APPENDIX 20
MITIGATION

Table of Contents

List of Figures

List of Tables

A20-1.0 MITIGATION PLAN FORMULATION

This appendix describes the plan formulation process undertaken to develop the proposed mitigation plan for the project. Technical details are provided about the assessment of impacts and the development of potential benefits of various mitigation measures and alternatives. Cost information is presented, and an analysis of cost effectiveness is detailed. The technical information is evaluated, and support for plan selection is provided. The information in this appendix supports the summary information covered in Section 5.0 of the SEIS II.

The preferred alternative incorporates environmental design features which reduce anticipated impacts to terrestrial, wetland, and waterfowl resources. Also, some increases to aquatic habitat resources would occur with implementation of the preferred alternative. However, unavoidable impacts to significant resources remain. These impacts require the development of compensatory mitigation measures as part of the preferred alternative. Specific planning objectives have been developed to guide the formulation of alternative measures to compensate these unavoidable losses. The mitigation planning process and resulting recommendations are described below.

A20-1.1 Mitigation Planning Objectives

The objective of mitigation is to compensate for unavoidable impacts to significant resources as a result of constructing the preferred alternative. A suite of ecological models were used to determine project impacts (see SEIS II Section 4.0 and applicable appendices). These models span the entire calendar year, cover various flood frequencies, and variable flood depths. The majority of project impacts are attributed to direct impacts resulting from addressing deficiencies along the existing levees and floodwalls and acquiring the associated borrow material. According to the ecological models, compensatory mitigation is required to compensate for the following impacts:

Table A20- 1. Mitigation Objectives by Habitat Type and District

District	Habitat Category			
	Wetlands (FCU/HSU) [1]		Waterfowl (DUD)[2]	Terrestrial Wildlife (AAHU)[3]
	Riverside	Landside		
Memphis	11,193	12,731	99,029	540.3
Vicksburg	15,523	4,863	545,676	867.9
New Orleans	997	3,986	18,246	197.8

[1] Functional Capacity Units calculated from Hydrogeomorphic Manual (HGM) and Habitat Suitability Units from Wetland Value Assessment (WVA) analyses.
[2] Duck-Use-Days (DUD) calculated from waterfowl analyses.
[3] Average Annual Habitat Units calculated using Habitat Evaluation Procedures (HEP) analyses on wildlife.

A20-1.2 MITIGATION PLANNING APPROACH

The objectives and criteria used in developing this mitigation plan are based on pertinent statutes, U.S. Army Corps of Engineers (USACE) regulations, and coordination with project sponsors, wildlife agencies, and environmental groups. Planning procedures are outlined in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, signed February 3, 1983, and Engineer Regulation 1105-2-100, Appendix C. Criteria adopted for use in the development and selection of a mitigation plan are as follows:

a. Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army which States that mitigation use a sequence of avoidance, minimization, and then compensation to reconcile project impacts.

b. Environmental design measures should be evaluated during planning to eliminate or reduce the need for compensation.

c. Project lands and lands with easements held by project sponsors should be used for compensation as much as possible.

d. Regionally significant unavoidable habitat losses (*i.e.*, bottomland hardwoods) should be compensated in-kind.

e. Land acquisition should be from willing sellers and should be confined to the vicinity of the project area. The feasibility of onsite mitigation will be balanced with the goal of acquiring lands adjacent to large contiguous tracts of bottomland hardwoods (BLH). However, if sufficiently large tracts are not available from willing sellers within the project area, then tracts elsewhere in the alluvial valley of the Mississippi River should be considered.

f. Land acquisition for compensation should be fee title; however, easements will be considered on a case-by-case basis in consultation with levee boards and State and Federal agencies. Acquisition will primarily be directed toward frequently flooded agricultural lands.

g. Mitigation priority should be given to large tracts and tracts adjacent to forested areas as these areas are more ecologically beneficial than small or isolated tracts and more efficient to administer and manage.

h. Land acquisition for compensation should be proportioned to the extent possible among USACE Districts where the losses occur.

A20-1.2.1 Mitigation Plan Formulation Methodology

Numerous measures are possible to mitigate the impacts resulting from the remaining work on the Mississippi River Levees enlargement project. The potential ecological value of mitigation for any particular tract of land depends on the type of mitigation measure (*e.g.*, natural

succession, BLH plantings) and tract-specific hydrologic variables (*i.e.*, flood frequency, flood depths, flood timing, and flood durations). Tract-specific hydrologic variables are primarily determined by the elevation of the tract. Tracts located at lower elevations, which flood more frequently and for longer durations, provide a different habitat value compared to tracts located at higher elevations, which flood less frequently and for shorter durations. Therefore, different potential mitigation zones can be established based on anticipated post-project hydrology. Additional information regarding the different types of mitigation measures and the establishment of mitigation zones is found in Section 5.0 of the SEIS II. Alternative mitigation measures may be classified into the following basic categories:

a. Implement measures to reduce environmental resource losses through project design.

b. Acquire additional land and implement management measures.

The first category has been satisfied through the selection of the recommended plan which includes environmental design measures to reduce project-related impacts to significant resources. Therefore, acquiring additional land and implementing management measures must be evaluated with respect to the overall benefits to terrestrial, wetland, and waterfowl resources.

A20-1.2.2 Mitigation Alternatives Development

To demonstrate consideration of a reasonable range of feasible alternatives, preliminary mitigation alternatives were initially screened to determine which range and combination of measures and alternatives would be carried forward for additional economic and ecological analyses. Reasonable alternatives include those that are forecasted to be economically and technically feasible, focusing on the accomplishment of the underlying project objectives and avoiding constraints. Mitigation alternatives not considered reasonable will therefore not be retained for further mitigation alternative analysis. Additional information regarding proposed mitigation alternatives and the initial screening process is provided below.

Implementation of Management Measures on Existing USACE Project Lands and Mitigation by Development of Other Public Lands

Other USACE lands include property acquired for other projects or for mitigation of other projects. Additionally, as many public areas managed for wildlife resources by State and other Federal agencies exist throughout the project area, the potential to develop and manage other public lands within the project area was considered during the preparation of this mitigation plan.

All existing USACE mitigation tracts within the project area and adjacent vicinity are being fully used to offset impacts of other projects. Furthermore, Federal and State agencies were queried with regard to lands available for implementation of management measures. Responses had no mention of possible activities to enhance resources on lands within their jurisdiction. Therefore, the implementation of management measures on existing USACE lands and mitigation by development of other public lands were not retained for further alternative analysis.
Mitigation by Acquisition and Management of Separable Lands

Fee Title Acquisition and Management of Bottomland Hardwoods

This alternative would provide additional habitat quality (*e.g.*, increasing FCU/HSU/AAHU/DUD) through management of existing bottom-land hardwoods. However, only the incremental increase in habitat value can be used to offset average annual habitat unit (AAHU) losses. Therefore, according to the ecological models, considerably larger amounts of land would be required to offset project induced impacts. Therefore, the acquisition and management of privately owned BLHs to offset project induced impacts losses have been eliminated from further mitigation alternative consideration.

Perpetual Land Use Easement Acquisition of Bottomland Hardwoods

This alternative would prevent any change in existing land use for BLHs by securing a perpetual land use easement. However, as this proposed alternative preserves existing BLHs rather than provide in-kind mitigation for BLH losses, this alternative was eliminated from further mitigation alternative planning consideration. Although, potential for preservation could be considered for compensatory mitigation in certain exceptional circumstances, and in concert with the inter-agency team. However, mitigation alternative development assume no preservation credits would be provided in any district.

Easement Acquisition of Cleared Agricultural Lands with Reforestation

This mitigation alternative would allow project area landowners to bid land into the program for a certain price, the Wetland Reserve Program is an example of this type of plan. However, as this mitigation alternative does not assure in-kind mitigation for BLH losses beyond the easement duration, this alternative has been eliminated from further mitigation alternative consideration.

Fee Title Acquisition of Cleared Agricultural Land with Natural Succession

This mitigation alternative would involve the acquisition of low-lying tracts of cleared agricultural land, performing topographic and hydrologic restoration, as needed, and allowing the site to natural re-vegetate. This mitigation method is especially effective when available acorn or other seed sources exist at or near the site to be acquired. However, often, available mitigation lands are typically cultivated on a large scale for crops with little or no adjacent trees for mast sources or located at the lowest elevations and tracts become dominated with early successional species such as black willow and cottonwood. In addition, the accrual of benefits is much lower than actively managed sites and therefore larger amounts of land are required to be set aside. Nonetheless, this alternative is practicable and capable of mitigating project induced impacts and will therefore be carried forward for additional consideration.

Fee Title Acquisition of Cleared Agricultural Land with Reforestation

This mitigation alternative would reestablish a functional BLH wetland on low-lying, frequently flooded agricultural lands. This is accomplished by establishing tree species suitable for the hydrologic condition on the mitigation tract. It is anticipated that later successional forest species, such as red and white oaks, which are valuable to a wide variety of wildlife species,

would be planted and would compensate for project induced impacts to terrestrial, waterfowl, and wetland resources. Additionally, this mitigation alternative is consistent with the national goal of no-net wetland loss in addition to providing for in-kind mitigation for BLH losses. Therefore, like acquisition of cleared land with natural succession, acquisition of cleared land with reforestation will be carried forward for further mitigation alternative consideration.

Mitigation Banks and In-Lieu-Fee Programs

Where appropriate, USACE considers purchase of credits from approved mitigation banks and in-lieu-fee programs in the impacted watershed to be a reasonable compensatory mitigation alternative. The option of using mitigation banks as an alternative to offset project induced impacts will be carried forward for further mitigation alternative consideration.

A20-1.2.3 Cost Effectiveness and Incremental Cost Analyses

For environmental mitigation planning, where traditional economic benefit-cost analysis is not practicable or possible, as costs and benefits are expressed in different units (*e.g.*, AAHU, HSI, DUD) two analytical methods are instead used in the planning process. First, cost effectiveness analysis is conducted to identify the least cost solution for each possible level of environmental output. Subsequent incremental cost analysis of the cost-effective solutions is then performed to identify changes in costs for increasing levels of environmental outputs. Therefore, in the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of environmental plans, cost effectiveness and incremental cost analysis are valuable tools to assist in mitigation alternatives development and decision making.

The cost effectiveness and incremental cost analysis was conducted using the USACE Institute for Water Resources (IWR) Planning Suite Decision Support Software. The planning suite was developed to assist with ecosystem restoration project alternative plan comparison by conducting cost effectiveness and incremental cost analyses, identifying plans which are the best financial investments (*i.e.*, "Best Buys") and displaying the effects of each on a range of decision variables. The latest version of the software (2.0.9) is available via the IWR website. The software has been reviewed by the Ecosystem Restoration National Planning Center of Expertise and certified for use by USACE Headquarters.

In addition to the results, it is also important to keep in mind that the most useful information developed by these two methods is the information provided about the relative relationships among mitigation alternatives. Additionally, these analyses will usually not lead, and are not intended to lead, to a single best solution or a one size fits all approach. However, they will help improve the quality of decision making by ensuring that a rational, supportable approach is used in considering and selecting mitigation alternatives to produce environmental outputs.

A20-1.2.4 Cost Effective Solutions

Plans carried forward for detailed analysis which produce the same anticipated ecological output but cost more, or which have equal cost, but produce less anticipated ecological output are filtered out by the IWR software. Cost assumptions are detailed in Attachment 1.

Expected environmental outputs in terms of average annual functional capacity units (AAFCU) and AAHU, along with the total cost and average annual cost for each of the mitigation alternatives (*i.e.*, no action, natural succession, active reforestation, mitigation banks) are presented in Table A20-1. Amongst the array of alternatives considered, active reforestation consisting of fifty percent oak species suitable to the tracts hydrologic regime was identified as the most cost-effective plan, and is, therefore, considered the "Best Buy" plan and was subsequently retained for further incremental cost analysis (Figure A20-1).

Table A20-1. Summary of Outputs (AAFCUs/AAHUs) and Costs[1].

Alternative	First Cost	Interest During Construction	Average Annual Cost	Average Annual FCU /HU	Cost Effective
No Action	$0	$0	$0	0	-
Active Reforestation	$14,344,125	$195,894	$538,576	986	**Yes**
Natural Succession	$14,775,800	$201,789	$554,784	986	No
Mitigation Banks*	$39,440,000	$538,622	$1,480,845	986	No

[1] Costs are shown at the 2020 price level and were annualized using the current FY20 Federal discount rate of 2.75 percent over a 50-year period of analysis.

*AAFCUs/AAHUs from mitigation banks were assumed values based on required acres of mitigation assuming planting of fifty percent red oak species according to ecological models used in impact analysis, as mitigation banks to not list available credits using the same methodology as various impact/benefit analyses performed for the MRL-SEIS-II.

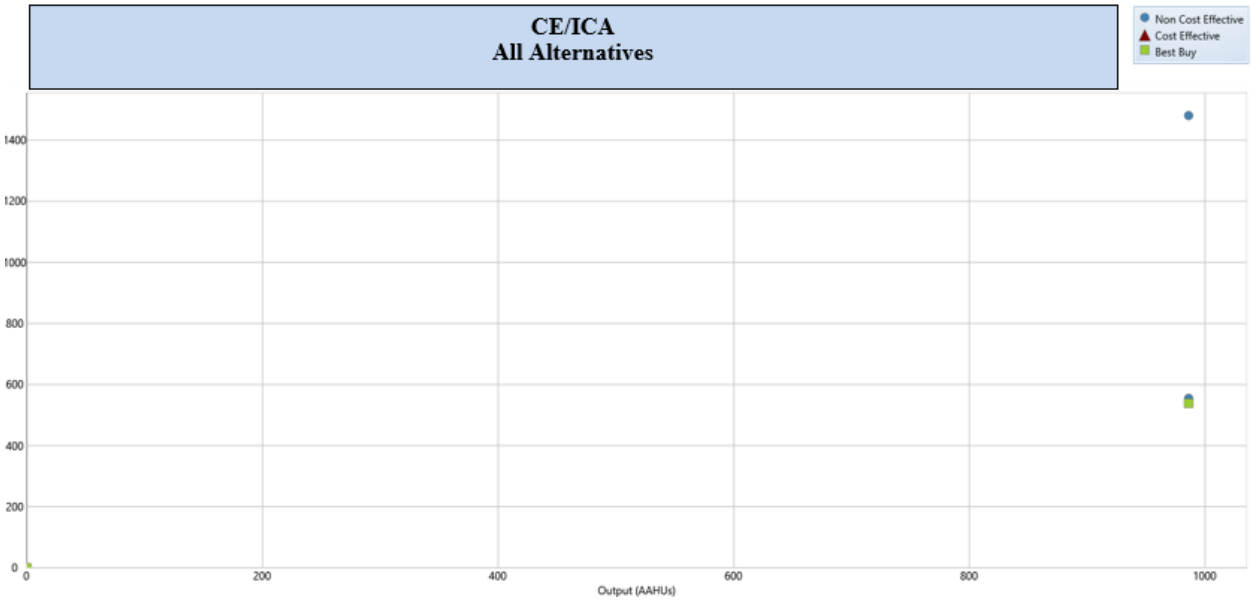

Figure A20- 1. Graphic showing the full range of solutions, highlighting the non-cost effective solutions, and showing the incrementally justified Best Buy solution from the IWR software.

A20-1.2.5 Incremental Cost Analysis

As noted in Section 5 of the SEIS II and presented here in Table A20-2, the ecological models show the required compensatory mitigation outputs also compensate for impacts to other significant ecological resources. For example, restoring wetland vegetation, as proposed, would mitigate 100 percent of the wetland losses but approximately 350 percent of the waterfowl losses and approximately 150 percent of the terrestrial habitat/wildlife losses. Therefore, additional increments to the incremental cost analysis were not warranted. Regardless, incremental cost analysis comparing the "Best Buy" plan (active reforestation) to the no action plan (active reforestation) is included in Table A20-3 and shown in Figure 1.

Table A20- 2. Summary of project impacts and anticipated compensatory mitigation benefits.

District	Memphis				Vicksburg				New Orleans			
Resource	Wetlands (FCU/HSU)		Waterfowl (DUD)	Terrestrial Wildlife (AAHU)	Wetlands (FCU/HSU)		Waterfowl (DUD)	Terrestrial Wildlife (AAHU)	Wetlands (FCU/HSU)		Waterfowl (DUD)	Terrestrial Wildlife (AAHU)
	Riverside	Landside			Riverside	Landside			Riverside	Landside		
Impacts	-11,193	-12,731	-99,029	-540	-15,523	-4,863	-545,676	-868	-997	-3,986	-18,246	-198
Mitigation	11,193	12,731	1,151,925	1,612	15,519	4,848	1,108,376	1,467	1,001	4,001	74,220	283
Net Effect	0	0	1,052,896	1,072	-4	-15	562,700	599	4	15	55,974	85

Table A20- 3. Best Buy Plans and Average Annual (AA) Incremental Costs.

Alter-native	**First Cost**	**Interest During Cons-truction**	**AA Cost**	**AA FCU/ HU**	**AA Cost FCU/ HU**	**Additional Output (FCU/ HU)**	**Additional AA Cost**	**Incremental Cost (FCU/HU)**
No Action	$0		$0	0	$0	0	$0	$0
Active Refores-tation	$14,344,125	$195,894	$538,576	986	$546	986	$538,576	$546

Note: Costs are shown at the 2020 price level and were annualized using the current FY20 Federal discount rate of 2.75 percent over a 50-year period of analysis.

A20-1.3 CONCLUSION

The mitigation planning analysis indicates that BLH reforestation of agricultural land is the most cost efficient means of overall project environmental resource impact compensation. Incremental cost analysis was used to rank different mitigation measures in order of cost effectiveness. Thus, selection of mitigation measures followed a sequence of cost effectiveness. Furthermore, additional incremental cost analysis will be conducted once site-specific tracts are acquired. This additional cost analysis will assist in making mitigation determinations regarding what type of species to plant based on habitat suitability and market availability. The results of this analyses would be coordinated with the interagency team as part of the completion of site-specific mitigation plans. Mitigation is considered complete when impacted habitat/function is compensated. Completion is not determined on a specific amount of mitigation acreage. Additional details regarding the mitigation strategy are found in Section 5 of the SEIS.

A20-2.0 REFERENCES

Murray E. and C. Klimas. 2013. A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Functions of Forested Wetlands in the Mississippi Alluvial Valley. ERDC/EL TR-13-14.

USACE. 2017. Wetland Value Assessment Coastal Marsh Community Models for Civil Works (version 2.0). U.S. Army Corps of Engineers Planning Models Improvement Program. US Army Corps of Engineers, New Orleans District.

USACE. 2018. Wetland Value Assessment Bottomland Hardwoods Community Model for Civil Works (Version 1.2). U.S. Army Corps of Engineers Planning Models Improvement Program. US Army Corps of Engineers, New Orleans District.

A20-3.0 ATTACHMENT 1

Mitigation Cost Calculations

In order to compensate unavoidable losses to environmental resources from the construction and operation, maintenance, and repair of the 143 Work Items, including the selection of borrow sites and the excavation of borrow material required for construction of the Work Items, compensatory mitigation requirements were calculated from a suite of environmental models certified by the USACE Ecosystem Restoration National Planning Center of Expertise. Table 1 summarizes the total unavoidable losses (impacts) to wetlands, waterfowl, terrestrial wildlife, and aquatic resources by District.

Table 1. Total impacts and mitigation from the 143 Work Items summarized by District.

District	Impacts					Required Mitigation (acres)[5]
	Wetlands (FCU/HSU) [1]		Waterfowl (DUD)[2]	Terrestrial Wildlife (AAHU)[3]	Aquatic Resources (HU)[4]	
	Riverside	Landside				
Memphis	-11,193	-12,731	-99,029	-540.3	379	673
Vicksburg	-15,523	-4,863	-545,676	-867.9	347	614
New Orleans	-997	-3,986	-18,246	-197.8	140	160
TOTAL	-27,713	-21,580	-662,951	-1,606	866	1,447

[1] Functional Capacity Units calculated from Hydrogeomorphic Manual (HGM) and Habitat Suitability Units from Wetland Value Assessment (WVA) analyses.
[2] Duck-Use-Days (DUD) calculated from waterfowl analyses.
[3] Average Annual Habitat Units calculated using Habitat Evaluation Procedures (HEP) analyses on wildlife.
[4] Habitat Units calculated from Borrow Area Habitat Suitability Index Fish Diversity Model (aquatic HUs were all positive benefits from addition of open water associated with borrow areas).
[5] Required mitigation acres for the proposed mitigation scenario of land acquisition and actively reforesting agricultural lands; acreages are driven by the wetland analyses, as wetlands require the most acreage for compensation.

Three compensatory mitigation alternatives were analyzed for the cost analyses and to determine the most cost effective plan: 1) land acquisition with active reforestation, 2) land acquisition with natural succession, and 3) purchase of credits using mitigation banks or in-lieu-fee-programs. The most cost effective means of completing compensatory mitigation and the recommended mitigation scenario was land acquisition with active reforestation. Details of the costs and associated assumptions are included below.

Land Acquisition with Active Reforestation

Costs for land acquisition with active reforestation include the purchase of available frequently flooded agricultural lands via fee simple title + the costs of active reforestation (e.g., seedling purchase and planting, cold storage and transportation, land preparation, road improvements, labor to conduct plantings, etc.). A breakdown of these costs/acre for the three Districts is described below.

Memphis and Vicksburg Districts

The costs for the acquisition of potential mitigation lands and the reforestation of those lands within the Memphis District and Vicksburg District were assumed to be similar across the District. An average cost of agricultural lands to possibly be acquired for reforestation near the Mississippi River Levee was used. See Table 2 below.

Table 2. Mitigation costs for reforestation of agricultural lands in the Memphis District and Vicksburg District.

	Memphis District	Vicksburg District
Agricultural land (cost/acre)	$8,500	$6,500
Active reforestation (cost/acre)	$400	$400
TOTAL COST/ACRE	$8,900	$6,900
Required acres of mitigation	673	614
TOTAL MITIGATION COST	$5,989,700	$4,236,600

New Orleans District

The New Orleans District used a watershed approach to determine costs for mitigation due to the varying cost of land in different watersheds, as described in Table 3 below.

Table 3. Mitigation costs for reforestation of agricultural lands in New Orleans District.

	Atchafalaya Watershed	Terrebonne Watershed	Lake Pontchartrain Watershed	Barataria Watershed	Mississippi River Watershed
Agricultural land (cost/acre)	$5,000	$7,500	$10,000	$7,500	$7,500
Active reforestation (cost/acre)	$400	$400	$400	$400	$400
TOTAL COST/ACRE	$5,400	$7,900	$10,400	$7,900	$7,900
	60	2	1	1	3

Required acres of mitigation (160 total acres)	0[1]	0[1]	53[1]	17[1]	23[1]
[1]Acres within respective watersheds requiring compensatory mitigation within the Louisiana Coastal Zone.					
TOTAL MITIGATION COST PER WATERSHED	$324,000	$15,800	$561,600	$142,200	$205,400
TOTAL MITIGATION COST	$1,249,000				

Total Mitigation Costs

The total cost of purchasing the required 1,447 acres of frequently flooded agricultural fields and actively reforesting with plantings is $11,475,300. Adding a 25 percent contingency ($2,868,825) to this total to account for risk and uncertainty equates to a total project mitigation cost of **$14,344,125**.

Land Acquisition with Natural Succession

The costs of land acquisition with natural succession is similar to that of active reforestation; however, there would be no planting costs. Additionally, based on the wetland analyses, natural succession would require a total of 68 additional acres across all districts (four additional acres from HGM; 64 acres from WVA) to compensate for the less optimal species composition compared to active reforestation with plantings. A breakdown of these costs/acre for the three Districts is described below.

Memphis and Vicksburg Districts

The costs for the acquisition of potential mitigation lands and the reforestation of those lands within the Memphis District and Vicksburg District were assumed to be similar across the District. An average cost of agricultural lands to possibly be acquired for reforestation near the Mississippi River Levee was used. See Table 4 below.

Table 4. Mitigation costs for reforestation of agricultural lands in the Memphis District and Vicksburg District.

	Memphis District	Vicksburg District
Agricultural land (cost/acre)	$8,500	$6,500
Required acres of mitigation	676	660
TOTAL MITIGATION COST/DISTRICT	$5,746,000	$4,290,000

New Orleans District

The New Orleans District used a watershed approach to determine costs for mitigation due to the varying cost of land in different watersheds, as described in Table 5 below.

Table 5. Mitigation costs for reforestation of agricultural lands in New Orleans District.

	Atchafalaya Watershed	Terrebonne Watershed	Lake Pontchartrain Watershed	Barataria Watershed	Mississippi River Watershed
Agricultural land (cost/acre)	$5,000	$7,500	$10,000	$7,500	$7,500
Required acres of mitigation (160 total acres)	67	2	1	1	3
	0[1]	0[1]	61[1]	19[1]	25[1]
[1]Acres within respective watersheds requiring compensatory mitigation within the Louisiana Coastal Zone.					
TOTAL MITIGATION COST PER WATERSHED	$335,000	$15,000	$620,000	$150,000	$210,000
TOTAL MITIGATION COST/DISTRICT	$1,330,000				

Total Mitigation Costs

The total cost of purchasing the required 1,515 acres of frequently flooded agricultural fields and allowing to re-vegetate naturally (without planting) is $11,366,000. A larger contingency was added to natural succession compared to active planting efforts due to the increased risk and uncertainty associated with a greater likelihood of invasion of by invasive species and associated costs of removal and a greater likelihood of intensive monitoring to determine species composition. Thus, adding a 30 percent contingency ($3,409,800) to this total to account for the greater risk and uncertainty equates to a total project mitigation cost of **$14,775,800**.

Mitigation Banks/In-lieu-fee Programs

The availability and costs of mitigation credits from mitigation banks and in-lieu-fee programs can vary depending on supply and demand, resulting in a considerable amount of uncertainty with costs. Additionally, there is considerable variation in the methodology used to evaluate credits from mitigation banks and in-lieu-fee programs with service areas overlapping the Work Items (e.g., WVA can be used in Louisiana, Charleston Method is used in Mississippi, ratio-

based methods in Tennessee, etc.). However, to compare costs associated with mitigation banks or in-lieu-fee programs to other mitigation scenarios, there is a need to have a standardized cost per unit of measure. An average cost/acre was determined to be the best way to provide this standardized measurement across the large project area. Based off of recent estimates from banks and in-lieu-fee programs with service areas overlapping the Work Items, an average of $40,000/acre was determined for the overall impacts across Memphis, Vicksburg, and New Orleans Districts. Table 6 summarizes the overall costs using this assumption.

Table 6. Estimated mitigation costs using mitigation banks or in-lieu-fee programs by USACE district.

	Memphis District	Vicksburg District	New Orleans District
Impacted Acres[1]	481	405	100
Costs/acre	$40,000	$40,000	$40,000
Cost/District	$19,240,000	$16,200,000	$4,000,000
TOTAL COST	**$39,440,000**		

[1]Impacted acres were back-calculated using the average effective wetland mitigation ratios (1.6:1 for WVA and 1.4:1 for HGM), as described in the wetland assessment (see Section 10.4.3 and Table 10.32 in Appendix 10). These effective mitigation ratios reflect the habitat suitability/functional capacity derived from average annual habitat units (AAHUs) over the 50 year period of analysis. The effective mitigation ratio is lower using the HGM approach because wetland mitigation sites maintain some wetland functions (e.g., detain precipitation) at target year zero, while the WVA models yield no habitat suitability at target year zero.