenance (*e.g.*, mowing, minor repair of any water retention features, invasive species control). Routine maintenance would be identified in each tract-specific mitigation plan. Maintenance of the 34 supplemental low flow groundwater wells would be the responsibility of the Vicksburg District.

8. Ecological Performance Standards

The goal of mitigation is to compensate significant unavoidable impacts to the extent justified and mandated by law. Therefore, the ecological performance standards for the overall project are as follows:

- 11,498 wetland FCU

- 267.6 terrestrial wildlife AAHU

- 1,349,228 waterfowl DUD

- 1,940 aquatic resource AAHU

As presented, these values would mitigate the impacts of the preferred alternative. However, to measure how effectively each site-specific tract is achieving the desired outcome through time, monitoring reports would be prepared at a frequency of 5 year intervals during the 0-20 year post mitigation period and at 10 year intervals during the 20-50 year post mitigation period to establish baseline conditions at mitigation locations and document changes in wetland function or habitat suitability over time.

These methods have proven effective for identifying shifts in wetland functional capacity and habitat over multiple time intervals including short- (*e.g.*, 0-5 year), mid- (*e.g.*, 5-10 year) and long (*e.g.*, >20 year) and implementation of a multi-year HGM assessment protocol will document functional capacity changes over the period of analysis (Berkowitz 2019).

Success criteria, which are early indicators of meeting overall ecological performance standards, would be considered achieved when the monitoring parameters summarized in Table 6.4 have been met. However, considering the size of the project area and the diverse array of hydrologic and ecological conditions contained within, definitive and localized success criteria would be further refined during the completion of each tract-specific mitigation plan. Additionally, each tract-specific mitigation plan would provide the anticipated mitigation benefit to each modeled ecological resource. Therefore, the ecological success of mitigation is quantified in a consistent manner with the way impacts were quantified.

Table 6.4. Preliminary compensatory mitigation monitoring parameters.

Mitigation Type	Monitoring Parameter
Bottomland Hardwood Reforestation	* Vegetation Present (percent composition, diversity, percent coverage)
	* Success of Planted Vegetation
	* Hydrology Functioning as Designed (duration, depth, timing)
	* HGM Variables
	* EnviroFish Variables

Vegetation

Vegetation would be monitored by visually inspecting each mitigation site annually for a period of five years. Parameters measured would include vegetation present (percent composition), success of planted vegetation, diversity, and percent coverage. Anticipation and desire are that, in addition to plantings, early successional species would colonize lower elevation mitigation sites, and that the established mitigation sites would be subject to self-design (*i.e.*, recipient of beneficial seasonal flood pulses) and not human desire (*i.e.*, minimal earthwork). Therefore, recommendations of percent survivorship of the newly planted vegetation are not recommended, but would measure percent composition to be analyzed in accordance with each respective ecological model. Instead, the project plan assumes that micro/macro-topography and hydrology would influence both native plant communities as well as species to be planted at each respective mitigation site.

Hydrology

Hydrology could be monitored by a variety of methods. Gages could be installed to provide daily sump elevations which measure, and therefore monitor, hydrologic parameters (flood timing, duration, and depth) of the mitigation sites. Likewise, the existing Mississippi/Yazoo River gages could be used to determine hydrology for mitigation zone 1 reforestation sites. Please note,

gages would only measure inundation, not saturation. Therefore, hydrologic performance standards would be determined and included during the completion of each tract-specific mitigation plan.

9. Mitigation Tract Monitoring Requirements

As previously noted, mitigation and monitoring would be conducted in two distinct phases. Regardless of phase, monitoring would continue until such time as success criteria have been met per WRDA 2007, as the focus on monitoring is to answer whether or not the mitigation tracts are providing the anticipated benefits. Therefore, monitoring would include the development of baseline conditions that are present pre-mitigation implementation. Post mitigation-implementation would be compared to pre-implementation to measure success. In Phase 1 of mitigation, each compensatory mitigation tract would be monitored a minimum of 3 times within the first 10 years (typically at years 1, 5, and 10 post-planting). A site-specific monitoring report would be prepared with each monitoring event and results furnished to the inter-agency team. In Phase 2 of mitigation, overall project impacts and benefits would also be monitored through the use of the same ecological models used to determine project impacts and compensatory mitigation requirements (*i.e.*, DUD, HEP, HGM, EnviroFish) to determine ecological conditions over time. The specific parameters are listed in each resource specific appendix.

10. Adaptive Management Plan

The Mitigation Rule requires adaptive management of mitigation sites. As previously discussed, USACE intends to conduct adaptive management in two phases. The primary focus of phase 1 monitoring and adaptive management is to determine whether each specific tract has become successfully established, or if changes to the tract-specific mitigation plan are warranted. After the initial 10-year monitoring time frame, the site-specific mitigation monitoring report, developed in coordination with the inter-agency team, would recommend whether adaptive management measures be implemented or proceed to phase 2 monitoring, which would measure anticipated benefits of the mitigation tract according to the ecological models used to determine impacts. Additionally in phase 2, the project area would be monitored for changes in land use, mitigation measures, hydraulics, and hydrology. Results of monitoring would be used to replicate the modeling conducted for this draft supplement to quantify project impacts. These results would be provided in phase 2 monitoring reports, developed in coordination with the inter-agency team.

Phase 1 Adaptive Management Report

An adaptive management report would be completed for each mitigation tract following phase 1 monitoring within the first 10 years of planting. The purpose of this report is to determine if mitigation implementation was successful or if changes are required (*i.e.*, adaptive management). Each report would provide details on the type of mitigation planned and anticipated habitat benefit (*i.e.*, what was stated in the detailed tract-specific management plan), as-built drawings (if applicable), and monitoring results. The following conclusions would be made as a result of monitoring:

<u>Scenario A – Success</u>

If the tract is functioning as designed (vegetation and hydrology established), or is achieving greater results than expected to each ecological resource (aquatics, wetlands, etc.), ecological

success is considered achieved and the site will enter long-term management (see Long-Term Management Plan).

Scenario B – Partial Success

There may be some instances in which one particular resource is being compensated at planned levels while others are not. An example is whether planted vegetation becomes established. Tree survivorship influences some models but not others. Likewise, some HGM functions require tree survivorship (*i.e.*, maintain plant communities) while other functions (*i.e.*, detain floodwater) do not. Therefore, in the event that no planted trees survive but the site has naturally vegetated with pioneer species, ecological success may be achieved for some resources and not others.

Each adaptive management report would discuss the reason for the success of any particular resource or wetland function in comparison to others. Since the project over-compensates some resources, remedial actions may not be warranted. Instead of immediately rectifying a deficiency, data from other monitoring sites would first be used to determine the overall resource category level of compensation. If results from other tracts determine that the resource has been compensated, ecological success would be considered achieved and the tract would enter long-term management (see Long-Term Management Plan).

If results from other tracts determine that the resource has not been compensated, remedial action would take place on the site (see Tract Specific Remedial Actions). Results would be furnished to the interagency team prior to making any adaptive management decision.

Scenario C – Mitigation Deficiency

One or more resources are not functioning, as anticipated under Scenario C, and mitigation is considered deficient. Therefore, remedial action is necessary (see Tract Specific Remedial Actions).

Tract-Specific Remedial Actions

Adaptive management remedial actions would first attempt to remedy the cause of the deficiency on the site-specific tract. A contingency has been added to the overall mitigation costs, as described in the Mitigation Cost Appendix and included in mitigation alternative plan formulation. Included in this contingency is the cost of real estate, mitigation planning, mitigation implementation, invasive species control, and monitoring. Therefore, potential remedial action costs such as replanting or addressing erosion concerns are included in the cost estimate as a contingency cost.

Following remedial actions, monitoring would continue until the initial success criteria have been met, and a subsequent adaptive management report would be prepared.

Phase 2 Adaptive Management

In addition to the monitoring required for each mitigation tract, the overall project would be monitored to determine if assumptions made in the draft supplement are valid and validate uncertainties (*e.g.*, temporal gains and losses) identified through the course of inter-agency coordination and IEPR.

The objectives of Phase 2 adaptive management are:

- Determine the environmental response to the action implemented
- Determine whether observed responses match expected ecological success outcomes
- Provide continuous improvement to changed conditions and new information

Accomplishment of these objectives would be determined by replicating the environmental modeling used to assess impacts in the draft supplement at prescribed intervals over a 50-year period (*i.e.*, the expected project life of the flood risk reduction improvements proposed to be constructed). A repeated measures approach of data collected using the ecological models within mitigation sites will include data gathered upon site acquisition and at a minimum frequency of 5 year intervals during the first 20 year post mitigation construction period and at 10 year intervals during the 20-50 year post mitigation period. These methods have proven effective for identifying shifts in wetland functional capacity and habitat over multiple time intervals including short- (*e.g.*, 0-5 year), mid- (*e.g.*, 5-10 year) and long (*e.g.*, >20 year) and implementation of a multi-year protocol will document functional capacity changes over the period of analysis (Berkowitz 2019). These adaptive management reports would be prepared relative to the time that the improvements become operational and thereafter, until the ecological success criteria have been met.

The project area would be monitored for changes in land use, mitigation measures, hydraulics, and hydrology using variables described above and contained within the ecological models used. Results of monitoring would be used to replicate the modeling conducted for this draft supplement to quantify project impacts. Therefore, the same models (*i.e.*, EnviroFish, DUD, HEP, HGM) that were used to quantify impacts would be used to monitor the project area. These results would be provided in the adaptive management reports.

11. Long-Term Management Plan

Under current authorities and policies, mitigation lands acquired in fee by the Federal Government could be managed by State agencies or Federal agencies once mitigation acquisition is completed and determined to meet ecological success criteria. It is the intent of USACE to turn over mitigation lands to a suitable third party for long-term management. However, USACE is ultimately responsible in ensuring that mitigation is achieved and maintained.

12. Financial Assurances

Financial assurances, including mitigation and monitoring requirements, are included in the project costs and would be subject to the Federal Government's annual appropriations.