Appendix E: General Mitigation Plan

Table of Contents

List of Tables

Preparation and Approval of Mitigation Plans

Component 1: Objectives

The components of this general mitigation plan apply to Corps-constructed mitigation projects.

The objective of this mitigation plan is to evaluate potential mitigation options that could satisfy the mitigation requirement for the tentatively selected plan (TSP) of the Upper Barataria Basin Louisiana (UBB) Integrated Feasibility Report (IFR) and Environmental Impact Statement (EIS). This general mitigation plan is based on a preliminary habitat analysis conducted in coordination with Fish and Wildlife Service. A more robust mitigation plan will be developed in coordination with the Interagency Team and included in the Final EIS.

During a preliminary investigation of the proposed UBB project area, CEMVN tentatively determined approximately 725 acres of direct impacts from the TSP. Approximately 291 acres of Bottomland Hardwood (BLH), 167 acres of Cypress-Tupelo Swamp, and 267 acres of Fresh Marsh. Impacts to wetlands would be avoided and/or minimized to the greatest extent practicable. As these locations have not yet been determined, their impacts will be discussed in the more robust mitigation plan developed for the Final EIS.

Component 2: Site Selection

Plan selection criteria would 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. Once mitigation alternatives are developed, incremental cost analysis will be applied in order to determine the recommended mitigation plan. The mitigation plan will be adapted as project implementation evolves.

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

Table 1: 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 or managed well understood (e.g. hydrology and ecology) and are management outcomes accurately predictable? (3) Do participants generally agree on the most

Issue	Explanation
	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, damage from storm-induced wave action, runoff from adjacent property which could

Issue	Explanation
	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. However, since a recommended alternative needs to be selected prior to being released for public review and comment, the PDT must attempt to analyze the impacts mitigation measures conceptually using preliminary information, for those resources which could be impacted to differing degrees by each of the measures, focusing only on noteworthy differences between the measures. This detailed analysis is included in the section 7 of the EIS.

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?

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. Cost containment is an important consideration and PDTs should not only analyze an alternative's ability to stay within CWE, but also determine the least-cost alternative. Cost metrics include Total Project Cost and Average Annual Cost (and components thereof).

For alternative comparison purposes, minimal OMRR&R activities are assumed for both the WVA modeling and for cost development. These are limited to: monitoring, invasive/nuisance plant eradication, maintenance/replacement of weirs and culverts, and channel maintenance. As additional details for the actual mitigation sites are developed, assumptions may be changed 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 detailed project design and revised WVA modeling for the selected mitigation sites.

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. These subcriteria would be considered for each alternative:

Watershed Considerations/Significance within the Watershed:

- Consistency with watershed plans (e.g. Coast 2050, LCA, LaCPR, State Master Plan 2017). 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. Coast 2050 is a strategic plan for coastal Louisiana, sponsored by the Louisiana State Wetlands Conservation and Restoration Authority and the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Task Force. It was adopted in 1999. The Coast 2050 report evolved into the Louisiana Coastal Area (LCA) Ecosystem Restoration Plan of 2004. In 2007, the Corps of Engineers, in partnership with the State of Louisiana, developed a preliminary report entitled The Louisiana Coastal Protection and Restoration (LaCPR) Preliminary Technical Report, which identified a range of coastal restoration and flood control measures for South Louisiana. Also in 2017, the state officially adopted Louisiana's Comprehensive Master Plan for a Sustainable Coast, which complements the LaCPR report.
- 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 parish of impact by habitat-type
- Critical features
    - critical geomorphic structures for ecosystem stability (critical geomorphic structures in the coastal ecosystem are those above sea level that protect lower elevation features and in many instances represent the first line of defense against marine influences and tropical storm events (i.e. restoration

or preservation of natural ridges, lake rims, land bridges, gulf shoreline barrier islands, barrier headlands, and Chenier ridges)

- LaCPR critical landscape features for storm damage risk reduction identified in Figure 7-17 of the Louisiana Coastal Protection and Restoration Final Technical Report and Comment Addendum, August 2009

- Habitat Linkages (e.g. wildlife corridors)

Ecological Site Considerations not captured in the WVA:

- 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 as well as satisfy US Fish and Wildlife concerns, in the draft Fish and Wildlife Coordination Act Report (FWCAR) dated 6 November 2019 (Appendix F), the non-federal sponsor (NFS) would commit to fully undertaking the monitoring, operation, and maintenance responsibilities as well as protection of the site for the mitigation project. Fee interest will be acquired in the land for USACE constructed mitigation projects, thus ensuring that no human activities will be allowed that could result in adverse effects to the constructed BLH habitat.

Component 4: Baseline Information

The study area is located within the Barataria Basin. The entire Barataria Basin encompasses approximately 1,565,000 acres and contains approximately 152,120 acres of swamp, 173,320 acres of fresh marsh, 59,490 acres of intermediate marsh, 102,720 acres of brackish marsh, and 133,600 acres of saline marsh (CWPPRA). The study area, the Upper Barataria Basin (UBB), covers 800 square miles of the upper portion of the Barataria Basin.

Forested and herbaceous wetlands within the study area are suffering from increased inundation due to the combined effects of subsidence, sea level rise, and loss of suspended sediment inputs from the Mississippi River. As a result, the existing study area cypress-tupelo swamps are no longer sustainable. Bottomland hardwoods at higher elevations are converting to cypress-tupelo swamp or marsh. Marshes in the upper portion of the basin have remained healthy and are expected to remain relatively healthy provided that area salinities do not increase and that the middle and lower basin marshes remain intact.

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. See Wetland Resources in the main report for further details.

Approximately 120 AAHUs of fresh marsh, 95 AAHUs of BLH and 111 AAHUs of cypress-tupelo swamp credits from mitigation banks would be needed to offset impacts.

Component 6: Mitigation Work Plan

The following mitigation measures may be considered in the following order:

1) Purchase of mitigation bank credits

The impacts to all habitat types could be mitigated through the purchase of mitigation bank credits. It is not known which banks would be available when the decision whether to purchase bank credits or not is made: some banks may not have enough credits remaining, some banks may be closed, and additional mitigation banks may be approved. As such, a general mitigation bank was assumed for the next step of the mitigation project analysis using information obtained from existing banks in the basin and no specific banks were identified. The Regulatory In lieu fee and Bank Information Tracking System (RIBITS) (https://ribits.usace.army.mil/) has information on all currently approved banks in the basin including their credit availability.

2) Potential Corps Constructed BLH, Swamp and Marsh Mitigation Sites

Mitigation for fresh marsh, BLH and swamp impacts associated with the TSP could be achieved by creating the applicable habitat near the project site (as proposed by USFWS in their draft CAR) or in state water bottoms within the basin. Mitigation for BLH and/or Swamp impacts associated with the TSP could also be achieved by BLH and/or swamp restoration and/or enhancement areas (mitigation areas) located in agriculture, scrub/shrub, pasture, and other non-forested areas of lower habitat value. Any submerged aquatic vegetation that is impacted at the potential mitigation sites would be offset by an increase in the size of the proposed marsh mitigation sites or the purchase of marsh mitigation credits from available mitigation banks.

Fill (borrow material) needed to attain the desired final target grade elevation for mitigation features created in open water could be obtained from the dredging of the sites of the water control structures. In addition, the borrow could be dredged or trucked from location(s) to be determined at a later date. Containment dikes may be needed during the construction of these mitigation features. If containment dikes are constructed, they would be gapped or degraded once the area has reached target elevation. Transportation and method of placement of the borrow material would be dependent upon the location of the mitigation site.

Earthwork that may be associated with the BLH and/or swamp mitigation sites could also include grading to ensure appropriate drainage, establishment of dirt access roads around the perimeter of the mitigation areas, establishment of dirt access roads within some of the mitigation areas, and tillage of soil in the mitigation areas. Any existing drainage features (drainage ditches, etc.) within or adjacent to the mitigation areas and within the property boundary would likely be removed to help ensure appropriate site hydrology, unless doing so would adversely affect drainage on off-site lands.

It is assumed that the marsh mitigation areas would naturally vegetate. If the areas do not show potential for natural vegetative recruitment, then they would be planted with native fresh marsh species. Native canopy and midstory plants typical of BLH and swamp habitats would be installed in the BLH and swamp mitigation areas following completion of the initial earthwork (Planting Plan Annex Attached). Note that the planted acreage of a few mitigation areas would be reduced by the impacts of the staging areas, roadways, and borrow sites within the mitigation area.

The table below shows each habitat type with its associated AAHUs (approximated (~)) of impact and the associated acres that would be needed at each type of mitigation site. These numbers are based on assumptions from previous mitigation projects. As project implementation evolves, final WVAs will be ran on specific mitigation sites to determine exact acres needed at each specific site.

Conceptual Mitigation Alternatives

Mitigation Site	**Marsh** *~120 AAHUs impacted*	**BLH** *~95 AAHUs impacted*	**Swamp** *~111 AAHUs impacted*
Bank	TBD	TBD	TBD
Open Water	~367 acres	~168 acres	~388 acres
Agricultural/ Pasture land	NA	~168 acres	~388 acres
Scrub/Shrub	NA	~559 acres	~925 acres

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.

If drainage ditches are required, they would be maintained to provide necessary hydrology for established species.

Component 8: Performance Standards (Success Criteria)

Below are general guidelines for mitigation projects. The general guidelines for swamp habitat are currently being revised by the Interagency Environmental Team (IET) and will be included in the final mitigation plan. Site specific success criteria and monitoring plans will be developed after project specific mitigation sites are identified and the associated mitigation plans developed.

General Construction

BLH

A. For construction from existing land, 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.

B. For mitigation features established in open water areas, complete all applicable activities associated with General Construction A. as outlined in the mitigation work plan and project plans and specifications. The necessary activities will vary with the mitigation site and may include, but are not limited to -

1. Initial construction requirements
    a. Construction of any necessary containment dikes
    b. Installation of fill.

2. Final construction requirements
    a. Planting (will generally be conducted 1 year after installation of fill to allow for project settlement.)
    b. Degrading or “gapping” of containment dikes,
    c. Construction or modification of water management features
    d. Continued eradication of invasive and nuisance plant species.

Marsh

A. Complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material), construction of permanent dikes if applicable, etc.) in accordance with the mitigation work plan and final project plans and specifications. Upon completion of construction, USACE or its contractor shall provide construction surveys to include all project features. These activities are classified as “initial construction requirements.”

B. Approximately 1 year following completion of all initial mitigation construction activities (when the restored marsh feature has stabilized to the point that the containment berms are no longer required to prevent the loss of fill material from the project site), USACE or its contractor shall complete all final mitigation construction activities, in accordance with the mitigation work plan and final project plans and specifications. Such activities may include, but are not limited to: degrading temporary retention/perimeter dikes; completion of armoring of permanent dikes; “gapping” or installation of “fish dips”; soil testing; completion of plantings; and construction of trenasses or similar features within marsh features as a means of establishing shallow water interspersion areas within the marsh. Finishing the aforementioned construction activities will be considered as the “completion of final construction requirements”.

Swamp

A. For construction from existing land: 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 and may include, but not be limited to clearing, grubbing, and grading activities; construction of new water management features (weirs, flap-gates, diversion ditches, etc.); modifications/alterations to existing water control structures and surface water management systems; plantings; and eradication of invasive and nuisance plant species.

B. For mitigation projects that are constructed from open water: construction activities will occur during both an initial and final construction phase to allow for settlement of fill. All construction activities will be completed in accordance with the mitigation work plan and the project plans and specifications. Initial construction activities may include some of the activities listed under 1.A. (with the noted exception of plantings) as well as the construction of perimeter containment dikes where necessary and the installation of fill (dredged sediments or other soil). Final construction activities will typically occur approximately 1 year after completion of the initial construction activities and may vary with the mitigation site. Activities may include, but not be limited to degrading or "gapping" of perimeter retention dikes; plantings, construction of water management structures (weirs, etc.); and continued eradication of invasive and nuisance plant species.

Topography[1]

BLH

A. Initial Success Criteria

1. For mitigation features requiring earthwork (grading) to attain desired elevation (excluding areas restored from open water):
   a. Following completion of General Construction Criteria A. 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].
2. For mitigation features restored from open water areas:
   a. One year after placement of fill material is complete
      - Demonstrate that at least 80% of the total fill area within each feature is within approximately +0.5/-0.25 feet of the desired target surface elevation[2] as determined by the settlement curve.
   b. Two years[3] after placement of fill material is complete
      - Demonstrate that at least 80% of the total fill area within each feature is within approximately +0.5/-0.25 feet of the desired target surface elevation[2] as determined by the settlement curve.

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.

Marsh

A. Initial Success Criteria:

1. Two years after completion of fill placement or one year after final construction (whichever is later):
   - Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within +0.5 to – 0.5 feet of the desired target surface elevation as determined by the settlement curve for that year.
2. Two years after completion of fill placement:
   - Demonstrate that at least 80% of the mitigation site has a surface elevation that is within +0.5 feet to – 0.25 of the desired target surface elevation as determined by the settlement curve for that year.

B. Intermediate Success Criteria:

1. Two years following achievement of Topography Criteria A.2. —
   - Demonstrate that at least 80% of the mitigation site has a surface elevation that is within the functional marsh elevation range[2].
   - There are no additional monitoring or attainment requirements for topography beyond meeting the Intermediate Success Criteria for topography.

Notes:
[1]Elevation survey data and report will be provided to the IET for review in order to determine concurrence. The surveys must include water levels inside and outside the marsh creation site at locations representative of site conditions.
[2]The “functional marsh elevation range”, i.e. the range of the marsh surface elevation that is considered adequate to achieve proper marsh functions and values, is determined during the final design phase.

Swamp

A. For mitigation features requiring earthwork (grading) to attain desired elevations (excluding areas restored from existing open water features) – Following completion of general construction criteria 1.A 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 proposed target soil surface elevation (e.g. the desired soil surface elevation).

B. For mitigation features restored from existing open water areas:
   1. One year after placement of fill material is complete, demonstrate that at least 80% of the total fill area within each feature is within approximately +0.5 feet of the projected settlement curve elevation and;

2. Two years after placement of fill material is complete, demonstrate that at least 80% of the total fill area within each feature is within approximately +0.5 feet of the projected settlement curve elevation.

Native Vegetation[1]

BLH

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.

Marsh

A. Fresh marsh:

1. Initial Success Criteria (2 growing seasons following completion of initial construction activities in General Construction A.):
   - Achieve a minimum average cover of 50% comprised of native herbaceous species.
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. (USACE 2010)
2. Intermediate Criteria (2 years following attainment of Native Vegetation Criteria A.1.):
   - Achieve a minimum average cover of 60% comprised of native herbaceous species.
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. (USACE 2010)
3. Long-Term Success Criteria[3] (Every monitoring event after attainment of Native Vegetation Criteria A.2.):
   - Achieve a minimum average cover of 60% comprised of native herbaceous species.
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. (USACE 2010)

Notes:
[1]Fresh marsh is typically not planted due to the expectation that it will naturally vegetate more quickly than intermediate or brackish marsh. However, if percent cover success criteria are not met, plantings may become necessary in the absence of other recommended actions

Swamp

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 excluding recruited seedlings (i.e. achieve a minimum average canopy species density of 269 seedlings/ac .).

2. The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan.

3. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.

B. Intermediate Success Criteria

1. (3 growing seasons Following Completion of A)

a) Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
b) Achieve a minimum average density of 125 living bald cypress trees (planted trees and/or naturally recruited native canopy species). The species composition of the additional native canopy species present must be generally consistent with the planted ratios for such species.
c) Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the remaining 50-year monitoring period.

2. (Within 12 Years Following Completion of A)

Achieve one of the two following vegetative cover requirements:

a. The average percent cover by native species in the canopy stratum is at least 75%.
OR
b. The average percent cover by native species in the canopy stratum is at least 50%, and; the average percent cover by native species in the midstory stratum exceeds 33%, or; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.

C. Long-Term Success Criteria (Within 30 Years Following Completion of B.2)

1. Demonstrate that the average percent cover by native species in the canopy stratum is at least 80%.
2. Demonstrate that the average diameter at breast height (DBH) of living bald cypress trees exceeds 10 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

3. Demonstrate that the average DBH of the other living native trees in the canopy stratum (trees other than bald cypress) exceeds 12 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
4. Demonstrate that the average total basal area accounted for by all living native trees in the canopy stratum combined exceeds approximately 161 square feet per acre. This criterion will thereafter remain in effect for the duration of the overall monitoring period.

Note: There are no success criteria for understory species, but data will be collected every monitoring event.

Invasive and Nuisance Vegetation

All Habitat Types

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)

BLH and Swamp

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 NFS will develop a Timber Stand Improvement/Timber Management Plan, and associated long-term success criteria, in coordination with the USACE and IET. Following approval of the plan, the NFS 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 (applicable to BLH-Wet and Swamp habitats only)

A. Intermediate and Long-term Success Criteria

1. 4 years after successful completion of plantings (General Construction A. or B.), 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) The NFS will provide the CEVMN with a wetland delineation to accompany the monitoring report.

Component 9: Monitoring Requirements

Baseline Monitoring Report (First Monitoring Report)

BLH and Swamp

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. or B., 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.

Marsh

A "baseline" monitoring report will be prepared upon completion of Final Construction Requirements B. and upon any re-plantings associated with construction. Information provided will typically include the following:

- A detailed discussion of all mitigation activities completed.
- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh, significant interspersion features established within the marsh features (as applicable), proposed monitoring transect locations, proposed sampling plot locations, photo station locations and water level survey locations.
- Initial and final construction surveys of all project features (including but not limited to the fill area, fish dips, weirs, culverts, etc.) and an analysis of the survey data will be provided addressing attainment of topographic success criteria. If a project is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh.
- Photographs documenting conditions in the project area will be taken at the time of monitoring. Photos will be taken at permanent photo stations within the restored marsh. 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 Interagency Team and will specify the requirements in the Mitigation Monitoring Plan. At a minimum, 4 photo stations will be established within each marsh cell.
- For planted marsh only -- A detailed inventory of all species planted, including the number of each species planted, the stock size planted, and where the species were planted will be documented. For mitigation sites that include more than one planted marsh cell/feature, provide a breakdown itemization indicating the number of each species planted in each feature and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.
- As part of the as-built/final construction survey, water level surveys will be taken inside and outside the marsh creation site at predetermined locations identified in coordination with the IET and NFS. Each interior water level elevation should have a corresponding exterior water level elevation taken consecutively and within close

proximity. If there appears to be disparity in water levels within the marsh creation site, additional shots may be required. The baseline monitoring report will provide the surveyed water level data and will compare it to mean high and mean low water elevation data collected from a tidal elevation recording station in the general vicinity of the mitigation site. The report will further address estimated mean high and mean low water elevations at the mitigation site based on field indicators.

- 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 estimate of the average percent cover by native plant species; general estimates of the average percent cover by invasive and nuisance plant species; general observations concerning colonization of the mitigation site by volunteer native plant species; general condition of native vegetation; trends in the composition of the plant community; wildlife utilization as observed during monitoring (including fish species and other aquatic organisms); the condition of interspersion features (tidal channels, trenasses, depressions, etc.) constructed within the marsh features, noting any excessive scouring and/or siltation occurring within such features; the natural formation of interspersion features within restored marshes; observations regarding general surface water flow characteristics within marsh interspersion features; the general condition of "gaps", "fish dips", or similar features constructed in permanent dikes; if present, the general condition of any armoring installed on permanent dikes. General observations made during the course of monitoring will also address potential problem zones and other factors deemed pertinent to the success of the mitigation project.
- 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.

Additional Monitoring Reports

BLH and Swamp

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:

<u>First monitoring report after a planting event</u>

- 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).

<u>Subsequent monitoring reports</u>

- 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 (General Construction 1.B.). 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.

Marsh

- All items listed for the Baseline Monitoring Report with the exception of: (a) the topographic surveys, although additional topographic surveys are required for specific monitoring reports (see below); and (b) the inventory of species and location map for all planted species.
- Quantitative data for all plants in each stratum. Data will be collected from permanent sampling quadrats established at approximately equal intervals along permanent monitoring transects established within each marsh feature. Each sampling quadrat will be approximately 2 meters X 2 meters in size (although the dimensions of each quadrat may be increased, if necessary, to provide better data in planted marsh features). The number of monitoring transects and number of sampling quadrats per transect will vary depending on size of the mitigation site and will be determined by the IET during the final design phase of the project. The resulting requirements, including quadrat dimensions, will be specified in the Final Mitigation Monitoring Plan for the project. Data recorded from the sampling quadrats will include but not be limited to: average total percent cover by native plant species; average total percent cover by invasive plant species; average total percent cover by nuisance plant species; percent cover of each plant species; the wetland indicator status of each species; and the average percent survival of each planted species (i.e. number of living planted species as a percentage of total number of plants installed), if discernable at the time of monitoring.
- One photograph shall be taken from the SE corner of each sampling plot to clearly capture the vegetation plot and must include a sign that indicates the plot number and sampling date.
- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.
- Topographic surveys of each marsh restoration feature for initial and intermediate monitoring events (at approximately 2 years and 4 years following completion of final construction activities (General Construction B.). These surveys will cover the same components as described for the topographic survey conducted for the Baseline Monitoring Report. In addition to the surveys themselves, each of the two monitoring reports will include an analysis of the topographic data in regards to the attainment of applicable topographic success criteria. If the surveys indicate topographic success criteria have not been achieved and supplemental topographic alterations are necessary, then another topographic survey will be required following completion of the supplemental alterations. This determination will be made by USACE and the IET.

Monitoring Reports Involving Timber Management Activities

BLH and Swamp

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 NFS's 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

BLH and Swamp

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.

Marsh

Planting or re-planting of certain areas within restored marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a planting event must include an inventory of the number of each species planted, the stock size used, and the locations for each species planted. It must also include a depiction of the areas re-planted or those planted, as applicable, cross-referenced to a listing of the species and number of each species planted in each area. The perimeter of re-planted area should be documented with GPS coordinates. If single rows are replanted, then GPS coordinates should be taken at the end of the transect.

Mitigation Monitoring Schedule and Responsibilities

BLH and Swamp

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. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the IET. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following initial success criteria are achieved (criteria follow numbering system used in success criteria section for each habitat type):

1. General Construction –A or B, as applicable.
2. Topography – A.1 or A.2, as applicable.
3. Native Vegetation – A
4. Invasive & Nuisance Vegetation – until such time as monitoring responsibilities are transferred to the NFS.

Monitoring events associated with the above will include the first or baseline monitoring event plus annual monitoring events thereafter until the monitoring responsibilities are transferred to the NFS.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports for all other required years after the USACE has demonstrated the initial success criteria listed above have been achieved. The responsibility for management, maintenance, and monitoring of the non-structural components of mitigation project (vegetative) will typically be transferred to the NFS during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of the initial success criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event (intermediate) should take place 2 growing seasons after initial success has been met. After intermediate success has been met, monitoring will be conducted every 5 years throughout the remaining 50-year period of analysis, (which begins once initial success criteria have been met.

In certain cases it is possible that the mitigation features may be established along with other mitigation features, like other habitats, at the same mitigation site. This scenario could require some adjustments to the typical monitoring schedule described above in order to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and will be prepared by the USACE and the IET.

If the initial survival criteria for planted canopy species are not achieved (i.e. the initial success criteria specified in native vegetation success criteria 2.A), 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. The NFS will be responsible for conducting this additional monitoring and preparing the monitoring reports. The NFS will also be responsible for the purchase and installation of supplemental plants needed to attain these success criteria.

If timber management activities are conducted by the NFS, the NFS will be responsible for conducting the additional monitoring and preparing the associated monitoring reports 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.

Once monitoring responsibilities have transferred to the NFS, the NFS will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. 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. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE in coordination with the IET.

Marsh

Monitoring will typically take place in mid to late summer during the required years for monitoring, but may be delayed until later in the growing season due to site conditions or other unforeseen circumstances. Monitoring Reports will be submitted by December 31 of each year of monitoring to the USACE, NFS, and the IET. The various monitoring and reporting responsibilities addressed in this section are all subject to the provisions set forth in the Introduction section.

The USACE will be responsible for conducting the monitoring events and preparing the associated monitoring reports until such time that the following mitigation success criteria are achieved (criteria follow numbering system used in success criteria section):

1. General Construction – A. and B.
2. Topography – A.1 and A.2.
3. Native Vegetation – For fresh marsh features, criteria A.1

4. Invasive & Nuisance Vegetation – A. until such time as monitoring responsibilities are transferred to the NFS.

The USACE will be responsible for conducting Baseline and Initial Success Monitoring events and preparing the associated monitoring reports.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports for all other required years after the USACE has achieved the initial success criteria listed above. The responsibility for management, maintenance, and monitoring of the non-structural components of the mitigation project (i.e. vegetation) will typically be transferred to the NFS during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of the initial success criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event (Intermediate) should take place 2 growing seasons after Initial Success (Topography A.2 and Native Vegetation A.1 or B.1) has been met. After Intermediate Success Criteria (Topography 2B and Native Vegetation A.2 or B.2) has been met, Long-Term Success Criteria monitoring will be conducted every 5 years throughout the remaining 50-year period of analysis (which begins once initial success criteria have been met).

In certain cases, it is possible that the marsh mitigation features may be established along with other mitigation features, like swamp or bottomland hardwood habitats, at the same mitigation site. This scenario could require some adjustments to the typical monitoring schedule described above in order to develop a reasonable and efficient monitoring schedule that covers all the mitigation features. Such adjustments, if necessary, would be made at the time final mitigation plans are generated. This schedule must be in general accordance with the guidance provided above and will be prepared by the USACE and the IET.

If certain success criteria are not achieved, failure to attain these criteria would trigger the need for additional monitoring events not addressed in the preceding paragraphs. The USACE would be responsible for conducting such additional monitoring and preparing the associated monitoring reports in the following instances:

(A) For fresh marsh features –

- If the initial vegetative cover success criteria (A.1) are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable vegetative cover criteria have been satisfied. This requirement only exists if planting the marsh mitigation feature is required to meet the success criteria, the USACE would be responsible for the purchase and installation of the required plants.

(B) For all types of marsh features–

- If initial topographic success criteria (A.1 and A.2) are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary additional surveys and a monitoring report will be required

to indicate whether applicable criteria have been satisfied. The USACE would also be responsible for performing the necessary corrective actions.

- If initial invasive and nuisance species criteria (A) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The USACE would be responsible for the irradiation activities needed to attain the success criteria.

There could also be cases where failure to attain certain success criteria would trigger the need for additional monitoring events for which the NFS would be responsible:

(A) For fresh marsh features –

- If the native vegetation intermediate success criteria (A.2) are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the success criteria have been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

(B) For all types of marsh features –

- If the topographic intermediate success criteria (B) are not achieved, the IET would convene to determine whether corrective actions are necessary. If corrective actions are necessary, additional surveys and a monitoring report will be required to indicate whether applicable criteria have been satisfied. The NFS would also be responsible for performing the necessary corrective actions if the IET determines such corrective actions are necessary.
- If the native vegetation long term success criteria (A.3 and B.3) are not achieved, the IET would convene to discuss whether corrective actions would be necessary. If corrective actions are necessary, a monitoring report will be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the native vegetative cover criteria have been attained. The NFS would be responsible for performing the corrective actions, conducting the additional monitoring events, and preparing the associated monitoring reports.
- If the intermediate and long term invasive and nuisance species criteria (A) are not achieved a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the applicable criteria have been satisfied. The NFS would be responsible for the irradiation activities needed to attain the success criteria.

Once monitoring responsibilities have been transferred to the NFS, the NFS will retain the ability to modify the monitoring plan and the monitoring schedule should this become necessary due to unforeseen events or to improve the information provided through monitoring. Fifteen years following achievement of Long Term Success Criteria, the number of monitoring transects and/or quadrats that must be sampled during monitoring events may be reduced substantially if it is clear that mitigation success is proceeding as

anticipated. Any significant modifications to the monitoring plan or the monitoring schedule must first be approved by the USACE and the IET.

Component 10: Long-term Management Plan

The non-federal sponsor (LADOTD) 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 Upper Barataria Basin Louisiana (UBB) Feasibility Study included in the draft IFR and EIS and is designed to mitigate for bottomland hardwood, swamp and fresh marsh impacts from the tentatively selected plan. 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. Full descriptions of the mitigation projects will be included in the final IFR and EIS, due to the current lack of information.

It should be noted that even though the proposed mitigation actions under the draft IFR and EIS include the potential purchase of credits from a mitigation bank, this section only details the Adaptive Management planning for constructible mitigation features for the feasibility study. 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 and/or the local sponsor. 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 UBB project. (Table 2) The CEM 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 acres/average annual habitat units (AAHUs). Furthermore, this CEM represents the current understanding of these factors and will be updated and modified, as necessary, as new information becomes available.

Table 2: Conceptual Ecological Model

Alternatives / Issues/Drivers	BLH Mitigation Sites	Swamp Mitigation Sites	Marsh Mitigation Sites	Mitigation Banks
Freshwater Input	+/-	+/-	+	*
Salinity Impacts	-	-	-	*
Subsidence	-	-	-	*
Sea Level Change	-	-	-	*
Runoff	-	+/-	+/-	*
Vegetative Invasive Species	-	-	-	*
Herbivory	-	-	-	*
Hydrology	+/-	+/-	+/-	*
Topography (elevation)	+/-	+/-	+/-	*

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. There are many uncertainties associated with restoration of the coastal systems. The project delivery team (PDT) identified the following uncertainties during the planning process.

A. Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing

B. Subsidence and water level trends at mitigation sites

C. Uncertainty Relative to Achieving Ecological Success:

- Water, sediment, and nutrient requirements for BLH (wet), swamp, and fresh marsh

- Magnitude and duration of wet/dry cycles for BLH (wet)
- Nutrients required for desired productivity for BLH (wet), swamp, and fresh marsh
- Growth curves based on hydroperiod and nutrient application for BLH (wet) and fresh marsh
- Tree litter production based on nutrient and water levels for BLH (wet)
- Tree propagation in relation to management/regulation of hydroperiod for BLH (wet)

D. Loss rate of vegetative plantings due to herbivory

E. Long-Term Sustainability of Project Benefits

Adaptive Management Evaluation

As part of the UBB, 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 were 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 for BLH (wet), swamp, and marsh
- Invasive species control
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet topographic and 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 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. Additional earthwork at mitigation sites (by adding sediment or degrading) to obtain elevations necessary for BLH, swamp and marsh vegetative establishment and maintenance.
    - Uncertainties addressed: A,B,C,E

3. Potential Action #3. Invasive species control to ensure survival of native species and meet required success criteria.
    - Uncertainties addressed: E

Actions 1 and 3 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. Specific measures to implement Action 2, if determined necessary to achieve project benefits, would be coordinated with the NFS and other agencies to determine the appropriate course of action. If it is determined that the project benefits are significantly compromised because of improper elevation, additional fill material may need to be pumped into or removed from the project area. Due to the impact the addition of fill to the mitigation projects once they have been planted would incur, lifts to the projects are not currently considered as a viable remedial action. Instead, increasing the size of the existing mitigation project or mitigating the outstanding balance of the mitigation requirement elsewhere or through the purchase of mitigation bank would be options that could be considered through additional coordination with the NFS and the IET. However, such options would have to undergo further analysis in a supplemental NEPA document.

Action 2 is potentially very costly actions. Before implementing such an action, the Corps would coordinate with the NFS and other agencies to determine if other actions, such as purchasing of credits in a mitigation bank or building additional mitigation elsewhere, would be more cost-effective options to fulfill any shortfalls in the overall project success. The USACE would be responsible for performing any necessary corrective actions, but the overall cost would be shared with the NFS according to the project cost-share agreement.

The USACE would be responsible for the proposed mitigation construction and would monitor the project until the initial success criteria are met. Initial construction and monitoring would be funded in accordance with all applicable cost-share agreements with the NFS. The USACE would monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. Once the USACE determines that the mitigation has met the initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. 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 other agencies and the NFS 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 and subject to cost-sharing requirements, 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 NFS obligation would be reflected in the Project Partnership Agreement, in which the NFS must operate and maintain the mitigation project at no cost to the Government.