Appendix B

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Table B-1: LPV Habitat Impacts as Documented During Completion of the IERs (Final Resolution)

LPV FINAL HABITAT IMPACTS from IERs																							
	Protected Side										Flood Side												
IER+	Fresh and Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Fresh and Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Open Water	TOTAL**	
	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	**AAHUs**	**Acres**
1	0	0	0	0	137.05	73.99	1.50	0.19	0	0	0	0	0	0	143.60	110.97	11.33	8.09	0	0	19.41	**293.48**	**193.24**
2	0	0	0	0	0	0	0	0	0	0	0	0	31.50	20.45	2.00	1.55	0	0	0	0	78.00	**33.50**	**22.00**
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	417.00	**0**	**0**
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.90	**0**	**0**
6	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	68.80	**0**	**0**
7	119.00	42.90	0	0	0	0	169.00	89.20	0	0	0	0	126.00	67.40	0	0	32.80	12.20	0	0	6.76	**446.80**	**211.70**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.30	**0**	**0**
9	0	0	0	0	0	0	0	0	0	0	1.90	1.20	0	0	0	0	1.20	0.66	10.02	4.65	1.80	**13.12**	**6.51**
10	106.47	57.26	0.08	0.05	0	0	38.32	16.44	0	0	53.20	31.26	269.84	178.68	0	0	35.31	15.22	0	0	50.00	**503.22**	**298.91**
11	0	0	0	0	0	0	0	0	2.46	0.41	0	0	80.84	34.70	0	0	0	0	9.48	1.59	45.00	**92.78**	**36.70**
18	0	0	0	0	0	0	0	0	44.00	14.65	0	0	0	0	0	0	0	0	0	0	0	**44.00**	**14.65**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**	**0.00**
Total	**225.47**	**100.16**	**0.08**	**0.05**	**137.05**	**73.99**	**208.82**	**105.83**	**46.46**	**15.06**	**55.10**	**32.46**	**508.18**	**301.23**	**145.60**	**112.52**	**80.64**	**36.17**	**19.50**	**6.24**	**695.97**	**1426.90**	**783.71**

+Includes IERs and supplements
****Total does not include impacts to open water as stated in this table**

Table B-2: Risk and Reliability Data Matrix

Risk & Reliability - LPV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns**	Adaptability	Long-term Sustainability
LPV ALTERNATIVES	Qualitative	Qualitative	Qualitative	% land @ TY50 (marsh)/ HSI @ TY50 (forest)
Non-Refuge BLH-Dry/BLH-Wet				
Bonnet Carre Restore	Uncertainty relative to spillway operation during early plant establishment; later spillway operation could impact mid-story -	Real Estate Ownerships: Public +	If all project components are implemented there is minimal room to add acreage. Manipulating elevation after planting is not practical. -	.98/.96
Frenier Restore	Minimal uncertainty related to existing hydrology 0	Real Estate Ownerships: Private; Coordination may be necessary regarding surface drainage issues - -	Additional acreage can be added. Manipulating elevation after planting is not practical, but there are options for manipulating surface hydrology. 0	.98/.95
Fritchie Restore/Enhance	Restoration feature only: uncertainty associated with fill (quality/quantity/settlement/location) and unproven methodology associated with BLH creation from open water -	Real Estate Ownership: Private -	There is only room to add acreage through restoration. Manipulating elevation after planting is not practical. -	.93(BLH-D)/.69(BLH-W-E)/.68(BLH-W-R)
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	Minimal uncertainty; no adaptive mgmt need. 0	Real Estate Ownership: N/A; Minimal uncertainty ++	After credits are purchased no adaptation is necessary. +	0.63-0.96

**Alternatives with any private ownerships are penalized because it is assumed that there is more uncertainty relative to the acquisition of private ownerships than public ownerships.

Risk & Reliability - LPV	**Self-Sustainability**			**Risk of Exposure to Stressors/ Reliability of Design**			**Financial Assurances**
LPV ALTERNATIVES	Active engineering features?	Anticipated OMRR&R Activities	Relative difficulty OMRR&R	Relative probability of exposure to stressors [Note: Although subsidence is addressed via land loss in the WVA it is noted here as a stressor for enhancement projects where elevation cannot be adjusted without destroying existing vegetation	Project performance relative to stressors	Resiliency after exposure to stressors	Relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Non-Refuge BLH-Dry/BLH-Wet							
Bonnet Carre Restore	No +	Inv species control, additional planting (if needed),general monitoring, and weir maintenance.-	Standard 0	Susceptible to storm surge, spillway operations, and storm-induced salinity impacts -	Storm-induced salinity and surge could stress trees, spillway opening could impact mid-story requiring replanting -		YES +
Frenier Restore	No +	Inv species control, additional planting (if needed), general monitoring, and weir maintenance -	Standard 0	Susceptible to storm-induced salinity impacts, storm surge, sea-level rise -	Salinity could stress trees; sea level rise could convert BLH to different habitat. -		YES +
Fritchie Restore/Enhance	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to periodic storm-induced salinity impacts, storm surge/wave action, sea-level rise, and subsidence - -	Salinity and storm surge/wave action could stress/kill trees; sea level rise could convert BLH to different habitat. -		YES +
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	n/a (because the bank is responsible) 0	n/a (because the bank is responsible) +	n/a (because the bank is responsible) +	unknown location and age 0	unknown 0		Some banks have financial assurances and some don't 0

Risk & Reliability - LPV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Adaptability	Long-term Sustainability
LPV ALTERNATIVES	Qualitative	Qualitative	Qualitative	% land @ TY50 (marsh)/ HSI @ TY50 (forest)
Non-Refuge Swamp				
Bonnet Carre Restore	Uncertainty relative to spillway operation during early plant establishment; later spillway operation could impact mid-story -	Real Estate Ownerships: Public +	There is some room to add acreage. Manipulating elevation after planting is not practical. 0	0.68
Caernarvon Restore	Uncertainty relative to diversion operation during early plant establishment; future diversion operation; achieving appropriate design elevation and hydrologic conditions. Unproven methodology associated with swamp creation from open water. Uncertainty associated with fill (quality/quantity/settlement/location) - -	Real Estate Ownerships: Private -	There is minimal room to add acreage. Manipulating elevation after planting is not practical. -	0.66
Mitigation Bank	Minimal uncertainty; no adaptive mgmt need.0	Real Estate Ownerships: N/A; Minimal uncertainty ++	After credits are purchased no adaptation is necessary. +	0.60-1.00
Milton Island Restore	Uncertainty associated with fill (quality/quantity/settlement/location); Some uncertainty related to existing hydrology and interactions with surrounding area; Some uncertainty related to stressors currently affecting surrounding swamp habitat and southern portion of proposed mitigation site. -	Real Estate Ownerships: Private; Coordination may be necessary regarding surface drainage issues - -	There is room to add acreage. Manipulating elevation after planting is not practical, but there are options for adapting hydrology. +	.58(R)/.29(E)

Risk & Reliability - LPV	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
LPV ALTERNATIVES	Active engineering features?	Anticipated OMRR&R Activities	Relative difficulty OMRR&R	Relative probability of exposure to stressors	Project performance relative to stressors	Resiliency after exposure to stressors	Relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Non-Refuge BLH-Dry/BLH-Wet							
Bonnet Carre Restore	No +	Inv species control, additional planting (if needed), general monitoring, and weir maintenance. -	Standard 0	Susceptible to storm surge, spillway operations, and storm-induced salinity impacts -	Storm-induced salinity and surge could stress trees, spillway opening could impact mid-story requiring replanting -		YES +
Caernarvon Restore	No +	Inv species control, additional planting (if needed) and general monitoring, possible channel maintenance, and scour issues. - -	Standard 0	Susceptible to change in diversion operations which could impact hydrology; storm-surge, storm-induced salinity impacts, sea-level rise. - -	Storm-induced salinity, surge, change in diversion flow could stress trees, and sea level rise could convert swamp to different habitat. -		YES +
Mitigation Bank	n/a (because the bank is responsible) 0	n/a (because the bank is responsible) +	n/a (because the bank is responsible) +	unknown location and age 0	unknown 0		Some banks have financial assurances and some don't 0
Milton Island Restore	No +	Inv species control, additional planting (if needed) and general monitoring. 0	Standard 0	Susceptible to storm-surge, storm-induced salinity impacts, sea-level rise. -	Storm-induced salinity and surge could stress trees; sea level rise could convert swamp to different habitat. -		YES +

Risk & Reliability - LPV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Adaptability	Long-term Sustainability
LPV ALTERNATIVES	Qualitative	Qualitative	Qualitative	% land @ TY50 (marsh)/ HSI @ TY50 (forest)
Non-Refuge Intermediate Marsh				
Bayou Des Mats Restore	Minimal uncertainty 0	Real Estate Ownerships: Public & Private -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	79%
Big Branch Restore	Minimal uncertainty 0	Real Estate Ownerships: Public & Private -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	66%
Caernarvon Restore	Minimal uncertainty 0	Real Estate Ownerships: Private -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	0%
Fritchie Restore	Minimal uncertainty 0	Real Estate Ownerships: Public & Private -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	62%
LaBranche Restore	Minimal uncertainty 0	Real Estate Ownerships: Private; CWPPRA Phase I project (PO-75) would have to be deauthorized prior to implementation of mitigation project - -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	90%
Milton Island Restore	Minimal uncertainty 0	Real Estate Ownerships: Private -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	87%

Risk & Reliability – LPV	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design			Financial Assurances
LPV ALTERNATIVES	Active engineering features?	Anticipated OMRR&R Activities	Relative difficulty OMRR&R	Relative probability of exposure to stressors	Project performance relative to stressors	Resiliency after exposure to stressors	Relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Non-Refuge Intermediate Marsh							
Bayou Des Mats Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to sea level rise 0	Sea level rise could convert marsh to different habitat (open water) 0		YES +
Big Branch Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
Caernarvon Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
Fritchie Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
LaBranche Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
Milton Island Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +

Risk & Reliability - LPV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Adaptability	Long-term Sustainability
LPV ALTERNATIVES	Qualitative	Qualitative	Qualitative	% land @ TY50 (marsh)/ HSI @ TY50 (forest)
Non-Refuge/Refuge Brackish Marsh				
Bayou Sauvage Restore	Minimal uncertainty 0	Real Estate Ownerships: Public & Private; Does not require USFWS exception to Final Policy on the NWR System and Compensatory Mitigation under Section 10/404 Prgm. USFWS has indicated that this would be acceptable mitigation for refuge impacts. 0	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	81%
Big Branch Restore	Minimal uncertainty 0	Real Estate Ownerships: Public & Private; Will require USFWS exception to Final Policy on the NWR System and Compensatory Mitigation under Section 10/404 Prgm, which could impact schedule. USFWS has indicated that this would be acceptable mitigation for refuge impacts.-	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	66%
Fritchie Restore	Minimal uncertainty 0	Real Estate Ownerships: Public & Private; Will require USFWS exception to Final Policy on the NWR System and Compensatory Mitigation under Section 10/404 Prgm, which could impact schedule. USFWS has indicated that this would be acceptable mitigation for refuge impacts.-	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	62%

Risk & Reliability - LPV	Uncertainty Relative to Achieving Ecological Success	Uncertainty Relative to Implementability Concerns	Adaptability	Long-term Sustainability
LPV ALTERNATIVES	Qualitative	Qualitative	Qualitative	% land @ TY50 (marsh)/ HSI @ TY50 (forest)
Golden Triangle Restore	Uncertainty relative to project area hydrodynamics during storm events due to surge barrier. -	Real Estate Ownesrhips: Public & Private; Does not require USFWS exception to Final Policy on the NWR System and Compensatory Mitigation under Section 10/404 Prgm. USFWS has indicated that this may not be acceptable mitigation for refuge impacts due to sustainability concerns.- -	Opportunity to add acreage. Could be adapted with marsh nourishment, supplemental plantings, or shoreline protection/maintenance. 0	59%
Refuge PS BLH Wet				
Bayou Sauvage Restore	Uncertainty associated with fill (quality/quantity/ settlement/location). Unproven methodology associated with BLH creation from open water.	Real Estate Ownerships: Public; Coordination required regarding western drainage structure operation and water management master plan.	There is room to add acreage. Manipulating elevation after planting is not practical. Some possibility for future hydrologic adaptations.	0.86
Refuge FS BLH-Wet				
Fritchie Enhance	Minimal uncertainty based on current data.	Real Estate Ownerships: Private	There is no room to add acreage. Manipulating elevation after planting is not practical.	0.69
Refuge PS Intermediate Marsh				
Bayou Sauvage Restore	Minimal uncertainty	Real Estate Ownerships: Public	Opportunity to add acreage. Could be adapted with marsh nourishment, shoreline protection/maintenance and supplemental plantings. Some possibility for future hydrologic adaptations.	36%

Risk & Reliability - LPV	**Self-Sustainability**			**Risk of Exposure to Stressors/ Reliability of Design**			**Financial Assurances**
LPV ALTERNATIVES	Active engineering features?	Anticipated OMRR&R Activities	Relative difficulty OMRR&R	Relative probability of exposure to stressors [Note: Although subsidence is addressed via land loss in the WVA it is noted here as a stressor for enhancement projects where elevation cannot be adjusted without destroying existing vegetation]	Project performance relative to stressors	Resiliency after exposure to stressors	Relative differences
	Yes/No	Anticipated OMRR&R Activities	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Non-Refuge/Refuge Brackish Marsh							
Bayou Sauvage Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
Big Branch Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
Fritchie Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to wave action and sea level rise -	Sea level rise and wave action could convert marsh to different habitat (open water) 0		YES +
Golden Triangle Restore	No +	Possible planting, general monitoring. 0	Standard 0	Susceptible to sea level rise 0	Sea level rise could convert marsh to different habitat (open water) 0		YES +
Refuge PS BLH Wet							
Bayou Sauvage Restore	No	Inv species control, additional planting (if needed) and general monitoring.	Standard	Possible susceptibility to storm-induced salinity impacts if levees are overtopped	Salinity could stress/kill trees		YES

Risk & Reliability – LPV	Self-Sustainability			Risk of Exposure to Stressors/ Reliability of Design		Financial Assurances
LPV ALTERNATIVES	Active engineering features?	Anticipated OMRR&R Activities	Relative difficulty OMRR&R	Relative probability of exposure to stressors [Note: Although subsidence is addressed via land loss in the WVA it is noted here as a stressor for enhancement projects where elevation cannot be adjusted without destroying existing vegetation]	Project performance relative to stressors	Resiliency after exposure to stressors
Refuge FS BLH-Wet						
Fritchie Enhance	No	Inv species control, additional planting (if needed) and general monitoring.	Standard	Susceptible to periodic storm-induced salinity impacts, storm surge/wave action, sea-level rise, subsidence.	Salinity and storm surge/wave action could stress/kill trees; sea level rise could convert BLH to different habitat.	YES
Refuge PS Intermediate Marsh						
Bayou Sauvage Restore	No	Possible planting, general monitoring.	Standard	Possible susceptibility to wave action	Salinity could stress/kill trees	YES

Table B-3: Watershed & Ecological Site Considerations Data Matrix

Watershed & Ecological - LPV	**Watershed Considerations/Significance in Watershed**					**Ecological Site Considerations (swamp and marsh only)**	
LPV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
	Yes (name area) / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Qualitative
Non-Refuge BLH-Dry/BLH-Wet							
Bonnet Carre Restore	Completely within the Bonnet Carre Spillway +	No (St Charles) - No Impacts for LPV, but BLH-Wet impacts for WBV (St Charles) 0	No 0	No 0	Yes ++	n/a 0	n/a 0
Frenier Restore	No -	No (St John the Baptist) 0	No 0	No 0	Partial +	n/a 0	n/a 0
Fritchie Restore/Enhance	In close proximity to Big Branch Marsh National Wildlife Refuge and Completely within PO-06 (CWPPRA) Fritchie Marsh Restoration +	No (St Tammany) 0	Yes (chenier) +	Yes, BLH-Dry is completely within Critical Feature # 2, Pontchartrain Landbridge/Highway 90 - BLH-Wet Majority covered in Critical Feature #2 +	No -	n/a 0	n/a 0
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	A mitigation bank is a resource managed area. +	No 0	No 0	No 0	No -	n/a 0	n/a 0

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Refuge BLH-Dry/BLH-Wet				
Bonnet Carre Restore	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. Potential borrow source from Mississippi River. +	Yes - Strategic Goals (Create wetlands, dedicated dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Yes, Not coincident with a coastal measure. Project is located on the flood side of existing levees but on the protected side of proposed LaCPR levees. +
Frenier Restore	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2, Objective 3 - Conversion of Ag land to BLH. *The Governor's office commissioned an Advisory Panel to define stakeholder issues and make associated policy recommendations for sustainable management of coastal forests in Louisiana based upon the Coastal Wetland Forest Conservation and Use Science Working Group, 2005 report. One of the major recommendations was to develop state programs for restoration of existing coastal wetland forests or creation of new coastal wetland forests on agricultural or other suitable open lands, and ensure these programs work in concert with relevant federal programs.* +	Yes - Strategic Goals (Create wetlands, dedicated dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Yes, Not coincident with a coastal measure. Project is located on the flood side of existing levees but on the protected side of proposed LaCPR levees. +

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Fritchie Restore/Enhance	Yes. Objective 1 - Addition of BLH outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. For Restoration Feature: Conversion of open water to BLH +	Yes - Strategic Goals (Create wetlands, dedicated dredging, maintain critical landforms) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Yes, Completely within coastal measure 2-5 East New Orleans Land Bridge Marsh Creation - 7,996 @ 900 acres/year (ENHANCE BLH DRY ONLY); On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. +
Mitigation Bank (mitigate BLH-Dry impacts with BLH-Wet credits)	No change since banks are already in place 0	No change since banks are already in place 0	No change since banks are already in place 0	No change since banks are already in place 0

**The predicted reductions in high and low monthly salinity provided in this table are derived from the results of the UNO Mass Balance Model which was used to complete the Environmental Impact Statement for the Mississippi River Gulf Outlet Ecosystem Restoration Project. This model produced predicted monthly high and low salinities for the Pontchartrain Basin under scenarios with and without the Hope Canal and Convent/Blind River diversions, and LCA modification to Caernarvon Diversion.

Watershed & Ecological - LPV	**Watershed Considerations/Significance in Watershed**					**Ecological Site Considerations (swamp and marsh only)**	
LPV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	Fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
	Yes (name area) / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Qualitative
Non-Refuge Swamp							
Bonnet Carre Restore	Completely within the Bonne Carre Spillway +	Yes (St Charles) +	No 0	No 0	Yes ++	Yes, fragmented by canals and roads --	No -
Caernarvon Restore	Completely within the BS-03a and BS-08 Caernarvon Freshwater Diversion and Outfall Management +	No (Plaquemines) 0	No 0	No 0	No -	Yes, fragmented by diversion bifurcation canals. --	No -
Mitigation Bank	A mitigation bank is a resource managed area. +	No 0	No 0	No 0	No -	unknown 0	unknown 0
Milton Island Restore	No -	No (St Tammany) 0	No 0	No 0	Yes ++	Yes, due to transmission line. --	No -

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Refuge Swamp				
Bonnet Carre Restore	Yes. Objective 1 - Addition of swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. Potential borrow source from Mississippi River. +	Yes - Regional Ecosystem Strategies (Restore swamps) Strategic Goals (Create Wetlands, dedicated dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Yes, Not coincident with a coastal measure. Project is located on the flood side of existing levees but on the protected side of proposed LaCPR levees. +
Caernarvon Restore	Yes. Objective 1 - Addition of swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to swamp. +	Yes - Regional Ecosystem Strategies (Restore swamps) Strategic Goals (Create Wetlands, dedicated dredging) +	Yes/No, The LCA Modification to Caernarvon project assumes that Big Mar is open water; therefore, the proposed cypress swamp mitigation must be modeled for impacts on existing diversion operations as well as any modifications it would have to the assumptions for the LCA Modification to Caernarvon feasibility study. The proposed swamp mitigation could increase sediment trapping within Big Mar and could also aid in re-distributing diversion (and diversion modification) benefits within the Caernarvon basin. The mitigation project would benefit from nutrients, fresh water, and sedimentation from the LCA Modification to Caernarvon project, but would duplicate some benefits for marsh creation assigned to the LCA Modification to Caernarvon project (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. 0	Yes, Completely within coastal measure 2-12 Caernarvon Diversion – sized to sustain all marshes between Bayou Terre aux Boeufs and the Miss. River; Project is located adjacent to the existing East Plaquemines Non-Federal Levee on the floodside. It is also on the floodside of the Lake Pontchartrain and Vicinity Levees ++

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Mitigation Bank	No change since banks are already in place 0	No change since banks are already in place 0	No change since banks are already in place 0	No change since banks are already in place 0
Milton Island Restore	Yes. Objective 1 - Addition of swamp outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to swamp. +	Yes - Regional Ecosystem Strategies (Restore swamps) Strategic Goals (Create Wetlands, dedicated dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0

Watershed & Ecological - LPV	**Watershed Considerations/Significance in Watershed**					**Ecological Site Considerations (swamp and marsh only)**	
LPV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	Fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
	Yes (name area) / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Qualitative
Non-Refuge Intermediate Marsh							
Bayou Des Mats Restore	Partially within the St Tammany Wildlife Refuge and Big Branch Marsh National Wildlife Refuge ++	No (St Tammany) 0	No 0	No 0	No -	No +	No -
Big Branch Restore	Majority within Big Branch Marsh National Wildlife Refuge ++	No (St Tammany) 0	No 0	No 0	Partial +	No +	No -
Caernarvon Restore	Completely within the BS-03a and BS-08 Caernarvon Freshwater Diversion and Outfall Management, Completely within the Caernarvon 4th Supplemental Project Area +	Yes (St Bernard) +	Yes (lake rim) +	No 0	Partial +	No +	No -
Fritchie Restore	Partially within Big Branch Marsh National Wildlife Refuge, Completely within PO-06 (CWPPRA) Fritchie Marsh Restoration ++	No (St Tammany) 0	No 0	No 0	Partial +	No +	No -

Watershed & Ecological - LPV	**Watershed Considerations/Significance in Watershed**					**Ecological Site Considerations (swamp and marsh only)**	
LPV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	Fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
	Yes (name area) / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Qualitative
LaBranche Restore	Slight overlap with PO-03b LaBranche Shoreline Protection Project ++	No (St Charles) 0	Yes (lake rim) +	No 0	Partial +	No +	No -
Milton Island Restore	No -	No (St Tammany) 0	Yes (lake rim) +	No 0	No -	No +	No -

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Refuge Intermediate Marsh				
Bayou Des Mats Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 3 ppt in high monthly salinity and 2 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0
Big Branch Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 3 ppt in high monthly salinity and 2 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0
Caernarvon Restore	Yes. Objective 1 - shoreline protection and addition of marsh outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes/No, This project will benefit from nutrients and fresh water from the LCA Modification to Caernarvon project. This project will likely duplicate some benefits for marsh creation assigned to the LCA Modification to Caernarvon project (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. 0	Yes, Completely within coastal measure 2-12 Caernarvon Diversion – sized to sustain all marshes between Bayou Terre aux Boeufs and the Miss. River. Project is located on the floodside of existing Lake Pontchartrain and Vicinity Levees and East Plaquemines Non-Federal Levee ++

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Fritchie Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Portions may be consistent with Measure 1-12 St Tammany Marsh Restoration. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0
LaBranche Restore	Yes. Objective 1 - shoreline protection and addition of marsh outside of levee protection, Objective 2, Objective 3 and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high mon thly salinity and 1 ppt in low monthly salinity)**. +	Yes, Completely within coastal measure 2-3 LaBranche Diversion – diversion directly into LaBranche wetlands to sustain those wetlands; Project is located on the flood side of existing levees but on the protected side of proposed LaCPR levees. ++
Milton Island Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0

Watershed & Ecological - LPV	**Watershed Considerations/Significance in Watershed**					**Ecological Site Considerations (swamp and marsh only)**	
LPV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	Fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
	Yes (name area) / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Qualitative
Non-Refuge/Refuge Brackish Marsh							
Bayou Sauvage Restore	Partially within Bayou Sauvage National Wildlife Refuge, Completely within PO-02c Bayou Chevee, Completely within PO-22 (CWPPRA) Bayou Chevee Shoreline Protection ++	Yes (Orleans) +	Yes (lake rim, land bridge) +	Yes, Partial coverage by Critical Feature #2, Pontchartrain Landbridge/Highway 90 +	Yes ++	Yes --	No -
Big Branch Restore	Partially within Big Branch Marsh National Wildlife Refuge ++	No (St Tammany) 0	No 0	No 0	Partial +	No +	No -
Fritchie Restore	Partially within Big Branch Marsh National Wildlife Refuge, Completely within PO-06 (CWPPRA) Fritchie Marsh Restoration ++	No (St Tammany) 0	No 0	No 0	Partial +	No +	No -
Golden Triangle Restore	Partially within Bayou Sauvage National Wildlife Refuge and completely within the acquisition boundary, Adjacent to PO-36 (EB) CIAP Orleans Land bridge shoreline protection and marsh creation ++	Yes (Orleans) +	No 0	Adjacent to Critical Feature #2, Pontchartrain Landbridge/Highway 90 0	Partial +	No +	No -

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Non-Refuge/Refuge Brackish Marsh				
Bayou Sauvage Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, Objective 4 (some restoration within Bayou Sauvage National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Consistent with Measure 1-14 East Orleans Landbridge Restoration. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh, maintain critical landforms) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Yes, partially within coastal measure 2-5 East New Orleans Land Bridge Marsh Creation - 7,996 @ 900 acres/year; On protected side of proposed Lake Pontchartrain surge barrier-weir but on floodside of LPV levee. + +
Big Branch Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, Objective 4 (some restoration within Big Branch National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 3 ppt in high monthly salinity and 2 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0
Fritchie Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, Objective 4 (some restoration within Big Branch National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Portions are consistent with Measure 1-12 St Tammany Marsh Restoration. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**. +	Not coincident with a coastal measure; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment. 0

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Golden Triangle Restore	Yes. Objective 1 - Addition of marsh outside of levee protection, Objective 2, Objective 3, Objective 4 (some restoration within Bayou Sauvage National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore. Consistent with Measure 1-18 Marsh Restoration using Dredge Material at Golden Triangle. Conversion of open water to marsh. +	Yes - Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create Wetlands, Dedicated Dredging) +	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**.+	Yes, completely within coastal measure 2-4 Bayou Bienvenue Diversion – to reduce East New Orleans landbridge loss rates by 50%; On protected side of proposed LaCPR levee but on floodside of LPV levee. + +

Watershed & Ecological - LPV	**Watershed Considerations/Significance in Watershed**					**Ecological Site Considerations (swamp and marsh only)**	
LPV ALTERNATIVES	Contiguous with or within resource managed area	Located in Parish with Impacts	Critical Geomorphic Feature	LaCPR Critical Landscape Feature	Habitat Linkage	Fragmentation within site boundary	Habitat connectivity to larger project area given future land use trends
	Yes (name area) / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Qualitative
Refuge PS BLH Wet							
Bayou Sauvage Restore	Completely within Bayou Sauvage National Wildlife Refuge, Completely within PO-16 (CWPPRA) Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1.	Yes (Orleans)	No	Yes, Critical Feature # 2, Pontchartrain Landbridge/Highway 90	No	Yes, due to drainage channel	No
Refuge FS BLH-Wet							
Fritchie Enhance	In close proximity to Big Branch Marsh National Wildlife Refuge and Completely within PO-06 (CWPPRA) Fritchie Marsh Restoration	No (St Tammany)	Yes (chenier, land bridge)	Yes, Critical Feature # 2, Pontchartrain Landbridge/Highway 90	No	n/a	n/a
Refuge PS Intermediate Marsh							
Bayou Sauvage Restore	Completely within Bayou Sauvage National Wildlife Refuge, Completely within PO-16 (CWPPRA) Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1.	Yes (Orleans)	No	Yes, Critical Feature # 2, Pontchartrain Landbridge/Highway 90	No	Yes, due to drainage channel	No

Watershed Considerations/Significance in Watershed (Consistency)				
Watershed & Ecological - LPV	With State Master Plan	With Coast 2050 Plan	With LCA	With LACPR
LPV ALTERNATIVES	Yes / No (objective)	Yes / No (objective)	Yes / No	Yes / No
Refuge PS BLH Wet				
Bayou Sauvage Restore	Yes. Objective 3, Objective 4 (project located within Bayou Sauvage National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. Potential borrow source from Mississippi River. Consistent with Measure 1-14 East Orleans Landbridge Restoration. Conversion of open water to BLH.	Yes - Strategic Goals (Create wetlands, dedicated dredging)	Because the project is located on the protected side of the levee system, it does not affect, nor is it affected by proposed LCA projects.	Not coincident with a coastal measure; On protected side of Lake Pontchartrain and Vicinity Levee so it will not add benefit to the levee system.
Refuge FS BLH-Wet				
Fritchie Enhance	Yes. Objective 2, Objective 3, Objective 4 (restoration within Big Branch National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. However plan prefers dredge material from rivers and offshore.	Yes - Strategic Goals (maintain critical landforms)	Yes, It may experience some freshening as diversions at Hope Canal and Convent/Blind River are implemented (predicted max. reduction of 2 ppt in high monthly salinity and 1 ppt in low monthly salinity)**.	Partially within coastal measure 2-5 East New Orleans Land Bridge Marsh Creation - 7,996 @ 900 acres/year; On protected side of proposed Lake Pontchartrain surge barrier-weir so it would not add benefit to this proposed levee alignment.
Refuge PS Intermediate Marsh				
Bayou Sauvage Restore	Yes. Objective 3, Objective 4 (restoration within Bayou Sauvage National Wildlife Refuge) and also measure LSP-5 Sediment Inventory and Allocation; sub-measure B. Potential borrow source from Mississippi River. Consistent with Measure 1-14 East Orleans Landbridge Restoration. Conversion of open water to marsh.	Yes - Region 2 Objectives, and Regional Ecosystem Strategies (Restore and sustain marsh) Strategic Goals (Create wetlands, dedicated dredging)	Because the project is located on the protected side of the levee system, it does not affect, nor is it affected by proposed LCA projects.	Not coincident with a coastal measure; On protected side of Lake Pontchartrain and Vicinity Levee so it will not add benefit to the levee system.

Table B-4: Environmental Impact Summary Data Matrix

	Hydrology/ Hydraulics	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms/ Benthic**	**T & E**	**EFH**
	Qualitative	*Yes/No; Extent of impact; Perm/Temp*	*Coordination or permitting necessary? Yes/no; Perm/Temp*	*Qualitative*	*Acreage of habitat by type impacted; acreage of habitat by type created*	*Acreage; perm/temp*	*Species; critical habitat*	*Acreage; species impacted/ life stage; temp/perm*
Non-Refuge BLH-Dry/Non-Refuge BLH-Wet								
General Mitigation Bank	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0
Bonnet Carre BLH-Dry and BLH-Wet Restoration	improved hydrology, decreased runoff +	Yes, if Miss. River used; 50 acres; Temporary -	No 0	Turbidity; temporary -	110 acres shallow water/scrub-shrub converted to 110 acres BLH W/D; improved habitat for various species +	mit. Site:~110 acres; permanent; borrow site: 50-120 acres; temp --	mit. Site: manatee, gulf sturgeon borrow: pallid sturgeon -	Mit site: no EFH; Borrow: if in lake 120 acres; brown shrimp, white shrimp, red drum; poslarval and juvenile; perm --
Frenier BLH-Dry and BLH-Wet Restoration	manipulated to natural hydrology, decreased runoff +	No 0	No 0	Turbidity; temporary -	115 acres of ag converted to 115 acres of BLH; improved habitat for various species +	0	none in area 0	no EFH 0

Fritchie Non-Refuge BLH-Dry Enhancement/ BLH-Wet Enhancement-Restoration	Increased then decreased runoff enhancement feature; conversion from permanently to seasonally flooded in restoration feature, but increased runoff 0	No 0	No 0	Turbidity; temporary -	385 acres of BLH improved; 45 acres open water converted to BLH; improved and increased habitat for various species; elimination of 45 acres waterfowl habitat; eagle and osprey nests present +	44 acres; permanent -	borrow and mit site: manatee; site: gulf sturgeon critical habitat --	enhancement: no EFH; restoration: 45 acres; post larval and juvenile brown shrimp, white shrimp, red drum; permanent; borrow: 25 acres; post larval and juvenile brown shrimp, white shrimp, red drum, juvenile spanish mackerel; perm -

SUBCRITERIA	**Aquatic/ Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics/ Land Use**
	Acreage of habitat created; acreage of habitat eliminated	*Yes/no; acreage*	*Qualitative*	*Acreage of recreational resource impact; recreational resources impacted; acreage of recreation resources created/enhanced/ restored*	*# commercial/ residential within 100 ft.*	*Qualitative*	*Probability of encountering HTRW*	*# low - income/minority populations disproportionately impacted*	*# comm/indust properties impacted; # residential units impacted; # public properties impacted; Acres ag land converted; acres forest land converted*
Non-Refuge BLH-Dry/Non-Refuge BLH-Wet									
General Mitigation Bank	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0
Bonnet Carre BLH-Dry and BLH-Wet Restoration	0 created; 110 scrub-shrub/limited open water eliminated; eliminates habitat for fish, crab, shrimp --	No 0	previous investigations show low probability of encountering resources -	100 acres fishing/crawfishing/ crabbing eliminated; 110 acres hiking/birding/limited crawfishing created 0	0 0	no impact 0	Low 0	0	0 0
Frenier BLH-Dry and BLH-Wet Restoration	none created nor eliminated 0	yes; 114 acres -	no previous surveys -	0 acres impacted; up to 115 acres hunting/birding created +	residential subdivision and several individual residences --	no impact 0	Low 0	0	115 acres of ag land converted -

Fritchie Non-Refuge BLH-Dry Enhancement/ BLH-Wet Enhancement-Restoration	45 acres open water/mud bottom eliminated; decreased habitat for fish, crab and shrimp -	yes; 237 acres --	Previous partial survey showed 1 non-eligible site; moderate probability of additional sites in Lake --	44 acres fishing converted to hunting; 385 acres hunting improved ++	residences, but little noise created by enhancement -	no impact 0	Low 0	0	0 0

SUBCRITERIA	**Hydrology/Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms/ Benthic**	**T & E**	**EFH**
	Qualitative	*Yes/No; Extent of impact; Perm/Temp*	*Coordination or permitting necessary? Yes/no; Perm/Temp*	*Qualitative*	*Acreage of habitat by type impacted; acreage of habitat by type created*	*Acreage; perm/temp*	*Species; critical habitat*	*Acreage; species impacted/ life stage; temp/perm*
Non-refuge Swamp								
General Mitigation Bank	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0
Bonnet Carre Swamp Restoration	improved hydrology, reduced runoff +	no impact 0	no impact 0	Turbidity; temporary -	250 acres shallow water/scrub-shrub converted to 250 acres swamp; improved habitat for various species +	mit. Site:~250 acres; permanent; borrow site: 120 acres; temp -	borrow: manatee and gulf sturgeon -	Mit site: no EFH; Borrow: if in lake 120 acres; brown shrimp, white shrimp, red drum; poslarval and juvenile; perm -
Caernarvon Swamp Restoration	convert from permanently flooded to semi-permanently flooded; could impact flows from Big Mar; increased runoff -	no impact 0	no impact 0	Turbidity; temporary -	660 acres of open water converted to 660 acres of swamp; colonial nesting rookery present; increased habitat for various species +	Mit site: 660 acres; permanent; borrow site: 290 acres; temp --	no species present 0	Mit site: 660 acres; postlarval and juvenile brown shrimp, white shrimp, red drum; permanent temporal loss; Borrow: 290 acres; poslarval and juvenile brown shrimp, white shrimp, red drum; perm --

Milton Island Swamp Restoration	improved hydrology; conversion from permanent flooding to seasonal flooding, increased runoff 0	no impact 0	no impact 0	Turbidity; temporary -	70 acres swamp enhanced; 280 acres of open water converted to swamp; colonial nesting rookery present; decreased habitat for certain waterfowl; increased habitat for various species; +	Mit site: 280 acres; permanent; borrow site: 106 acres; temp -	borrow site: manatee and gulf sturgeon -	Mit site: 0 acres EFH. Borrow: 106 acres; postlarval and juvenile brown shrimp and red drum; perm -

SUBCRITERIA	**Aquatic/ Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics/ Land Use**
	Acreage of habitat created; acreage of habitat eliminated	*Yes/no; acreage*	*Qualitative*	*Acreage of recreational resource impact; recreational resources impacted; acreage of recreation resources created/enhanced/ restored*	*# commercial/ residential within 100 ft.*	*Qualitative*	*Probability of encountering HTRW*	*# low - income/minority populations disproportionately impacted*	*# comm/indust properties impacted; # residential units impacted; # public properties impacted; Acres ag land converted; acres forest land converted*
Non-refuge Swamp									
General Mitigation Bank	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0	no impact 0
Bonnet Carre Swamp Restoration	250 acres swamp created; 250 acres scrub-shrub/limited open water eliminated; continued use by fish, crab and shrimp 0	No 0	previous investigations show low probability of encountering resources -	250 acres of fishing becomes more limited; 250 acres of crawfishing and crabbing enhanced; 250 acres of birding habitat created. 0	0 0	no impact 0	Low 0	0 0	0 0

Caernarvon Swamp Restoration	660 acres swamp created; 660 acres open water/emergent marsh eliminated; continued use by fish, crab and shrimp 0	No 0	previous investigations found 2 non-eligible sites; no additional discoveries anticipated -	660 acres reduced fishing, improved duck hunting 0	0 0	no impact 0	Low 0	0 0	0 0
Milton Island Swamp Restoration	70 acres swamp enhanced, 280 acres swamp created; 280 acres open water eliminated; continued use by fish and shrimp 0	yes; 244 acres -	no previous surveys of open water site; 1 site ident. 100 meters south; moderate to high probability of encountering during gapping --	280 acres reduced fishing, increased hunting, crawfishing and crabbing 0	0 0	no impact 0	Low 0	0 0	0 0

SUBCRITERIA	**Hydrology/ Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms/ Benthic**	**T & E**	**EFH**
	Qualitative	*Yes/No; Extent of impact; Perm/Temp*	*Coordination or permitting necessary? Yes/no; Perm/Temp*	*Qualitative*	*Acreage of habitat by type impacted; acreage of habitat by type created*	*Acreage; perm/temp*	*Species; critical habitat*	*Acreage; species impacted/ life stage; temp/perm*
Non-Refuge Intermediate Marsh								
Bayou Des Mats Marsh Restoration	Increased runoff -	no impact 0	no impact 0	Turbidity; temporary -	280 acres open water eliminated; 280 acres emergent marsh created; increases bird habitat +	Mit site: 280 acres; permanent; borrow site: 125 acres; temp -	borrow: manatee and gulf sturgeon critical habitat --	mit site: impact offset; borrow: 125 acres; postlarval and juvenile brown shrimp, white shrimp, red drum, juvenile Spanish mackerel; permanent -
Caernarvon Marsh Restoration	reduced wave energy, increased runoff 0	no impact 0	no impact 0	Turbidity; temporary -	570 acres open water eliminated; 570 acres emergent marsh created; increases bird habitat ++	Mit site: 570 acres; permanent; borrow site: 290 acres; temp - -	no species present 0	mit site: impact offset; borrow: 290 acres; postlarval and juvenile brown shrimp, white shrimp, red drum; permanent --
Fritchie Marsh Restoration	Increased runoff -	no impact 0	no impact 0	Turbidity; temporary -	325 acres open water eliminated; 325 acres marsh created; increases bird habitat +	mit site: 325 acres; permanent: borrow site: 125 acres; temporary -	borrow: manatee; gulf sturgeon critical habitat; mit site: manatee --	mit site: impact offset; borrow: 125 acres; postlarval and juvenile brown shrimp, white shrimp, red drum, juvenile Spanish mackerel; permanent -
Big Branch Marsh Restoration	Increased runoff -	no impact 0	no impact 0	Turbidity; temporary -	300 acres open water eliminated; 300 acres marsh created; increases bird habitat +	mit site: 300 acres; permanent; borrow site: 103 acres; temporary -	borrow: manatee; gulf sturgeon critical habitat; mit site: manatee --	mit site: impact offset; borrow: 103 acres; postlarval and juvenile brown shrimp, white shrimp, red drum, juvenile Spanish mackerel; permanent -

LaBranche Marsh Restoration	Increased runoff -	no impact 0	no impact 0	Turbidity; temporary -	320 acres open water eliminated; 320 acres marsh created; increases bird habitat +	mit site: 320 acres; permanent; borrow site: 160 acres temporary -	borrow: manatee; gulf sturgeon; mit site: manatee -	mit site: impact offset; borrow: 160 acres; postlarval and juvenile brown shrimp, white shrimp and red drum; permanent --
Milton Island Marsh Restoration	Increased runoff -	no impact 0	no impact 0	Turbidity; temporary -	275 acres open water eliminated; 275 acres marsh created; increases bird habitat +	mit site: 275 acres; permanent; borrow site: 106 acres; temporary -	borrow: manatee and gulf sturgeon -	mit site: impact offset; borrow: 106 acres; postlarval and juvenile brown shrimp, white shrimp and red drum; permanent -

SUBCRITERIA	**Aquatic/ Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics/ Land Use**
	Acreage of habitat created; acreage of habitat eliminated	*Yes/no; acreage*	*Qualitative*	*Acreage of recreational resource impact; recreational resources impacted; acreage of recreation resources created/enhanced/ restored*	*# commercial/ residential within 100 ft.*	*Qualitative*	*Probability of encountering HTRW*	*# low - income/minority populations disproportionately impacted*	*# comm/indust properties impacted; # residential units impacted; # public properties impacted; Acres ag land converted; acres forest land converted*
Non-Refuge Intermediate Marsh									
Bayou Des Mats Marsh Restoration	280 acres marsh created; 280 acres open water eliminated; increase in habitat diversity +	No 0	no previous survey; high probability on lake shoreline --	280 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0
Caernarvon Marsh Restoration	290 acres marsh created; 290 acres open water eliminated; increase in habitat diversity +	No 0	Previous survey ident. 1 non-eligible site; no impact and no additional surveys needed 0	570 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0
Fritchie Marsh Restoration	mit site: 325 acres marsh created; 325 acres open water eliminated; increased habitat diversity +	No 0	Previous partial survey showed 1 non-eligible site; moderate probability of additional sites in Lake --	325 acres; fishing and duck hunting improved 0	1 -	no impact 0	Low 0	0 0	0 0

Big Branch Marsh Restoration	mit site: 300 acres marsh created; 300 acres open water eliminated; increased habitat diversity +	No 0	previous survey: several sites; more surveys needed -	300 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0
LaBranche Marsh Restoration	mit site: 320 acres marsh created; 320 acres open water eliminated; increased habitat diversity +	No 0	previous partial survey ident. on lakeshore, more may be present; borrow survey showed no sites; low probability within site -	320 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0
Milton Island Marsh Restoration	mit site: 275 acres marsh created; 275 acres open water eliminated; increased habitat diversity +	No 0	no previous surveys of open water site; 1 site ident. 100 meters south; moderate to high probability of encountering during gapping --	275 acres; fishing and duck hunting improved 0	several residences -	no impact 0	Low 0	0 0	0 0

SUBCRITERIA	**Hydrology/ Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms/ Benthic**	**T & E**	**EFH**
	Qualitative	*Yes/No; Extent of impact; Perm/Temp*	*Coordination or permitting necessary? Yes/no; Perm/Temp*	*Qualitative*	*Acreage of habitat by type impacted; acreage of habitat by type created*	*Acreage; perm/temp*	*Species; critical habitat*	*Acreage; species impacted/ life stage; temp/perm*
Non-Refuge/Refuge Brackish Marsh								
Big Branch Marsh Restoration	Increased runoff -	No 0	No 0	Turbidity; temporary 0	225 acres open water eliminated; 225 acres marsh created; increases bird habitat -	mit site: 225 acres; permanent; borrow site: 103 acres; temporary +	borrow: manatee and gulf sturgeon critical habitat; mit site: manatee -	mit site: impact offset; borrow: 103 acres; postlarval and juvenile brown shrimp, white shrimp and red drum, juvenile Spanish mackerel -
Golden Triangle Marsh Restoration	Increased runoff -	No 0	No 0	Turbidity; temporary 0	255 acres open water eliminated; 255 acres marsh created; increases bird habitat -	mit site: 255 acres; permanent; borrow site: 200 acres; temporary +	borrow: manatee, sea turtle and gulf sturgeon critical habitat; mit site: manatee -	mit site: impact offset; borrow: 200 acres; postlarval and juvenile brown shrimp, white shrimp and red drum, juvenile Spanish mackerel --
Fritchie Marsh Restoration	Increased runoff -	No 0	No 0	Turbidity; temporary 0	280 acres open water eliminated; 280 acres marsh created; increases bird habitat -	mit site: 280 acres; permanent; borrow site: 125 acres; temporary +	borrow: manatee, gulf sturgeon critical habitat; mit. Site: manatee -	mit site: impact offset; borrow: 125 acres; postlarval and juvenile brown shrimp, white shrimp and red drum, juvenile Spanish mackerel -
Bayou Sauvage Floodside Marsh Restoration	Increased runoff; reduced wave energy 0	No 0	No 0	Turbidity; temporary 0	250 acres open water eliminated; 250 acres marsh created; increases bird habitat -	mit site: 250 acres; permanent; borrow site: 150 acres; temporary +	borrow: manatee, sea turtle, gulf sturgeon critical habitat; mit. Site: manatee -	mit site: impact offset; borrow: 150 acres; postlarval and juvenile brown shrimp, white shrimp, red drum, juvenile Spanish mackerel-

SUBCRITERIA	**Aquatic/ Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics/ Land Use**
	Acreage of habitat created; acreage of habitat eliminated	*Yes/no; acreage*	*Qualitative*	*Acreage of recreational resource impact; recreational resources impacted; acreage of recreation resources created/enhanced /restored*	*# commercial/ residential within 100 ft.*	*Qualitative*	*Probability of encountering HTRW*	*# low - income/minority populations disproportionately impacted*	*# comm/indust properties impacted; # residential units impacted; # public properties impacted; Acres ag land converted; acres forest land converted*
Non-Refuge/Refuge Brackish Marsh									
Big Branch Marsh Restoration	mit site: 225 acres marsh created; 225 acres open water eliminated; increased habitat diversity +	No 0	previous survey: several sites; more surveys needed -	225 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0
Golden Triangle Marsh Restoration	mit site: 255 acres marsh created; 255 acres open water eliminated; increased habitat diversity +	No 0	survey for site and borrow complete; no eligible sites identified. 0	225 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0

Fritchie Marsh Restoration	mit site: 280 acres marsh created; 280 acres open water eliminated; increased habitat diversity +	No 0	Previous partial survey showed 1 non-eligible site; moderate probability of additional sites in Lake --	280 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0
Bayou Sauvage Floodside Marsh Restoration	mit site: 250 acres marsh created; 250 acres open water eliminated; increased habitat diversity +	No 0	No survey; low prob in open water but survey needed of ridges -	250 acres; fishing and duck hunting improved 0	0 0	no impact 0	Low 0	0 0	0 0

SUBCRITERIA	**Hydrology/Hydraulics**	**Navigable Waters**	**Scenic Rivers**	**Water Quality**	**Wildlife & Habitats**	**Water Bottoms/ Benthic**	**T & E**	**EFH**
	Qualitative	*Yes/No; Extent of impact; Perm/Temp*	*coordination or permitting necessary? Yes/no; Perm/Temp*	*Qualitative*	*Acreage of habitat by type impacted; acreage of habitat by type created*	*Acreage; perm/temp*	*Species; critical habitat*	*Acreage; species impacted/ life stage; temp/perm*
Refuge Protected Side BLH-Wet and Intermediate Marsh								
Bayou Sauvage BLH-W and Intermediate Marsh Restoration	Increased runoff	no	no	Turbidity; temporary	355 acres open water eliminated; 110 acres marsh and 245 acres BLH-W created; increases bird habitat	mit site: 355 acres; permanent; borrow site: 300 acres; temporary	borrow: manatee, gulf sturgeon critical habitat	mit site: no EFH; borrow: 300 acres; postlarval and juvenile brown shrimp, white shrimp and red drum; juvenile Spanish mackerel
Refuge Floodside BLH-Wet								
Fritchie Refuge BLH-Wet Enhancement	Increased then decreased runoff	no	no	no impact	55 acres BLH enhanced; improved habitat for various species	0	0	no EFH

SUBCRITERIA	**Aquatic/ Fisheries**	**Prime Farmland**	**Cultural Resources**	**Recreation**	**Noise**	**Aesthetics**	**HTRW**	**Environmental Justice**	**Socioeconomics/ Land Use**
	Acreage of habitat created; acreage of habitat eliminated	*Yes/no; acreage*	*Qualitative*	*Acreage of recreational resource impact; recreational resources impacted; acreage of recreation resources created/enhanced/restored*	*# commercial/ residential within 100 ft.*	*Qualitative*	*Probability of encountering HTRW*	*# low - income/minority populations disproportionately impacted*	*# comm/indust properties impacted; # residential units impacted; # public properties impacted; Acres ag land converted; acres forest land converted*
Refuge Protected Side BLH-Wet and Intermediate Marsh									
Bayou Sauvage BLH-W and Intermediate Marsh Restoration	mit site: 110 acres marsh and 245 acres BLH-W created;355 acres open water eliminated; overall reduction in habitat for blue crab, bass and catfish	no	partial survey; low probability	245 improved birding; improved fishing from 110 acres marsh	0	no impact	low	0	0

Refuge Floodside BLH-Wet									
Fritchie Refuge BLH-Wet Enhancement	no aquatic/ fisheries	yes; 26 acres	Previous partial survey showed 1 non-eligible site; more survey needed	55 acres improved hunting	residential subdivision	no impact	low	0	0

Table B-5: Time to Contract Award Matrix

Project Alternative	Total Duration
Mitigation Bank BLH-W/D Non-Refuge	1 year, 3 mos
Bonnet Carre FS BLH-W/D Restoration	1 year, 5 mos
Frenier Area FS BLH-W/D Restoration	2 yrs, 7 mos
Non-Refuge Fritchie FS BLH-W/BLH-D Enhancement/BLH-W Restoration	2 yrs, 7 mos
Mitigation Bank Swamp Non-Refuge	1 year, 3 mos
Bonnet Carre FS Swamp Restoration	1 year, 5 mos
Caernarvon FS Swamp Restoration	2 yrs, 7 mos
Milton Island FS Swamp Restoration	2 yrs, 7 mos
Bayou Des Mats FS IM Restoration	2 yrs, 7 mos
Caernarvon FS IM Restoration	2 yrs, 7 mos
Fritchie FS IM Restoration	2 yrs, 7 mos
Big Branch FS IM Restoration	2 yrs, 7 mos
LaBranche FS IM Restoration	2 yrs, 7 mos
Milton Island FS IM	2 yrs, 7 mos
Big Branch FS BM Restoration	2 yrs, 7 mos
Golden Triangle FS BM Restoration	2 yrs, 7 mos
Fritchie FS BM Restoration	2 yrs, 7 mos
Bayou Sauvage FS BM Restoration	2 yrs, 7 mos
Bayou Sauvage PS IM/BLH-W Restoration	1 yrs, 5 mos
Refuge Fritchie FS BLH-W Enhancement	2 yrs, 7 mos

Table B-6: Time to NCC Matrix

Project Alternative	Total Duration
Mitigation Bank BLH-W/D Non-Refuge	1 year, 3 mos
Bonnet Carre FS BLH-W/D Restoration	6 yrs, 7 mos
Frenier Area FS BLH-W/D Restoration	7 yrs, 7 mos
Non-Refuge Fritchie FS BLH-W/BLH-D Enhancement/BLH-W Restoration	8 yrs, 7 mos
Mitigation Bank Swamp Non-Refuge	1 year, 3 mos
Bonnet Carre FS Swamp Restoration	6 yrs, 7 mos
Caernarvon FS Swamp Restoration	8 years, 7 mos
Milton Island FS Swamp Restoration	8 yrs, 7 mos
Bayou Des Mats FS IM Restoration	5 yrs, 7 mos
Caernarvon FS IM Restoration	6 yrs, 7 mos
Fritchie FS IM Restoration	5 yrs, 7 mos
Big Branch FS IM Restoration	5 years 7 mos
LaBranche FS IM Restoration	5 yrs, 7 mos
Milton Island FS IM	5 yrs, 7 mos
Big Branch FS BM Restoration	5 yrs, 7 mos
Golden Triangle FS BM Restoration	5 yrs,7 mos
Fritchie FS BM Restoration	5 yrs, 7 mos
Bayou Sauvage FS BM Restoration	5 yrs, 7 mos
Bayou Sauvage PS IM/BLH-W Restoration	7 yrs, 7 mos
Refuge Fritchie FS BLH-W Enhancement	7 yrs, 7 mos

Table B-7: Other Cost Considerations Matrices

Swamp OCC			
		Total Project Cost	Average Annual Cost
Bonnet Carre Restore		~116% > least cost	~107% > least cost
Caernarvon Restore		~660% > least cost	~682% > least cost
Mitigation Bank	High	~3% > least cost	3% > least cost
	Low	Least Cost	Least Cost
Milton Island Restore		~179% > least cost	~184% > least cost

BLH OCC			
		Total Project Cost	Average Annual Cost
Bonnet Carre		~122% > least cost	~117% > least cost
Frenier		~15% > least cost	~11% > least cost
Fritchie		~201% > least cost	~186% > least cost
Mitigation Bank (Lo/Hi)	High	~10% > least cost	~10% > least cost
	Low	Least cost	Least cost

Intermediate Marsh OCC		
	Total Project Cost	Average Annual Cost
Bayou Des Mats	~24% > least cost	~24% > least cost
Big Branch	~28% > least cost	~29% > least cost
Caernarvon	~181% > lest cost	~190% > lest cost
Fritchie	~74% > least cost	~75% > least cost
LaBranche	~88% > least cost	~90% > least cost
Milton Island	least cost	least cost

Brackish Marsh OCC		
	Total Project Cost	Average Annual Cost
Bayou Sauvage Floodside Marsh Restoration	~32% > least cost	~34% > least cost
Big Branch Marsh Restoration	~3% > least cost	~3% > least cost
Fritchie Marsh Restoration	~46% > least cost	~49% > least cost
Golden Triangle Marsh Restoration	least cost	least cost

Table B-8: Cost Effectiveness Matricies

Swamp CE (AAHUs/$)		
Bonnet Carre Restore		~99% > least cost
Caernarvon Restore		~565% > least cost
Mitigation Bank	High	~3% > least cost
	Low	Least Cost
Milton Island Restore		~151% > least cost

BLH CE		
Bonnet Carre		~108% > least cost
Frenier		~2% > least cost
Fritchie		~153% > least cost
Mitigation Bank (Lo/Hi)	High	~10% > least cost
	Low	Least cost

Intermediate Marsh CE	
Bayou Des Mats	~24% > least cost
Big Branch	~29% > least cost
Caernarvon	~178% > least cost
Fritchie	~75% > least cost
LaBranche	~90% > least cost
Milton Island	least cost

Brackish Marsh CE	
Bayou Sauvage Floodside Marsh Restoration	~34% > least cost
Big Branch Marsh Restoration	~3% > least cost
Fritchie Marsh Restoration	~49% > least cost
Golden Triangle Marsh Restoration	least cost

Table B-9: Three SLR Scenario Analysis

Project Group	SLR	Project area (starting area)	FWP Mit Hab AAHUs	FWOP mit Hab AAHUs	FWP open water AAHUs	FWOP open water AAHUs	Mitigation Hab Net AAHUS	Open Water Hab Net AAHUs	Net benefits AAHUs	Long Term Sustainability 3 SLR reruns
Bayou Des Mats FS IM Restoration										
	Low	536	445.18	8	23.33	259.03	437.19	-235.7	220.12	0.87
	Intermediate	536	420	8	34.56	249.82	412	-215.26	209.66	0.78
	High	536	312.21	7.71	65.11	232.64	304.5	-167.53	152.23	0.00
Big Branch FS IM Restoration										
	Low	519	391.3	0.56	24.89	188.92	390.74	-164.03	211.78	0.81
	Intermediate	519	350.5	0.45	36.69	184.61	350.04	-147.91	189.41	0.65
	High	519	212.76	0.13	72.32	175.59	212.64	-103.27	110.73	0.00
Caernarvon FS IM Restoration										
	Low	430	283.9	0.64	34.61	174.29	283.27	-139.69	146.83	0.61
	Intermediate	430	224.17	0.29	57.86	165.68	223.88	-107.82	116.88	0.21
	High	430	70.29	0.02	119.62	145.84	70.27	-26.21	39.15	0.00
Fritchie FS IM Restoration										
	Low	847	618.07	0	51.17	363.55	618.07	-312.38	317.93	0.78
	Intermediate	847	556.93	0	73.9	351.93	556.93	-278.04	287.59	0.61
	High	847	324.34	0	141.66	305.31	324.34	-163.64	166.93	0.00
La Branche FS IM Restoration										
	Low	402	343.72	3.16	6.62	197.75	340.56	-191.13	169.05	0.93
	Intermediate	402	335.9	3.16	12.53	190	332.73	-177.47	168.15	0.89
	High	402	203.56	1.62	58.66	161.83	201.94	-103.17	103.52	0.00
Milton Island FS IM Restoration										
	Low	408	349.87	1.73	11.23	207.6	348.13	-196.37	172.49	0.92
	Intermediate	408	335.98	1.73	16.17	200.1	334.24	-183.93	167.09	0.87
	High	408	214.49	1.61	55.68	185.76	212.87	-130.07	102.24	0.00

Project Group	SLR	Project area (starting area)	FWP Mit Hab AAHUs	FWOP mit Hab AAHUs	FWP open water AAHUs	FWOP open water AAHUs	Mitigation Hab Net AAHUS	Open Water Hab Net AAHUs	Net benefits AAHUs	Long Term Sustainability 3 SLR reruns
Bayou Sauvage FS BM Restoration										
	Low	386.6	325.2	0.76	15.9	263.64	324.44	-247.75	165.5	0.91
	Intermediate	386.6	311.39	0.75	19.9	247.92	310.54	-228.03	160.94	0.83
	High	386.6	244.51	0.26	40.74	199.58	244.25	-158.84	132.28	0.52
Big Branch FS BM Restoration										
	Low	285	214.87	0.27	17.79	122.16	214.6	-104.37	126	0.81
	Intermediate	285	193.7	0.27	23.3	119.36	193.42	-96.06	113.01	0.65
	High	285	118.56	0.14	46.52	117.6	118.42	-71.08	65.78	0.00
Fritchie FS BM Restoration										
	Low	847	622.79	0	53.63	405.29	622.79	-351.66	352.11	0.78
	Intermediate	847	562.57	0	78.01	392.6	562.57	-314.58	318.91	0.61
	High	847	329.76	0	149.73	342.76	329.76	-193.03	184.54	0.00
Golden Triangle FS BM Restoration										
	Low	430.59	315.99	0.08	28.16	122.32	315.92	-94.16	202.01	0.71
	Intermediate	430.59	287.07	0.08	31.88	122.32	286.99	-90.44	182.15	0.57
	High	430.59	137.31	0.05	79.73	122.34	137.25	-42.61	87.29	0.00
Frenier Area FS BLH-W Restoration										
	Low	93	57.89	0.14			57.75			0.95
	Intermediate	93	57.89	0.14			57.75			0.95
	High	93	57.45	0.14			57.31			0.94
Bonnet Carre FS BLH-W Restoration										
	Low	93	58.9	0.24			58.66			0.96
	Intermediate	93	58.9	0.24			58.66			0.96
	High	93	58.58	0.24			58.34			0.92
Fritchie FS BLH-W Restoration										
	Low	26	11.46	0.01			11.45			0.68
	Intermediate	26	11.46	0.01			11.45			0.68
	High	26	9.99	0.01			9.98			0.49
Fritchie FS BLH-W Enhancement										
	Low	265	149.64	97.76			52.87			0.69
	Intermediate	265	149.64	96.76			52.87			0.69
	High	265	142.14	129.83			12.31			0.59

Project Group	SLR	Project area (starting area)	FWP Mit Hab AAHUs	FWOP mit Hab AAHUs	FWP open water AAHUs	FWOP open water AAHUs	Mitigation Hab Net AAHUS	Open Water Hab Net AAHUs	Net benefits AAHUs	Long Term Sustainability 3 SLR reruns
Bonnet Carre FS BLH-D Restoration										
	Low	26.7	17.2	0.07			17.13			0.98
	Intermediate	26.7	17.2	0.07			17.13			0.98
	High	26.7	17.29	0.07			17.22			0.96
Frenier Area FS BLH-D Restoration										
	Low	32	18.78	0.15			18.62			0.89
	Intermediate	32	18.78	0.15			18.62			0.89
	High	32	19.27	0.15			19.12			0.89
Fritchie FS BLH-D Enhancement										
	Low	153	115.59	110.98			4.61			0.93
	Intermediate	153	115.59	110.98			4.61			0.93
	High	153	115.98	111.37			4.61			0.94
Bonnet Carre FS Swamp Restoration										
	Low	204	95.57	16.46			79.11			0.68
	Intermediate	204	95.57	16.46			79.11			0.68
	High	204	91.44	16.46			74.98			0.68
Caernarvon FS Swamp Restoration										
	Low	199.3	85.55	54			31.55			0.76
	Intermediate	199.3	82.3	53.86			28.44			0.66
	High	199.3	77.69	49.68			28.01			0.50
Milton Island FS Swamp Restoration										
	Low	56	14.02	7.19			6.83			0.29
	Intermediate	56	14.02	7.19			6.83			0.29
	High	56	12.12	7.19			4.92			0.19
Milton Island FS Swamp Restoration OW Fish Pond										
	Low	158	69.26	18.14			51.13			0.58
	Intermediate	158	69.26	18.14			51.13			0.58
	High	158	56.63	18.14			38.49			0.37

Note: BLH and Swamp WVAs do not assess impacts to open water.

Table B-10: Previously Constructed Wetland or Ecosystem Restoration Projects in Lake Pontchartrain Basin

Program	Parish	Year Constructed	Description	Direct Overlap	Extended Boundary Overlap
CIAP PO-39: Bald Cypress/Tupelo Coastal Forest	Livingston	2011	Acquisition and preservation of approximately 2,600 contiguous acres of coastal wetland forest, specifically bald cypress-tupelo swamp within the Maurepas Swamp in Livingston Parish, Louisiana.	No	No
CIAP PO-48: Green Property Preservation Project	St. Tammany	2011	Property acquisition and preservation of approximately 27 acres of cypress swamp and bottomland hardwood forests within the Bayou Lacombe watershed in St. Tammany Parish, Louisiana. Purchase completed August 2011.	No	No
CIAP PO-49: French Property Preservation Project	St. Tammany	2009	Property acquisition of approximately 40 acres of pine trees and mixed hardwoods to aid in the extension of the wildlife corridor between critical habitats along Bayou Liberty in St. Tammany Parish, Louisiana. The property will also be utilized for educating the public on wetland value.	No	No

CIAP PO-51: Mandeville Aquatic Ecosystem Restoration Project	St. Tammany	2010	Upgrade of the existing wastewater treatment plant including the addition of a wetland assimilation system for disbursement of treated sewerage effluent into an adjacent wetland area on to the western border of the City of Mandeville, Louisiana. Added benefits of the assimilation will be the increase of wetland vegetation to an area impacted during Hurricanes Katrina and Rita.	No	No
CWPPRA BS-03a: Caernarvon Diversion Outfall Management	Plaquemines	2002	Effective management of the diverted freshwater and nutrients from the Mississippi River through the Caernarvon diversion structure into the surrounding marsh areas in Plaquemines Parish, Louisiana by the use of water control structures.	Yes	Yes
CWPPRA PO-06: Fritchie Marsh Restoration	St. Tammany	2001	The introduction of freshwater and nutrients in the Fritchie marsh area in St. Tammany Parish, Louisiana to decrease salinities, improve hydrologic conditions and enrich the marsh habitat.	Yes	Yes
CWPPRA PO-16: Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1	Orleans	1996	The enhancement of marsh vegetation within the Bayou Sauvage National Wildlife Refuge impounded area by improving hydrologic conditions including the removal of excess water.	Yes	Yes

CWPPRA PO-17: Bayou LaBranche Wetland Creation	St. Charles	1994	Marsh creation project located within the Bayou Labranche wetland area near the southwestern Lake Pontchartrain shoreline which included the placement of dredged material into a confined open water area to create marsh vegetation.	No	No
CWPPRA PO-18: Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 2	Orleans	1997	A hydrologic restoration project which included the construction of a pump station near the confluence of the hurricane protection levee and Irish Bayou Canal in Orleans Parish, Louisiana to lower water levels in an impounded area of the Bayou Sauvage National Wildlife Refuge for the promotion of wetland vegetation growth.	No	Yes
CWPPRA PO-19: Mississippi River Gulf Outlet (MRGO) Disposal Area Marsh Protection	St. Bernard	1999	The preservation of vegetated wetlands in the MRGO disposal area by repairing two breaches in the back levee of the MRGO south of the La Loutre ridge to prevent ponding of water in the disposal area.	No	No
CWPPRA PO-22: Bayou Chevee Shoreline Protection	Orleans	2001	The construction of a rock dike from Stump Bayou to Bayou Chevee on the southeastern shore of Lake Pontchartrain and an additional rock dike which ties into the USFWS dike at the southern end near Bayou Chevee and continues east for approximately 2,300 feet. The project was designed to protect and promote growth of the wetland habitats behind the structure.	Yes	Yes

CWPPRA PO-24: Hopedale Hydrologic Restoration	St. Bernard	2005	Hydrologic restoration of the marsh area northeast of the community of Hopedale including the replacement of culverts to prevent ponding of water on the marsh surface and promote growth of wetland vegetation.	No	No
CWPPRA PO-30: Lake Borgne Shoreline Protection	St. Bernard	2008	A shoreline protection project which included the construction of rock breakwaters to prevent the marsh area between Lake Borgne and MRGO from converting to open water. The breakwater was constructed just south of Fort Bayou along the Lake Borgne shoreline to Doulluts Canal. An additional CWPPRA shoreline protection project (PO-31) Lake Borgne Shoreline Protection at Bayou Dupre with similar project goals was merged with this project. The project included the construction of breakwater structures on either side of Bayou Dupre along the Lake Borgne shoreline.	No	Yes
CWPPRA PO-33: Goose Point/Point Platte Marsh Creation	St. Tammany	2009	A marsh creation project constructed by the placement of dredged material into open water areas behind the Lake Pontchartrain shoreline and within containment dikes. Two areas were built east of Point Platte and two areas north of Goose Point. The goal of this project was to create and nourish degraded marsh and help prevent breaches into the northern shoreline of Lake Pontchartrain. All marsh creation areas are located within the Big Branch National Wildlife Refuge.	No	Yes

DOTD: I-310 Mitigation	St. Charles	1993	Mitigation for environmental impacts associated with the construction of Interstate 310 which was completed in 1993 in St. Charles Parish, Louisiana.	No	Yes
State of Louisiana BS-06: Lake Lery Hydrologic Restoration	St. Bernard	1997	A hydrologic restoration project which provides freshwater enhancement to the marsh areas north of Lake Lery and includes the construction of a pumping station located south of the Chalmette Loop levee in St. Bernard Parish, Louisiana.	No	Yes
State of Louisiana PO-01: Violet Siphon	St. Bernard	1992	Repair and enlargement of the existing siphon to allow increased flow of freshwater and nutrients into the surrounding marsh areas to enhance wetland vegetation growth and decrease salinity.	No	No
State of Louisiana PO-02c: Bayou Chevee	Orleans	1994	The placement of approximately 2,000 feet of Christmas tree fencing at the mouth of Bayou Chevee within the Bayou Sauvage National Wildlife Refuge to provide shoreline stability and protect the interior wetland habitat from wave induced erosion.	Yes	Yes
State of Louisiana PO-03: LaBranche Shoreline Stabilization and Canal Closure	St. Charles	1987	Restoration of the southwestern Lake Pontchartrain shoreline in the vicinity of LaBranche wetlands by the placement of shoreline protection features including a canal closure.	No	Yes

State of Louisiana PO-03b: LaBranche Shoreline Protection	St. Charles	1996	A shoreline protection project which included the construction of rock breakwater along the southwestern Lake Pontchartrain shoreline east of Bayou LaBranche to protect the wetlands behind the structure from erosion caused by high wave energy.	Yes	Yes
State of Louisiana PO-08: Central Wetlands Pump Outfall	St. Bernard and Orleans	1992	The construction of a pump station on the Forty Arpent Canal levee to increase freshwater salinities and enhance wetland vegetation growth in an area located in the northwest portion of the Central Wetlands in St. Bernard Parish, Louisiana.	No	No
State of Louisiana PO-10: Turtle Cove Shore Protection	St. John the Baptist	1994	A shoreline protection project which includes a rock breakwater constructed along the Lake Pontchartrain shoreline in the Manchac Wildlife Management Area approximately 4 miles southwest of Pass Manchac. The project goal is to maintain and protect the fragile marshes behind the structure which separate interior open water areas from Lake Pontchartrain.	No	No

State of Louisiana PO-4355NP4 Fontainebleau State Park Mitigation	St. Tammany	1999	A mitigation project for impacts associated with the construction of park cabins along the northern Lake Pontchartrain shoreline east of Bayou Castine within the Fontainebleau State Park, St. Tammany Parish. The project involved the deposition of sand in the near shore zone to supply sediment to close approximately 600 feet of breaches east of the Fontainebleau State Park cabins along the shoreline.	No	No
US Army Corps of Engineers: Caernarvon Freshwater Diversion Structure	Plaquemines	1991	The Caernarvon Freshwater Diversion structure is located on the east bank of the Mississippi River near the community of Caernarvon, Louisiana. The structure contains five gated culverts and an outflow channel designed to discharge freshwater from the Mississippi River at no greater than a maximum rate of 8,000 cubic feet per second into Breton Sound Basin to increase the productivity of fish and wildlife habitat.	No	No
US Army Corps of Engineers: LPV Pre-Katrina Mitigation (Manchac Shoreline)	St. John the Baptist	1995	The project is located along the Lake Pontchartrain shoreline south of Pass Manchac near the southern border of the Manchac Wildlife Management Area (WMA) and consists of approximately 5 miles of segmented rock breakwater designed for wetland habitat protection in the WMA.	No	No

US Army Corps of Engineers: MRGO O&M (MRGO East Bank Shoreline Protection in the vicinity of Bayous Bienvenue and Dupre)	St Bernard	1992	The project is located along the eastern bank of the MRGO in the vicinity of Bayous Bienvenue and Dupre. It consists of approximately 24,000 feet of rock breakwaters to provide wave reduction and protect the marshes behind the structure. Additional maintenance was performed on the structure in 2007/2008 to repair damages from Hurricane Katrina.	No	No
US Army Corps of Engineers: MRGO O&M (MRGO West Bank Shoreline Protection in the vicinity of Stump Bayou)	St Bernard	Late 1990s	The project is located along the western bank of the MRGO in the vicinity of Stump Bayou. It consists of approximately 3,000 feet of rock breakwaters to provide wave reduction and enhance protection to the marshes behind the structure.	No	No
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental and MRGO O&M (MRGO East Bank Shoreline Protection in the Vicinity of Bayou Yscloskey)	St Bernard	2008	The project is located along the eastern bank of the MRGO in the vicinity of MRGO river mile 39 to 44 near Bayou Yscloskey. The reach consists of approximately four miles of segmented foreshore rock dikes to reduce wave action and enhance protection to the marshes behind the structure.	No	Yes
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (Doulluts Canal to Jahnckes Ditch)	St Bernard	2008	This shoreline protection project is located along the southeastern shoreline of Lake Borgne between Doulluts Canal and Jahnckes Ditch. The design for this reach was funded and completed in 2005 by CWPPRA PO-29 project; however, the reach was funded and built with 3rd Supplemental funds.	No	No

WRDA BS-08: Caernarvon Freshwater Diversion	Plaquemines, St. Bernard	1991	A freshwater diversion located on the Mississippi River near the community of Caernarvon with a maximum flow capacity of 8,000 cfs. designed to divert freshwater, nutrients, and sediment from the Mississippi River through the diversion structure to the surrounding marshes to enhance wetland habitat.	Yes	Yes

Table B-11: Wetland or Ecosystem Restoration Projects Under Construction or Partially Constructed in the Lake Pontchartrain Basin

Program	Parish	Description	Direct Overlap	Extended Boundary Overlap
CIAP PO-73: EB-Central Wetlands Assimilation	St. Bernard & Orleans	Construction of a wetland assimilation system in the northwest corner of the Central Wetlands near Bayou Bienvenue in Orleans and St. Bernard Parishes for the disbursement of treated sewerage effluent into the adjacent wetland areas for wetland habitat enhancement. The project also includes the planting of cypress seedlings. The project is currently under construction and is anticipated for completion in January 2013.*	No	No
CIAP PO-36: EB-Orleans Land Bridge Shoreline Protection and Marsh Creation	St. Bernard & Orleans	Construction of a shoreline protection feature on the northwestern shoreline of Lake Borgne to protect the marshes behind the structure from wave-induced shoreline erosion. The project construction began in January 2011and is projected to be complete by May 2013.*	No	Yes
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (Bayou Bienvenue Shoreline Protection)	St Bernard	A rock shoreline protection feature is being constructed along the Lake Borgne shoreline from Bayou Bienvenue south to Bayou Mercier to provide protection to the adjacent marshlands. Construction began January 2012 and is anticipated for completion by June 2012.	No	Yes
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (Bayou Dupre Shoreline Protection)	St Bernard	A rock shoreline protection feature is being constructed along the Lake Borgne shoreline from an area south of Bayou Dupre to the vicinity of Mosquito Bayou to provide protection to the adjacent marshlands. Construction began December 2011 and is anticipated for completion by April 2012.	No	Yes

Table B-12: Reasonably Foreseeable Future Wetland or Ecosystem Restoration Projects in Lake Pontchartrain Basin

Program	Parish	Description	Direct Overlap	Extended Boundary Overlap
CIAP BS-17: Lake Lery Rim Reestablishment and Marsh Creation	St. Bernard	The use of dredged material from Lake Lery to create and enhance marsh habitat along a 5 mile strength of the western bank of Bayou Terre aux Boeufs north of Delacroix, Louisiana. The project also includes the construction of a rock dike along the northern and eastern shoreline of Lake Lery to protect the adjacent marshes from wave induced erosion. Anticipated construction start date is June 2013 with an anticipated construction end date of October 2014.	No	Yes
CIAP PO-40: Hydrologic Restoration in Swamps West of Lake Maurepas	Livingston	A hydrologic restoration project which includes the introduction of freshwater and sediments from the Amite River Diversion Canal into the western Maurepas swamp to enhance the overall health of the existing cypress/tupelo swamps. The project is currently in the design phase, with an anticipated construction start date of January 2013 and anticipated construction end date of December 2013.	No	No
CIAP PO-42: West LaBranche Shoreline Protection	St. Charles	A shoreline protection project which includes the construction of a rock dike along the southern shoreline of Lake Pontchartrain from the entrance of Bayou LaBranche and continuing east and tying into the existing LaBranche Wetlands shoreline protection project (PO-03). The project is designed to stop wave-induced shoreline erosion and protect the wetland habitat behind the structure. The project is currently in design and construction is anticipated to begin September 2012 and is expected to be completed by December 2012.	No	Yes
CIAP PO-43: East LaBranche Shoreline Protection	St. Charles	A shoreline protection project which includes the construction of a rock dike along the southern shoreline of Lake Pontchartrain which will tie into the existing PO-03b LaBranche Wetland shoreline protection project and continue east along the shoreline. The project is designed to stop wave-induced shoreline erosion and protect the	No	Yes

		wetland habitat behind the structure. The project is currently in design and will commence construction as soon as the PO-42 West LaBranche shoreline protection project is complete. Construction completion date is expected prior to December 2016.		
CIAP PO-44: Blind River Freshwater Diversion Property Purchase	St. James	The project involves the acquisition of approximately 68 acres of land from the Mississippi River to Parish Canal near Romeville, Louisiana for the opportunity to construct a freshwater diversion project in the future. Property purchase anticipated prior to December 2016.	No	No
CIAP PO-45: East Bank Wastewater Assimilation	St. James	Construct a wetland assimilation treatment plant in Grand Point, Louisiana for disbursement of treated sewerage effluent into a predominantly cypress/tupelo forested wetland area in Maurepas Swamp Wildlife Management Area to increase wetland vegetation health. Grant application is anticipated in the near future with construction scheduled to begin in July 2013 and anticipated construction completed by August 2014.	No	No
CIAP PO-46: Reserve Relief Canal Shoreline Protection	St. John the Baptist	A shoreline protection project to include the construction of a rock dike along the shoreline to the east and west of the confluence between the Reserve Relieve Canal and Lake Maurepas to protect the integrity of the shoreline and prevent wetland loss. The project is currently in design with an anticipated construction start date of September 2012. Construction is expected to be completed by May 2013.	No	No
CIAP PO-52: Lake Pontchartrain Shoreline Protection	Tangipahoa	A shoreline protection project to include the construction of a foreshore dike along the western Lake Pontchartrain shoreline from the Tangipahoa River south to the Pass Manchac. The goal of the proposed project is to protect the integrity of the shoreline and prevent wetland loss. The project is currently in design with an anticipated construction start date of May 2012 and an anticipated construction completion date of April 2013.	No	No
CIAP PO-70: Northshore Beach	St.	The use of dredged material to create and restore marsh in open water areas adjacent to the northern Lake Pontchartrain shoreline southeast	No	Yes

Marsh Creation/ Restoration	Tammany	of Bayou Bonfouca in St. Tammany Parish, Louisiana. The goal of the project is to protect the interior marshes by reducing shoreline erosion. Grant application is complete. The project is expected to begin construction in March 2013 and be completed by February 2014.		
CIAP BS-13: EB Bayou Lamoque Floodgate Removal	Plaquemines	A hydrologic restoration project which includes the removal of floodgates from the Bayou Lamoque freshwater diversion structure to introduce a greater amount of freshwater, sediment and nutrients from the Mississippi River into the adjacent marsh areas. The goal of the project is to enhance the growth and health of the wetland vegetation. In design phase, scheduled construction start date is March 2012 and anticipated construction completion date is September 2012.	No	No
LCA BS-20: Medium Diversion at White Ditch	Plaquemines	Medium sized diversion to provide freshwater, nutrients, and fine sediment to wetlands between Mississippi River and River aux Chenes ridges. Facilitate organic sediment deposition, improve biological productivity, and prevent further marsh deterioration. The final feasibility study and supplemental environmental impact statement was completed in September 2010.	No	No
LCA PO-68: Small Diversion at Convent/Blind River	St. James & Ascension	A freshwater diversion project proposed for construction near Convent, Louisiana which includes a diversion structure to deliver freshwater, nutrients and sediment into the Maurepas swamp via the Mississippi and Blind Rivers. The project objectives are to improve vegetative health and prevent habitat deterioration. The final feasibility study and supplemental environmental impact statement were completed in October 2010.	No	No
LCA PO-69: Amite River Diversion Canal Modification	Ascension & Livingston	Construct gaps in spoil banks of Amite River Diversion Canal to introduce nutrients and sediment into western Maurepas Swamp. Facilitate organic deposition, improve biological productivity, and prevent further swamp deterioration. The final feasibility study and supplemental environmental impact statement were completed in October 2010	No	No

State of Louisiana Surplus Fund 2007 PO-72: Biloxi Marsh Shoreline Protection	St. Bernard	A shoreline protection project to be constructed along the southeastern shoreline of Lake Borgne tying into the northernmost section of the Doulluts Canal to Jahnckes Ditch shoreline protection project and extending approximately 5 miles northeast along the Lake Borgne shoreline. Anticipated construction start date is July 2012 and anticipated construction end date is August 2013.	No	No
US Army Corps of Engineers: Modification to Caernarvon 4th Supplemental	St. Bernard	Marsh and hydrologic restoration including shunt channel construction, canal dredging, marsh nourishment, and breach construction to allow for distribution of fresh water to areas that are currently not hydraulically connected to the Caernarvon diversion structure. The project will provide a direct benefit of 670 AAHUs and create 65 acres of intermediate marsh over the 50 year planning horizon. Anticipated construction start is September 2012 and construction is expected to be completed by May 2013.	Yes	Yes
US Army Corps of Engineers: LPV Pre-Katrina Mitigation (Manchac Shoreline)	St. John the Baptist	Mitigation for the habitat impacts which occurred during the construction of the LPV Hurricane Protection System. The project is to be located along the Lake Pontchartrain shoreline south of Pass Manchac in the Turtle Cove area. The project consists of the construction of approximately 5 miles of rock breakwater for wetland habitat protection and wetland habitat creation by the deposition of dredged material between the structure and shoreline in the Manchac WMA. Notice to proceed with construction was issued February 2012. Anticipated construction end date is May 2013.	No	No
US Army Corps of Engineers: LPV Task Force Guardian Mitigation (Bayou Sauvage)	Orleans	Mitigation for New Orleans East and Walker Road borrow pit impacts associated with post-Katrina restoration efforts by Task Force Guardian. Anticipated construction start date is May 2012; anticipated construction end date is August 2014.	No	No

US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (West of Shell Beach Shoreline Protection)	St Bernard	A rock shoreline protection feature is to be constructed along the Lake Borgne shoreline south of Proctor Point in the vicinity of Shell Beach to provide protection to the adjacent marshlands. Also, marsh creation will be implemented at specific locations behind the shoreline protection features. The project is currently in design. Anticipated construction start date is March 2012 with an anticipated completion date of late summer 2012.	No	No

Table B-13: Plant Species Referenced in PIER 36	
Common Name	**Scientific Name**
Alligator weed	*Alternanthera philoxeroides*
American elm	*Ulmus americana*
American sycamore	*Platanus occidentalis*
Bald cypress	*Taxodium distichum*
Bedstraw	*Galium spp.*
Bermuda grass	*Cynodon dactylon*
Black willow	*Salix nigra*
Boxelder	*Acer negundo*
Bushy beardgrass	*Andropogon glomeratus*
Buttonbush	*Cephalanthus occidentalis*
Carpetweed	*Mollugo verticillata*
Cedar elm	*Ulmus crassifolia*
Chinese tallow tree	*Sapium sebiferum*
Cocklebur	*Xanthium spp.*
Coffeeweed	*Sesbania spp.*
Common persimmon	*Diospyros virginiana*
Dallis grass	*Paspalum dilatatum*
Delta duck potato	*Sagittaria platyphylla*
Eastern cottonwood	*Populus deltoides*
Floating water primrose	*Ludwigia peploides*
Goldenrod	*Solidago spp.*
Green ash	*fraxinus pennsylvanica*
Honey locust	*Gleditsia triacanthos*
Ironweed	*Vernonia spp.*
Marshhay cordgrass	*Spartina patens*
Mock bishopweed	*Ptilimnium macrospermum*
Mosquito fern	*Azolla caroliniana*
Nuttall oak	*Quercus nuttallii*
Peppergrass	*Lepidium spp.*
Peppervine	*Ampelopsis arborea*
Pickerelweed	*Pontederia rotundifolia*
Pignut hickory	*Carya glabra*
Pigweed	*Amaranthus spp*
Planertree	*Planera aquatica*
Ragweed	*Ambrosia spp.*
Red maple	*Acer rubrum*
Red mulberry	*Morus rubra*
Smooth cordgrass	*Spartina alterniflora*
Southern waterhemp	*Amaranthus sp.*
Spiny thistle	*Cirsium horridulum*
Sugarberry	*Celtis laevigata*
Sweetgum	*Liquidambar styraciflua*
Three-corner grass	*Schoenoplectus americanus*

Vervain	*Verbena spp.*
Water hyacinth	*Eichhornia crassipes*
Water Oak	*Quercus nigra*
Water pennywort	*Hydrocotyle umbellata*
Water tupelo/tupelogum	*Nyssa aquatica*
Wire grass	*Spartina patens*
Woolly croton	*Croton capitatus*
Wood sorrel	*Oxalis spp.*
Yankeeweed	*Eupatorium compositifolium*

Table B-14: Common Wildlife Species Found in the LPV Basin	
Common Name	**Scientific Name**
American alligator	*Alligator missippiensis*
American beaver	*Castor canadensis*
American coot	*Fulica americana*
American kestrel	*Falco sparverius*
American white pelican	*Pelecanus erythrorhynchos*
American widgeon	*Anas americana*
Bald eagle	*Haliaeetus leucocephalus*
Banded water snake	*Nerodia fasciata*
Barred owl	*Strix varia*
Belted kingfisher	*Ceryle alcyon*
Black skimmer	*Rynchops niger*
Black-necked stilt	*Himantopus mexicanus*
Blue-winged teal	*Anas discors*
Boat-tailed grackle	*Quiscalus major*
Bobcat	*Lynx rufus*
Bottlenose dolphin	*Tursiops truncatus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Bronze frog	*Rana clamitans*
Brown pelican	*Pelecanus occidentalis*
Bufflehead	*Bucephala albeola*
Bullfrog	*Rana catesbeiana*
Carolina wren	*Thryothorus ludovicianus*
Cattle egret	*Bubulcus ibis*
Clapper rail	*Rallus longirostris*
Common grackle	*Quiscalus quiscalus*
Common moorhen	*Gallinula chloropus*
Common snapping turtle	*Chelydra serpentine*
Common yellowthroat	*Geothlypis trichas*
Cotton mouse	*Peromyscus gossypinus*
Coyote	*Canis latrans*
Diamondback terrapin	*Malaclemys terrapin*
Double-crested cormorant	*Phalacrocorax auritus*
Eastern pipistrelle	*Pipistrellus subflavus*
Eastern cottontail rabbit	*Sylvilagus floridanus*
Eastern wood-pewee	*Contopus virens*
Evening bat	*Nycticeius humeralis*
Feral hog	*Sus scrofa*
Forster’s tern	*Sterna forsteri*
Fulvous harvest mouse	*Reithrodontomys fulvescens*
Gadwall	*Anas strepera*
Glossy ibis	*Plegadis falcinellus*
Gray fox	*Urocyon cinereoargenteus*
Great blue heron	*Ardea herodias*

Great egret	*Casmerodius albus*
Greater yellowlegs	*Tringa melanoleuca*
Green anole	*Anolis carolinensis*
Green-backed heron	*Butorides striatus*
Green sea turtle	*Chelonia mydas*
Green treefrogs	*Hyla cinerea*
Green-winged teal,	*Anas crecca*
Ground skink	*Scincella lateralis*
Gulf coast toad	*Bufo valliceps*
Gull-billed tern	*Sterna nilotica*
Herring gull	*Larus argentatus*
Hispid cotton rat	*Sigmodon hispidus*
House mouse	*Mus musculus*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Killdeer	*Chardrius vociferous*
Laughing gull	*Larus atricilla*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Loggerhead sea turtle	*Caretta caretta*
Lesser Scaup	*Aythya affinis*
Mallard	*Anas platyrhyncos*
Marsh rice rat	*Oryzomys palustris*
Marsh wren	*Cistothorus palustris*
Mink	*Mustela vison*
Mottled duck	*Anas fulvigula*
Mourning Dove	*Zenaida macroura*
Muskrat	*Ondatra zibethicus*
Nine-banded armadillo	*Dasypus novemcinctus*
Northern cardinal	*Cardinalis cardinalis*
Northern mockingbird	*Mimus polyglottos*
Northern pintail	*Anas acuta*
Northern raccoon	*Procyon lotor*
Northern Shoveler	*Anas clypeata*
Northern yellow bat	*Lasiurus intermedius*
Norway rat	*Rattus norvegicus*
Nutria	*Myocastor coypus*
Olivaceous cormorant	*Phalacrocorax brasilianus*
Pig frog	*Rana grylio*
Rafinesque's big-eared bat	*Plecotus rafinesquii*
Red bat	*Lasiurus borealis*
Red-eared slider	*Trachemys scripta*
River otter	*Lutra canadensis*
Red fox	*Vulpes vulpes*
Redhead	*Aythya americana*
Red-shouldered hawk	*Buteo lineatus*

Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Roof rat	*Rattus rattus*
Seaside sparrow	*Ammodramus maritimus*
Seminole bat	*Lasiurus seminolus*
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Snowy egret	*Egretta thula*
Southern leopard frog	*Rana sphenocephala*
Squirrel treefrogs	*Hyla squirella*
Stinkpot	*Sternotherus odoratus*
Swamp rabbit	*Sylvilagus aquaticus*
Tricolored heron	*Egretta tricolor*
West Indian manatee	*Trichechus manatus*
Western cottonmouth	*Agkistrodon piscivorus*
White-eyed vireo	*Vireo griseus*
White-faced ibis	*Plegadis chihi*
White-footed mouse	*Peromyscus leucopus*
White ibis	*Eudocimus albus*
White-tail deer	*Odocoileus virginiana*
Wood duck	*Aix sponsa*
Yellow-crowned night-heron	*Nycticorax violaceus*

Table B-15: Fish and Aquatic Species Found in the LPV Basin (Bonnet Carré, Mississippi River and Lake Ponchartrain)	
Common Name	**Scientific Name**
Atlantic croaker	*Micropogonias undulatus*
American oyster	*Crassostrea virginica*
Asiatic clam	*Corbicula fluminea*
bay anchovy	*Anchoa mitchilli*
bighead carp	*Hypophthalmichthys nobilis*
black drum	*Pogonias cromis*
blue crab	*Callinectes sapidus*
blue catfish	*Ictalurus furcatus*
bluegill	*Lepomis macrochirus*
bowfin	*Amia calva*
brown shrimp	*Farfantepenaeus aztecus*
channel catfish	*Ictalurus punctatus*
common carp	*Cyprinus carpio*
crawfish	*Procambarus sp.*
freshwater drum	*Aplodinotus grunniens*
grass carp	*Ctenopharyngodon idella*
Gulf menhaden	*Brevoortia patronus*
Gulf sturgeon	*Acipenser oxyrinchus desotoi*
hardhead catfish	*Ariopsis felis*
inland silverside	*Menidia beryllina*
largemouth bass	*Micropterus salmoides*
least killifish	*Heterandria formosa*
paddlefish	*Polyodon spathula*
pallid sturgeon	*Scaphirhynchus albus*
rainwater killifish	*Lucania parva*
redear sunfish	*Lepomis microlophus*
redfish/ red drum	*Sciaenops ocellatus*
Rio Grande cichlid	*Cichlasoma cyanoguttatum*
sand sea trout	*Cynoscion arenarius*
sailfin molly	*Poecilia latipinna*
sheepshead	*Archosargus probatocephalus*
sheepshead minnow	*Cyprinodon variegatus*
shovelnose sturgeon	*Scaphirhynchus platorynchus*
silver carp	*Hypophthalmichthys molitrix*
southern flounder	*Paralichthys lethostigma*
Spanish mackerel	*Scomberomorus maculatus*
spot	*Leiostomus xanthurus*
spotted/speckled sea trout	*Cynoscion nebulosus*
striped mullet	*Mugil cephalus*
warmouth	*Lepomis gulosus*
white shrimp	*Litopenaeus setiferus*
yellow bullhead	*Ameiurus natalis*

Zebra mussel	*Dreissena polymorpha*

Table B-16: FY 2012 Fishing/ Hunting Licenses[1], Boater Registrations

Parish/County	Fishing Licenses		Hunting Licenses	
	Resident-Freshwater	Resident–Saltwater	Resident	Boater[2] Registrations
St. Bernard	4,628	4,565	1,711	2,702
Plaquemines	4,229	4,165	1843	3,927
Orleans	15,127	14,612	4,325	4,649
St. Tammany	29,732	28,495	11,707	18,716
Jefferson	39,090	38,253	11,938	18,627
St. John the Baptist	4,922	4,558	1,773	2,269
Tangipahoa	13,859	12,581	6,886	7,242
St. James	3,072	2,643	1,363	2,135
Ascension	15,365	12,331	6,394	8,530
Livingston	18,759	14,539	8,723	11,092
Study Area Total	148,783	136,742	56,663	79,889
Study Area Percent of State	27%	35%	20%	25%

[1] Number of licenses issued in Parish granting residents fishing or hunting privileges.

[2] Boater registration data is for 2011.

Table B-17: State and Federal Recreation Areas

Name	Parish location	Managed by	Size in acres	Brief description	Trails	Boating	Hunting or trapping	Fishing	Observe Birds, Wildlife	Educational programs	Play, picnic, swim	Camping	Other
Bayou Sauvage NWR	Orleans	U.S. Fish and Wildlife Service	23,000	Park is entirely within the city limits of New Orleans and is the nation's largest urban wildlife refuge.	3-mile hiking trail; another 9-mile biking trail	1 boat ramp; motor boating and non-motor boating	No	Fishing from boat, bank; craw-fishing, crabbing	Yes; observation deck	Classroom space, educational programming, interpretive panels	Yes; 1 picnic shelter	No	
Biloxi WMA	St. Bernard	Louisiana Department of Wildlife and Fisheries	39,583	Biloxi WMA is accessible only by boat via commercial launches at Hopedale and Shell Beach. The area is owned and leased to the Louisiana Department of Wildlife and Fisheries by the Biloxi Marsh Lands Corporation.	No	Motor boating	Small game, waterfowl, birds, alligator	Boat, bank fishing, crabbing, shrimping, shellfishing	Yes	No	No	No	
Fort Pike SHS	St. Tammany	Louisiana Department of Culture, Recreation and Tourism	94	Fort Pike, a military installation, was completed in 1826. The park offers educational programs and demonstrations.	No	1 boat ramp	No	No	Yes	Museum, historic site, educational programming, interpretive panels	Picnic tables	No	
St. Bernard SP	St. Bernard	Louisiana Department of Culture, Recreation and Tourism	NA	The park contains a network of man-made lagoons and offers many amenities and activities.	Nature trail	Boat launch nearby	No	Yes	Yes	No	Swimming pool, picnic shelters	Yes	

Name	Parish location	Managed by	Size in acres	Brief description	Trails	Boating	Hunting or trapping	Fishing	Observe Birds, Wildlife	Educational programs	Play, picnic, swim	Camping	Other
Big Branch Marsh NWR	St. Tammany	U.S. Fish and Wildlife Service	19,000	Environmental education, birding, fishing, hunting, biking, hiking, wildlife observation, photography and canoeing. A major public use area is the Boy Scout Road boardwalk and trail.	4.5 mile hiking and biking trail, ¼ mile boardwalk	2 boat ramps	Deer, small game, waterfowl, alligator	Yes, from boat and bank	Yes, one observation deck	Classroom space in visitor center attended by 1,000 people annually		No	Visitor Center, interpretive panels
St. Tammany Wildlife Refuge	St. Tammany	State Parks Commission	NA	Refuge extends 10 miles along Lake Pontchartrain and inland 100 – 1,300 feet	No	No	No	No	Yes	No	No	No	
Fontainebleau SP	St. Tammany	Louisiana Department of Culture, Recreation and Tourism	2,800	Offers a variety of activities including hiking, cycling, in-line skating, swimming, picnicking, fishing	2 walking trails (6 miles), 1 biking trail (23 miles)	No	No	Yes, 300' fishing pier	Yes	Conference room, educational programming, interpretive panels	Lake swimming with sandy beach, 1 picnic shelter	Improved campsites, Group camp, cabins, trailer camping	Visitor Center
Manchac WMA	St. John the Baptist	Louisiana Dept. of Wildlife and fisheries	8,328	Manchac WMA is popular for duck hunting in the Prairie Pond, also allows fishing and wildlife viewing	No	1 boat launch just north of the WMA	Small game, waterfowl, alligator	Yes	Yes	No	No	No	
Fairview Riverside SP	St. Tammany	Louisiana Department of Culture, Recreation and Tourism	99	State Park offers a variety of activities including fishing, picnicking and a playground	½ mile walking trail/boardwalk	1 boat ramp	No	Yes	Yes	Museum, historic site, educational programming	Play area, picnic tables	101 improved campsites	

Name	Parish location	Managed by	Size in acres	Brief description	Trails	Boating	Hunting or trapping	Fishing	Observe Birds, Wildlife	Educational programs	Play, picnic, swim	Camping	Other
Joyce WMA	Tangipahoa	Louisiana Dept. of Wildlife and fisheries	16,394	Access into the interior of the property is extremely limited. Access mainly via abandoned logging canals. Boat access limited to upper reaches.	Elevated boardwalk to swamp	Limited, boat trail, 1 launch within, 2 nearby WMA	Deer, rabbits, waterfowl, alligator	Yes	Yes	No	No	No	
Maurepas Swamp WMA (Eastern and Western Tracts)	Livingston, Ascension and St. James	Louisiana Dept. of Wildlife and fisheries	103,263	Majority of access by boat, limited foot access.	½ mile nature trail	7 boat launch sites	Deer, rabbit, alligator	Freshwater fishing	Yes	No	No	Yes	
Tickfaw SP	Livingston	Louisiana Department of Culture, Recreation and Tourism	1,183	Tickfaw State Park, of which the Tickfaw River is the western boundary, includes a cypress/tupelo swamp, a bottomland hardwood forest, and a mixed pine/hardwood forest.	5 hiking trails (4.75 miles)	2 boat ramps	No	Yes, from boat and bank	Bird watching	Classrooms, educational programming, interpretive panels	1 play area, picnic tables, 2 picnic shelters	30 improved campsites, 20 unimproved, 14 group, 1 lodge	Visitor Center

The State- and Federally-managed facilities in the study area vary widely in terms of the recreational opportunities provided. The table is based on data gathered through a review of publicly available brochures, contacts with park or refuge managers, and site visits. It provides details about the availability of different types of recreational opportunities at each of the facilities.

Table B-18: LWCF Expenditures in Study Area for Rec Resources

Parish	Number of Projects	Actual* LWCF funds expended
Orleans	25	$6,610,701
St. Bernard	4	$1,359,347
St. Tammany	13	$1,757,207
Jefferson	41	$7,576,079
St. John the Baptist	10	$524,212
Livingston	17	$1,589,164
Tangipahoa	21	$1,525,996
Total	131	$20,942,706

*Dollar values expended in the years since 1964 are not adjusted for inflation.

Table B-19: Cumulative Impacts of Past Present and Reasonably Forseable Projects in the LPV Basin

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
CIAP PO-44: Blind River Freshwater Diversion Property Purchase	Diversion	+	+/-	+	+/-	+/-	o	+/-	o	o	o	o	o
LCA BS-20: Medium Diversion at White Ditch	Diversion	+	+/-	+/-	+/-	+/-	o	+/-	o	o	o	o	o
LCA PO-68: Small Diversion at Convent/Blind River	Diversion	+	+/-	+/-	+/-	+/-	o	+/-	o	o	o	o	o
LCA PO-69: Amite River Diversion Canal Modification	Diversion	+	+/-	+/-	+/-	+/-	o	+/-	o	o	o	o	o
State of Louisiana PO-01: Violet Siphon	Diversion	+	+/-	+/-	+/-	+/-	o	+/-	o	o	o	o	+/-
WRDA BS-08: Caernarvon Freshwater Diversion	Diversion	+	+/-	+/-	+/-	+/-	o	+/-	o	o	o	o	o
CIAP PO-45: East Bank Wastewater Assimilation	Habitat Enhancement	+	+	o	o	+/-	o	+/-	o	o	o	o	o
CIAP PO-51: Mandeville Aquatic Ecosystem Restoration Project	Habitat Enhancement	+	+	+/-	+/-	+/-	o	+/-	o	o	o	o	o
CIAP PO-48: Green Property Preservation Project	Habitat Preservation	+	+	+	o	o	o	o	+	o	o	o	o
CIAP PO-49: French Property Preservation Project	Habitat Preservation	+	+	+	o	o	o	o	+	o	o	o	o
CWPPRA PO-19: Mississippi River Gulf Outlet (MRGO) Disposal Area Marsh Protection	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
CWPPRA PO-30: Lake Borgne Shoreline Protection	Habitat Preservation	+	+	+/-	+/-	+/-	o	o	+	o	o	o	o
US Army Corps of Engineers: MRGO O&M (MRGO East Bank Shoreline Protection in the vicinity of Bayous Bienvenue and Dupre)	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
US Army Corps of Engineers: MRGO O&M (MRGO West Bank Shoreline Protection in the vicinity of Stump Bayou)	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental and MRGO O&M (MRGO East Bank Shoreline Protection in the Vicinity of Bayou Yscloskey)	Habitat Preservation	+	+	o	+	+/-	o	o	+	o	o	o	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (Bayou Bienvenue Shoreline Protection)	Habitat Preservation	+	+	o	+	+/-	o	o	+	o	o	o	o
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (Bayou Dupre Shoreline Protection)	Habitat Preservation	+	+	o	+	+/-	o	o	+	o	o	o	o
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (Doulluts Canal to Jahnckes Ditch)	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
CIAP PO-39: Bald Cypress/Tupelo Coastal Forest	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CIAP PO-42: West LaBranche Shoreline Protection	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
CIAP PO-43: East LaBranche Shoreline Protection	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
CIAP PO-46: Reserve Relief Canal Shoreline Protection	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CIAP PO-52:Lake Pontchartrain Shoreline Protection	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
CIAP PO-73: EB-Central Wetlands Assimilation	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA BS-03a: Caernarvon Diversion Outfall Management	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA PO-22: Bayou Chevee Shoreline Protection	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
State of Louisiana PO-02c: Bayou Chevee	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
State of Louisiana PO-03: LaBranche Shoreline Stabilization and Canal Closure	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
State of Louisiana PO-03b: LaBranche Shoreline Protection	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o
State of Louisiana PO-10: Turtle Cove Shore Protection	Habitat Restoration	+	+	o	+	+/-	o	+	o	o	o	o	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
State of Louisiana PO-4355NP4 Fontainebleau State Park Mitigation	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CIAP BS-13: EB Bayou Lamoque Floodgate Removal	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CIAP PO-40: Hydrologic Restoration in Swamps West of Lake Maurepas	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CWPPRA PO-06: Fritchie Marsh Restoration	Hydrologic Restoration	+	+	o	+	+	o	o	o	o	o	o	o
CWPPRA PO-16: Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CWPPRA PO-18: Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 2	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CWPPRA PO-24: Hopedale Hydrologic Restoration	Hydrologic Restoration	+	+	o	+	+	o	o	o	o	o	o	o
State of Louisiana BS-06: Lake Lery Hydrologic Restoration	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
State of Louisiana PO-08: Central Wetlands Pump Outfall	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
US Army Corps of Engineers: Modification to Caernarvon 4th Supplemental	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CIAP BS-17: Lake Lery Rim Reestablishment and Marsh Creation	Marsh Creation	+	+	o	+	+/-	o	+	o	o	o	o	o
CIAP PO-36: EB-Orleans Land Bridge Shoreline Protection and Marsh Creation	Marsh Creation	+	+	o	+	+/-	o	+	o	o	o	o	o
CIAP PO-70: Northshore Beach Marsh Creation/ Restoration	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA PO-17: Bayou LaBranche Wetland Creation	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA PO-33: Goose Point/Point Platte Marsh Creation	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
DOTD: I-310 Mitigation	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
State of Louisiana Surplus Fund 2007 PO-72: Biloxi Marsh Shoreline Protection	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
US Army Corps of Engineers: LPV Pre-Katrina Mitigation (Manchac Shoreline)	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
US Army Corps of Engineers: LPV Pre-Katrina Mitigation (Manchac Shoreline)	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
US Army Corps of Engineers: LPV Task Force Guardian Mitigation (Bayou Sauvage)	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
US Army Corps of Engineers: MRGO O&M 3rd and 4th Supplemental (West of Shell Beach Shoreline Protection)	Marsh Creation	+	+	o	+/-	+/-	o	+	o	o	o	o	o
Bonnet Carre Spillway	Structure	+/-	+/-	+/-	+/-	+/-	+/-	-	-	o	o	+	o
CIAP PO-71: Waterline Booster Pump Station	Structure	+/-	+/-	o	+/-	o	+/-	-	-	o	o	+	o
East Plaquemines Non-Federal Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
Forty Arpent Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
GIWW Navigation System	Structure	+/-	+/-	o	+/-	+/-	+/-	+/-	o	o	o	+	o
Hurricane and Storm Damage Risk Reduction System, Lake Pontchartrain and Vicinity (HSDRRS-LPV)	Structure	+/-	+/-	o	-	-	+/-	-	-	o	o	+	o
I-10 Mile 246 to 248 Non-federal Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
Inner Harbor Navigation Canal (IHNC) Lock Replacement	Structure	+/-	+/-	o	-	-	+/-	+/-	-	o	o	+	o
Little Woods/Maxent Non-federal Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
Lower Ninth Ward Non-federal Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
Maxent Lagoon Non-federal Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
Mississippi River Gulf Outlet (MRGO)	Structure	+/-	+/-	o	+/-	+/-	+/-	-	o	o	o	+	o

Project Name	Project Type	Wetlands and Other Surface Waters	Wildlife	Threatened and Endangered Species	Fisheries, Aquatic Resources, and Water Quality	Essential Fish Habitat	Cultural Resources	Recreational Resources	Aesthetic Resources	Air Quality	Noise	Socioeconomics	Environmental Justice
Mississippi River Levees: Mississippi River & Tributaries (MR&T) Project	Structure	+/-	+/-	-	-	-	+/-	-	-	o	o	+	o
Mississippi River Navigation Channel	Structure	+/-	+/-	o	+/-	+/-	+/-	-	o	o	o	+	o
Monticello Non-federal Levee	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
MRGO Closure at Bayou La Loutre	Structure	+/-	+/-	o	+/-	+/-	+/-	-	-	o	o	o	o
New Orleans to Venice Levee System, Phoenix to Bohemia	Structure	+/-	+/-	o	-	-	+/-	-	-	o	o	+	o
Ormond Non-federal Levees	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	+	o
US Army Corps of Engineers: Caernarvon Freshwater Diversion Structure	Structure	+/-	+/-	o	o	o	+/-	-	-	o	o	o	o

APPENDIX C
IER IMPACT DISCREPANCY MEMOS

CEMVN-PDN-CEP Date: 28 January 2013

MEMORANDUM FOR RECORD

SUBJECT: Discrepancies in public disclosure of LPV HSDRRS impact acreages and AAHUs

1. Reference the construction of the Lake Pontchartrain and Vicinity (LPV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) projects which began in March 2007. During the NEPA process, a number of documents were released disclosing the acres and Average Annual Habitat Units (AAHUs) anticipated to be impacted by construction of the HSDRRS projects [ie. Individual Environmental Reports (IERs) and USFWS Coordination Act Reports (CAR)]. It should be noted that acreages and AAHUs in the IERs are estimates of anticipated impacts based on early conceptual designs. In some cases, there were noted discrepancies in the impact numbers disclosed within and among these documents. This memo identifies those discrepancies and states the correct impact numbers to be reported (attachment 1) from the date of this memorandum when referencing the HSDRRS IERs.

2. A forthcoming Mitigation IER will disclose the updated impacted acreages and AAHUs, based on 100% project plans and as-built drawings (if available). In addition, an analysis of aerial imagery will be conducted on the footprints identified in these plans to verify the HSDRRS construction impacts have been correctly quantified. Once As-Builts for the whole HSDRRS are available, this process will be repeated to determine the final mitigation requirement for the HSDRRS work.

3. The discrepancies, and their respective resolutions, are provided below:

Project	Discrepancy	Resolution
IER 1	Decision Record (DR) states 302 acres wetland impacts.	IER Conclusion provides correct number of 307 acres wetland impacts (3 acres of forested wetland assumed to be swamp, 276 acres of cypress swamp, 11 acres of BLH, and 17 acres of open water).
IERS 1a	IER noted the final CAR was received 23 June 2011.	LDWF letter was received on this date. Final CAR was received 03 May 2011.
IER 2	Final CAR, 15 July 2008 and 09 Sept 2009, stated impacts to intermediate marsh. ********** IER stated temp impacts to lake Pontchartrain 39 acres.	Corrected to brackish marsh in final CAR, 07 May 2010. ********** Temp impacts to lake Pontchartrain should be 59 acres.
IERS 2.a	Final CAR, 15 July 2008 and 09 Sept 2009, stated impacts to intermediate marsh. ********** IER noted impacts to 22 acres of brackish marsh and swamp. ********** DR stated 13 AAHUs of mitigation.	Corrected to brackish marsh in final CAR, 07 May 2010. ********** Should be impacts to 22 AAHUs of brackish marsh and swamp. ********** Should state 13 AAHUs of impacts (11.45 AAHUs of brackish marsh and 1.55 AAHUs of swamp).

Project	Discrepancy	Resolution
IER 7	IER mistakenly stated impacts to floodside intermediate marsh. ********** IER cited acreages and AAHUs from draft CAR. ********** DR stated 7.2 acres open water impacts with proposed action. ********** IER "Fisheries" section stated 351.2 acres impacts.	Final CAR, 15 June 2009, correctly classified floodside marsh as brackish. *** ********** Final CAR, 15 June 2009, provides correct acreages and AAHUs. ********** 7.2 acres open water impacts would occur with no action alternative. ********** Final CAR, 15 June 2009, provides correct acres of impacts as 352.1.
IERS 7	IERS 7 and the DR stated 106.9 acres impacts to wetlands and waters of the U.S. with 100.13 acres of that being wetlands. ********** IER 7 and IERS 7 misstated the total proposed wetland impact throughout impact discussion. ********** IERS 7 inaccurately stated 1.43 acres of impacts due to levee tie-ins.	The final CAR, 07 May 2010, provides the correct acres of 101.66 and 94.9 respectively. ********** The final CAR, 07 May 2010, provides the correct impacts of 447 acres. ********** Final CAR provides correct acres of impacts as 1.57.
IER 9	DR, 08 Feb 2010, states inaccurate acres of wetland impacts. ********** IER "Conclusions and Final Decision" section is not specific enough in stating acres impacted. ********** IER "Conclusions and Final Decision" section and the DR did not capture the non-wet BLH impacts. ********** CAR did not include the temporary impacts to 1.8 acres of water.	CAR provides the correct number of acres impacted. ********** Should state 5.2 acres of wetlands and waters of the U.S. would be impacted. ********** IER "Mitigation" section, IER non-wet impact discussions, and final CAR, 25 Jan 2010, include impacts to 10 acres of non-wet BLH. ********** The correct water impacts were stated in the IER and the DR.
IER 10	DR states 64.67 AAHUs of intermediate marsh impacts. ********** DR only identifies impacts in AAHUs IER only identifies impacts by acres DR and IER did not designate impacts by protected side/flood side. ********** IER "Cumulative Impacts" Table 16 shows BLH flood side impacts as 14.22. ********** IER includes AAHUs from the draft CAR.	Total should be 64.76 AAHUs of intermediate marsh impacts. ********** CAR provides overall AAHU and acreage impact totals by protected side/flood side. ********** BLH flood side impacts should be 15.22 AAHUs. ********** Final CAR, 19 May 2009, provides the correct AAHUs.

Project	Discrepancy	Resolution
IER 11 Tier 1	DR does not include 39 acres BLH wet impacts. ********** DR and USFWS letter do not include 56 acres of upland habitat impacts. ********** DR and USFWS letter do not include 301 acres of open water impacts.	IER and USFWS letter include the 39 acres of impacts to BLH wet. ********** IER discusses the 56 acres of upland habitat impacts. ********** Open water impacts are discussed in the IER.
IER 11 Tier 2	IER includes preliminary impact values of 18.12 AAHUs brackish marsh/water impacts and 20.71 AAHUs total impacts. ********** The discussion within the IER and the "habitat impact estimates" in Table 6 of the IER used different methodologies and data to determine habitat impacts resulting in slight differences in marsh classification.	Final CAR and DR include the correct impact values of 24.33 AAHUs and 26.92 AAHUs respectively. ********** The correct impacts using standard FWS methodology are stated in the final CAR dated October 9, 2008.
IER 11.c Tier 2	DR and IER state the proposed action will incur an additional 22 acres of impact to brackish marsh but do not explain how the total impact to 122 acres of brackish marsh from all Tier 2 actions (including the proposed increase of 22 acres) would result in an a overall reduction in impacts to 80.84 acres. Also, a reduction in BLH-Wet impacts is not stated in either document.	The majority of the decrease in brackish marsh impacts (acres) was a result of the removal of major waterways and large open water areas from WVA analysis. A change in footprint location also contributed to a reduction in the impact acreage (brackish marsh and BLH-Wet) BUT resulted in an increase in AAHUs impacted (+10.37 brackish marsh) due to the higher quality habitat in the revised footprint.

Sandra Stiles

Sandra Stiles
Chief, Coastal Environmental Section
Environmental Planning Branch

CEMVN-PDN-CEP Date: 28 Jan 2012

MEMORANDUM FOR RECORD

SUBJECT: Discrepancies in public disclosure of Government and Contractor Furnished Borrow HSDRRS impact acreages and AAHUs

1. Reference the construction of the Lake Pontchartrain and Vicinity (LPV) Hurricane and Storm Damage Risk Reduction System (HSDRRS) projects which began in March 2007. During the NEPA process, a number of documents were released disclosing the acres and Average Annual Habitat Units (AAHUs) anticipated to be impacted by construction of the HSDRRS projects [ie. Individual Environmental Reports (IERs) and USFWS Coordination Act Reports (CAR)]. It should be noted that acreages and AAHUs in the IERs are estimates of anticipated impacts based on early conceptual designs. In some cases, there were noted discrepancies in the impact numbers disclosed within and among these documents. This memo identifies those discrepancies and identifies the correct impact numbers to be reported from the date of this memorandum when referencing the HSDRRS IERs.

2. A forthcoming Mitigation IER will disclose the updated impacted acreages and AAHUs from use of borrow pits covered in the government furnished IERs. Mitigation incurred by the use of contractor furnished borrow areas is the responsibility of the land owner and must be completed before the CEMVN will utilize these areas.

3. The discrepancies, and their respective resolutions, are provided below:

Project	Discrepancy	Resolution
IER 25	IER states impact to 942.1 acres bottomland hardwoods (BLH).	DR, IER "Mitigation" section and final CAR, 15 Nov 2010, provide the correct amount of impacts as 933 acres.
IER 29	DR, 19 Sept 2009, noted impacts to dry non-jurisdictional BLH as 51.50 AAHUs in "Mitigation" section and 48.6 AAHUs in Table 1. ********** DR, Table 1 notes 24.1 AAHUs impacts for Willow Bend Phase II BLH.	Correct number is 48.6 AAHUs of impacts which is disclosed in IER and final CAR, 3 Sept 2009. ********** IER and final CAR, 3 Sept 2009, provide the correct impacts of 42.1 AAHUs.

Sandra Stiles
Chief, Coastal Environmental Section
Environmental Planning Branch

Attachment 1

LPV FINAL HABITAT IMPACTS from IERs

	Protected Side										Flood Side												
IER+	Fresh and Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Fresh and Intermediate Marsh		Brackish Marsh		Swamp		BLH wet		BLH dry		Open Water	TOTAL**	
	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	AAHUs	Acres	**Acres**	**AAHUs**
1	0	0	0	0	137.05	73.99	1.50	0.19	0	0	0	0	0	0	143.60	110.97	11.33	8.09	0	0	19.41	**293.48**	**193.24**
2	0	0	0	0	0	0	0	0	0	0	0	0	31.50	20.45	2.00	1.55	0	0	0	0	78.00	**33.50**	**22.00**
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	417.00	**0**	**0**
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.90	**0**	**0**
6	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	68.80	**0**	**0**
7	119.00	42.90	0	0	0	0	169.00	89.20	0	0	0	0	126.00	67.40	0	0	32.80	12.20	0	0	6.76	**446.80**	**211.70**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.30	**0**	**0**
9	0	0	0	0	0	0	0	0	0	0	1.90	1.20	0	0	0	0	1.20	0.66	10.02	4.65	1.80	**13.12**	**6.51**
10	106.47	57.26	0.08	0.05	0	0	38.32	16.44	0	0	53.20	31.26	269.84	178.68	0	0	35.31	15.22	0	0	50.00	**503.22**	**298.91**
11	0	0	0	0	0	0	0	0	2.46	0.41	0	0	80.84	34.70	0	0	0	0	9.48	1.59	45.00	**92.78**	**36.70**
18	0	0	0	0	0	0	0	0	44.00	14.65	0	0	0	0	0	0	0	0	0	0	0	**44.00**	**14.65**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00**	**0.00**
Total	**225.47**	**100.16**	**0.08**	**0.05**	**137.05**	**73.99**	**208.82**	**105.83**	**46.46**	**15.06**	**55.10**	**32.46**	**508.18**	**301.23**	**145.60**	**112.52**	**80.64**	**36.17**	**19.50**	**6.24**	**695.97**	**1426.90**	**783.71**

APPENDIX D

DRAFT GUIDELINES CONCERNING MITIGATION OF IMPACTS TO OPEN WATER HABITATS AND THE USE OF WVA MODELS TO EVALUATE SUCH IMPACTS (2 March 2012)

1 INTRODUCTION

This document is intended to provide draft guidance concerning mitigation of impacts to open water habitats resulting from Hurricane & Storm Damage Risk Reduction System (HSDRRS) civil works projects, including impacts generated by HSDRRS mitigation activities. It also provides draft guidance concerning the use of Wetland Value Assessment (WVA) models to evaluate these impacts. These guidelines were developed by the US Army Corps of Engineers, New Orleans District (CEMVN) in coordination with US Fish and Wildlife Service (USFWS) staff and National Marine Fisheries Service (NMFS) staff.

The guidance contained herein is not applicable to the evaluation of impacts to open water areas within marsh habitats, or to mitigation of such impacts. Coastal marsh habitats frequently include open water areas that are interspersed with the vegetated marsh features, forming a mosaic of marsh (land) areas and open water areas. Impacts to open water areas within marsh habitats will continue to be addressed as part of the overall marsh landscape. For now, the appropriate WVA marsh community model will continue to be used to evaluate proposed impacts to the marsh/open water complex, since the marsh community models already incorporate a means of assessing project impacts to both the marsh components and the open water components of marsh habitats. At this time, the guidance contained herein is also not applicable to the evaluation and mitigation of impacts to open water areas involving CEMVN civil works projects other than HSDRRS projects.

It is emphasized that the guidelines contained herein are preliminary. They will be refined and finalized during the course of preparing the Tiered Individual Environmental Report(s) (TIERs) covering the constructible portions of the Tentatively Selected Mitigation Plan. The final guidelines will be prepared by CEMVN in coordination with the Interagency Environmental Team and the Non-Federal Sponsor.

2 MITIGATION FOR IMPACTS TO OPEN WATER HABITATS

2.1 Determination of Whether Mitigation Is or Is Not Required

Mitigation of impacts to open water habitats will typically be required for the following scenarios:

A. Any fill impact (deposition of fill) that will:
   (a) Affect open water habitat that is classified by the National Marine Fisheries Service (NMFS) as Essential Fish Habitat (EFH; i.e. NMFS asserts EFH jurisdiction over the affected habitat), and;
   (b) The impact will cause the affected open water area to become non-aquatic habitat.
   Note that, as a very general rule of thumb, NMFS may or may not assert EFH jurisdiction over open water areas in freshwater settings that are non-tidal, but typically will assert EFH jurisdiction over open water areas found in other salinity regimes (i.e. intermediate, brackish, saline) and may assert EFH jurisdiction over open water areas in tidal freshwater settings. Also note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

B. Any fill impact to an open water area containing Submerged Aquatic Vegetation (SAV), regardless of the percent cover accounted for by SAV, provided that the impact is anticipated to result in the permanent loss of SAV.

Note that for this scenario, the WVA model used to evaluate the impact would encompass the entire impact footprint (i.e. areas with SAV patches and areas lacking SAV). Also note that when determining SAV presence and coverage, both native and invasive/exotic SAV species will be considered (i.e. the total SAV cover will include the cover accounted for by native species and the cover accounted for by invasive/exotic species combined). Also note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

C. Any excavation (dredging) impact to an open water area containing SAV, regardless of the percent cover accounted for by SAV, which adversely affects the SAV but will not result in the creation of anoxic conditions in the affected area.
Note that for this scenario, the WVA model used to evaluate the impact would only be applicable to the SAV patches (i.e. the impacts to the open water areas lacking SAV would not be considered in the model). Note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

D. Any excavation impact to an open water area designated as EFH that will result in the creation of permanent anoxic conditions in the affected area, regardless of whether SAV is present or not.
Note that it may be difficult to predict whether a proposed action would result in permanent anoxic conditions. Rather than assuming mitigation will be necessary when there are uncertainties, the approach may be to conduct monitoring of the affected area following implementation of the proposed action to determine whether anoxic conditions have developed and then determine mitigation requirements based on this monitoring. Coordinate with NMFS during project planning to determine the best approach. Note that the exception to mitigation requirements addressed in item (3) below may be applicable to the impact scenario described above.

E. Any fill or excavation impact that adversely affects open water habitat where SAV is present and the SAV species include seagrasses, regardless of the percent cover accounted for by the SAV and regardless of the percentage of the total SAV cover accounted for by seagrasses. As used herein, seagrass species include; turtle grass (*Thalassia testudinum*), Manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), star grass (*Halophila englemannii*), and paddle grass (*Halophilia decipiens*).
Note that for this scenario, the WVA model used to evaluate the impact would encompass the entire impact footprint (i.e. areas with SAV patches and areas lacking SAV).

F. Any fill or excavation impact that adversely affects open water habitat that is designated as oyster seed grounds by the Louisiana Department of Wildlife and Fisheries (LDWF).

Mitigation of impacts to open water habitats will not typically be required for the following scenarios:

(1) The proposed action involves dredging that will only impact an open water area where no SAV is present, even if the affected area is EFH. This does not apply to dredging that will: (a) adversely impact open water areas designated as oyster seed grounds by LDWF, or; (b) result in the creation of permanent anoxic conditions in the affected area and the affected area is EFH.

(2) The proposed action involves filling an open water area such that the affected area will not be converted to non-aquatic habitat. This does not apply to: (a) fill activities that will result in the permanent loss of SAV, even though the affected area may remain inter-tidal, or; (b) fill activities that will adversely impact open water areas designated as oyster seed grounds by LDWF.

(3) The proposed action will adversely impact <1 acre within a single open water area (i.e. one impact encompassing <1 acre), even if SAV is present, or; the proposed action will adversely impact multiple open water areas but the total of the impact polygons will affect <1 acre (i.e. cumulative impact is <1 acre), even if SAV is present. This does not apply to actions that will adversely impact: (a) open water areas designated as oyster seed grounds by LDWF; (b) open water areas with SAV and the SAV includes seagrasses; (c) open water areas classified by NMFS as EFH,

although there may be limited cases when the stated mitigation exemption may be applied to EFH. The reader is cautioned that the exemption to mitigation requirements addressed in this item may not be applicable to other situations not specifically addressed in (3)(a) through (3)(c). One should coordinate directly with US Fish and Wildlife Service (USFWS) and NMFS regarding specifics of the proposed action before assuming this exemption is applicable.

Mitigation for temporary impacts to open water areas through actions such as excavating (dredging) temporary construction access canals, followed by back-filling of the affected area, may or may not be required even in cases where SAV, excluding seagrasses, and/or EFH will be impacted. The need for mitigation will be assessed on a case-by-case basis.

Be aware that there could be special circumstances that mandate mitigation of adverse impacts to open water habitats, regardless of the exceptions to mitigation discussed in items (1) through (3) above. Examples include, but are not necessarily limited to: actions that would also adversely affect threatened or endangered species; actions that would also adversely affect federally designated critical habitat; actions that would also adversely affect federally managed species. Another example involves proposed dredging of EFH whereby a substantial acreage of open water habitat lacking SAV will be permanently impacted in such a way that the depth of dredging will preclude colonization by SAV.

Before mitigation will be considered, one should also note that any proposed project that will adversely impact open water habitats will still be subject to demonstrating that all practicable measures to avoid the impact have been taken, that the proposed impact is not avoidable, and that all practicable measures to minimize unavoidable impacts have been taken.

2.2 Type and Location of Mitigation

As a preface to the following discussion, keep in mind that the guidance contained in the Federal Register, Vol. 73, No. 70, Section 332.3(b) concerning the type and location of compensatory mitigation will be applicable to mitigation proposed as compensation for impacts to open water habitats. In general, this guidance indicates that: (a) Mitigation should be within the same watershed as the impact, or, in the case of marine impacts, within the same marine ecological system; (b) The preferential order (i.e. preferred hierarchy) for mitigation is: use of a mitigation bank; use of in-lieu fee program credits; a watershed approach where the goal is to provide the greatest benefits to the watershed (includes on-site mitigation, off-site mitigation, mitigation banks, in-lieu fee program, out-of-kind mitigation); on-site, in-kind mitigation; off-site and/or out-of-kind mitigation.

In general, the preferred method of compensating impacts to open water habitats containing SAV will be in-kind (type-for-type) mitigation through measures such as creation or restoration of SAV beds in existing open water areas or enhancement of open water areas to promote development of SAV beds. However, out-of-kind mitigation in the form of marsh creation, restoration, or enhancement will also be acceptable in most cases. Factors that will be considered in determining whether the mitigation should be in-kind may include, but are not limited to: (a) the relative prevalence of SAV beds within the watershed/basin; (b) the density of SAV species in the area that will be impacted; (c) the persistence of SAV beds in the area that will be impacted (e.g. how persistent SAV cover is during a typical year); (d) the ability to achieve successful in-kind mitigation.

If mitigation will be provided through marsh creation, restoration, or enhancement activities, the marsh should be similar to the predominant marsh type (i.e. fresh, intermediate, brackish, or saline) in the area where the open water impact occurs, provided that this marsh type is capable of replacing most of the functions and values of the affected open water habitat (particularly as regards the fish and wildlife species that could utilize the affected open water habitat). The marsh mitigation feature should include components that allow access to the marsh by fish and other aquatic organisms and must be intertidal. The location of the marsh mitigation feature should be within the same watershed/basin as the impacted habitat.

In some cases, a proposed action that will impact open water habitats may also impact marsh habitats, thereby requiring mitigation for the marsh impact. There may also be cases where the establishment of proposed mitigation features used to compensate for project impacts to non-open water habitats (ex.

mitigation for impacts to marsh, swamp, and/or bottomland hardwood habitats) will impact open water habitats. Assuming one or more marsh mitigation features will be included as part of the overall project mitigation plan, the proposed marsh mitigation may be utilized to compensate for the open water habitat impacts as well as for the marsh impacts. In this case, the marsh mitigation feature(s) used as compensation for the open water impacts should be the feature(s) closest to the location of the open water impacts.

3 EVALUATION OF IMPACTS TO OPEN WATER HABITATS

If mitigation of adverse impacts to open water habitats is required, the open water component of the appropriate WVA marsh model will typically be used to determine the net loss of functions and values (net loss of Average Annual Habitat Units or AAHUs) that will result from the impacts. It must be demonstrated that the proposed mitigation for such impacts will fully compensate for the lost functions and values. This will be accomplished through use of the appropriate WVA marsh model (all components of the marsh model if mitigation will be provided via marsh creation, restoration, or enhancement; the open water component of the marsh model if mitigation will be provide via open water habitat creation, restoration, or enhancement). If the net gain in AAHUs that will result from the proposed mitigation is equal to or greater than the net loss of AAHUs that will result from the impact, then it will typically be assumed that the proposed mitigation adequately compensates for the proposed impact.

One should note that impact/mitigation assessment methods other than the WVA methodology may be used. Such methods will need to be approved on a case-by-case basis.

In situations where mitigation of impacts to open water habitats is not required, such impacts must still be quantified, evaluated, and discussed in an appropriate NEPA document. However, WVA models (or other impact assessment methods) will not need to be used as part of the impact evaluation.

Federal Register, Vol. 46, No. 15 (USFWS Mitigation Policy) sets forth guidance concerning how USFWS may make recommendations concerning mitigation. This guidance is not applicable to mitigation for impacts to threatened or endangered species. Within the cited document, four “resource categories” are used to indicate that the level of mitigation recommended will be consistent with the fish and wildlife resource values involved.

In general, USFWS categorization of impacts to open water habitats will be as follows. The reader is cautioned, however, that there may be exceptions to the generalizations that follow; hence, direct coordination with USFWS is always recommended.

Resource Category 4

Impacts to open water bottoms, regardless of depth, with no SAV present (even if the proposed action causes the affected area to become non-tidal). Typically, USFWS would not recommend mitigation for such impacts unless the impact will adversely affect LDWF oyster seed grounds or NMFS requests mitigation for EFH impacts. USFWS would discourage impacts, to the extent feasible, and would advise that measures to minimize impacts to water quality (particularly in the case of proposed borrow areas) be taken as part of the proposed action.

Resource Category 3

Impacts to SAV beds in open water habitats. Typically, USFWS would recommend mitigation for such impacts and would require that appropriate mitigation sequencing be employed (impact avoidance and minimization) prior to considering mitigation. USFWS would seek to ensure the mitigation proposed adequately replaces the lost functions and values that would result from the impact, but would not necessarily require in-kind mitigation. USFWS may not require mitigation in cases described under the mitigation exemption described in section 2.1(3).

4 WVA MODELS FOR IMPACTS TO OPEN WATER HABITATS

Components of the WVA models for coastal marsh communities will be utilized to determine the net loss of AAHUs that will result from the proposed impacts to existing open water habitats. Note that all of the formulas addressed herein are directly obtained from the document entitled "Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Coastal Marsh Community Models", dated March 19, 2010. This methodology is presently being considered for interim regional approval by the USACE, with the interim approval period lasting 3 years. It is possible that the WVA Marsh Community Model may ultimately be revised for USACE final certification. Such a revision may alter the formulas set forth below.

The reader is further advised that the guidance that follows indicates one can use either the predominant marsh type present near the area where the open water impact or open water mitigation will occur, or one can use the average annual salinity near the impact/mitigation area to determine which formulas should be used. The average annual salinity should be used only in cases where there are no nearby marsh habitats present. Otherwise, the predominant marsh habitat type should be used to determine the appropriate formulas.

4.1 Habitat Suitability Index (HSI) Formulas for Open Water Habitats

The following formulas will be used to determine Habitat Suitability Index (HSI) values for affected open water areas:

(A) If the majority of nearby marsh habitats are fresh or intermediate marshes and/or the average annual salinity in the affected open water area ranges from 0 to <5 ppt:

$$HSI = [\{ 3.5 \times (SIV_2^3 \times SIV_6)^{(1/4)} \} + (SIV_3 + SIV_4 + SIV_5) / 3] / 4.5$$

(B) If the majority of nearby marsh habitats are brackish marshes and/or the average annual salinity in the affected open water area is ranges from 5 to 16 ppt:

$$HSI = [\{ 3.5 \times (SIV_2^3 \times SIV_6^2)^{(1/5)} \} + (SIV_3 + SIV_4 + SIV_5) / 3] / 4.5$$

(C) If the majority of nearby marsh habitats are saline marshes and/or the average annual salinity in the affected open water area is >16 ppt:

$$HSI = [\{ 3.5 \times (SIV_2^3 \times SIV_6^{2.5})^{(1/3.5)} \} + (SIV_3 + SIV_4 + SIV_5) / 3] / 4.5$$

where $SIV_{\#}$ is the Suitability Index (SI) value for the indicated model variable ($V_{\#}$, i.e. variables V_2 through V_6), as determined from applicable suitability index graphs set forth in the marsh community model. V_2 = % SAV cover; V_3 = marsh edge & interspersion; V_4 = % of open water area ≤ 1.5 feet deep; V_5 = mean salinity, in ppt, during the growing season; V_6 = aquatic organism access.

4.2 Benefit Assessment Formulas (AAHU Formulas) for Open Water Habitats

The typical formulas for calculating net AAHUs for marsh habitats are:

(A) Formula for fresh and intermediate marshes:

$$AAHUs = [(2.1 \times (Marsh\ AAHUs)) + (Open\ Water\ AAHUs)] / 3.1$$

(B) Formula for brackish marshes:

$$AAHUs = [(2.6 \times (Marsh\ AAHUs)) + (Open\ Water\ AAHUs)] / 3.6$$

(C) Formula for saline marshes:

AAHUs = [(3.5 x (Marsh AAHUs)) + (Open Water AAHUs)] / 4.5

When evaluating strictly open water habitats, there would be no marsh habitats interspersed within the boundaries of the open water habitats being considered. Given this, the number of marsh AAHUs would be zero and the preceding formulas are reduced to the following when computing the final AAHUs for open water habitats:

(A) If the majority of nearby marsh habitats are fresh or intermediate marshes and/or the average annual salinity in the affected open water area ranges from 0 to <5 ppt:

Final Open Water AAHUs = Open Water AAHUs / 3.1

(B) If the majority of nearby marsh habitats are brackish marshes and/or the average annual salinity in the affected open water area is ranges from 5 to 16 ppt:

Final Open Water AAHUs = Open Water AAHUs / 3.6

(C) If the majority of nearby marsh habitats are saline marshes and/or the average annual salinity in the affected open water area is >16 ppt:

Final Open Water AAHUs = Open Water AAHUs / 4.5

4.3 Example of Using Weighted Averages for Model Variable Input

Conditions may vary considerably within a given open water habitat being evaluated, particularly as regards SAV cover. The following provides an example of using weighted averages to arrive at appropriate SI values when performing WVA analyses for such conditions.

Example Scenario:
Project will impact a single open water area. The overall impact "footprint" (polygon) encompasses 200 acres. Within this footprint, 3 separate areas (polygons A, B, and C) contain SAV whereas the remainder of the footprint area contains no SAV. The water depth varies. Data for impact acreages, SAV cover, and water depth are:

- Polygon A – 10 acres, SAV cover = 90%, water depth = 3 feet.
- Polygon B – 40 acres, SAV cover = 10%, water depth = 1 foot.
- Polygon C – 20 acres, SAV cover = 70%, water depth = 2 feet.
- Polygon D (remainder of overall impact footprint excluding polygons A thru C) – 130 acres, SAV cover = 0%, water depth = 3 feet.

Assuming the WVA analysis will only be run for the areas containing SAV (a total of 70 acres), weighted averages would be as follows:

- V2 (% SAV) = [(90% x 10/70) + (10% x 40/70) + (70% x 20/70)] = 38.6% weighted avg. SAV cover.
- V4 (% Open Water ≤1.5 feet deep) = [(0% x 10/70) + (100% x 40/70) + (0% x 20/70)] = 57% weighted avg. open water ≤1.5 feet deep.

If the WVA analysis will be run for the entire impact footprint, weighted averages would be as follows:

- V2 (% SAV) = [(90% x 10/200) + (10% x 40/200) + (70% x 20/200) + (0% x 130/200)] = 13.5% weighted avg. SAV cover.
- V4 (% Open Water ≤1.5 feet deep) = [(0% x 10/200) + (100% x 40/200) + (0% x 20/200) + (0% x 130/200)] = 20% weighted avg. open water ≤1.5 feet deep.

APPENDIX E

SCREENING CRITERIA RATIONALE

The Project Delivery Team (PDT) evaluated approximately 400 alternative measures for Lake Pontchartrain and Vicinity (LPV) HSDRRS Mitigation and approximately 400 alternative measures for West Bank and Vicinity (WBV) HSDRRS Mitigation during screening. Measures included proposed USACE-constructed mitigation projects on public and private lands, as well as alternatives to purchase credits from mitigation banks. Screening criteria were developed by the PDT and are described in detail below. Screening criteria respond to Congressional authority and other laws, policies and guidance, and the CEMVN Commander's Intent, and include, but are not limited to, constraints. Alternatives that did not meet any one of the screening criteria were discarded without further investigation.

Screening Criteria Common to LPV and WBV Mitigation Basins

No conversion of existing wetlands to uplands.

- Definition/Application

This criterion specifies that no existing wetlands would be converted to create an upland project such as a BLH-ridge. The application of this criterion eliminated any projects converting marsh, swamp or BLH-wet to BLH-dry.

- Justification/Legal and Policy References
    - No net loss of wetlands. WRDA 1990, Section 307.
    - Avoid and minimize impacts to wetlands. E.O. 11990.
    - Mitigation Planning Objectives. Mitigation planning objectives are clearly written statements that prescribe specific actions to be taken… and identifies specific amounts (units of measurement, e.g., habitat units) of compensation required to replace or substitute for remaining, significant unavoidable losses.ER 1105-2-100 C-3 b(13).
    - (c) Fundamental to the Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern. (d) From a national perspective, the degradation or destruction of special aquatic sites, such as filling operations in wetlands, is considered to be among the most severe environmental impacts covered by these Guidelines. The guiding principle should be that degradation or destruction of special sites may represent an irreversible loss of valuable aquatic resources. Federal Water Pollution Control Act, 33 U.S.C. 1344 (b)(1); 40 CFR 230.1

- (a) Except as provided under section 404(b)(2), no discharge of dredge or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. (Section 404(b)(2) established the National Pollutant Discharge Elimination System (NPDES) to control water pollution by regulating point sources that discharge pollutants into waters of the United States.) 33 U.S.C. 1344 (b)(1); 40 CFR 230.10

Additionally, conversion of wetlands to uplands would require mitigation, decreasing the cost effectiveness of such a project.

Compliant with applicable laws and policies

- Definition/Application

A given mitigation alternative must be compliant with all federal laws and policies. In application, laws such as WRDA 2007 ("Mitigation plans should comply with the mitigation standards and policies established pursuant to the regulatory programs administered by the Secretary of the Army." §2036(a)) served as a framework from which to develop additional screening criteria, rather than a screening criteria in and of itself. Other laws were applied directly as screening criteria. One example is the application of 31 U.S.C. 1301, under which projects authorized under other authorities were screened out.

- Justification/Legal and Policy References

The following Engineering Regulations require that project alternatives comply with applicable laws and policies:

- The objectives and requirements of applicable laws and executive orders are considered throughout the planning process in order to meet the federal objective. USACE ER 1105-2-100, 2-2.

- Each alternative shall be formulated in consideration of four criteria described in the [Principles & Guidelines]: completeness, efficiency, effectiveness, and acceptability… Acceptability is the extent to which the alternatives are acceptable in terms of applicable laws, regulations and public policies. USACE ER 1105-2-100, 2-3.

- Civil Works studies and projects should be in compliance with all applicable Federal environmental statutes and regulations and with applicable State laws and regulations where the Federal government has clearly waived sovereign immunity. USACE ER 1105-2-100, 2-7.

Additionally, two principles of fiscal law prohibit the use of funds appropriated under one authority from being expended on actions pursuant to a different authority. First, 31 USC

1301(a) posits that appropriations may be used only for their intended purposes. Second, as a general principle, when both specific and general authorizations/ appropriations exist, the specific always rules over the general such that agencies do not have an option. For example, if a specific appropriation exists for a particular item, then that appropriation must be used and it is improper to "charge" the more general appropriation or any other appropriation. These principles were used to screen out projects that were authorized under authorities other than the HSDRRS authority.

Within Mitigation Basin

- Definition/Application

For purposes of this screening criterion, mitigation basins may be viewed as watersheds or drainage basins. Mitigation measures for impacts to habitats within the LPV mitigation basin would need to be provided within the LPV mitigation basin and that mitigation measures for impacts to habitats within the WBV mitigation basin would need to be provided within the WBV mitigation basin (i.e. provide mitigation in the same watershed/basin as where the impact occurred).

The boundaries of the LPV mitigation basin can be generally described as follows: North boundary = Interstate 12 (I-12); South boundary = east bank of the Mississippi River; East boundary = from the I-12 intersection with the western boundary of the Pearl River Basin, then southward along this boundary, then southward through Breton Sound and Chandeluer Sound inside the barrier islands; West boundary = the east bank of the Mississippi River to the intersection of Interstate 10 with the river.

The boundaries of the WBV mitigation basin can be generally described as follows: North boundary = west bank of the Mississippi River; South boundary = Bayou Lafourche; East boundary = a line following the approximate boundary separating fresh marsh vegetation from intermediate marsh vegetation (i.e. the fresh marsh/intermediate marsh interface or boundary of these two types of marsh habitats), as determined by USGS (Sasser et al., 2008); West boundary = Bayou Lafourche northward to its intersection with the Mississippi River. The basis for the east boundary was that WBV HSDRRS improvements only impacted fresh marsh habitats and mitigation for these impacts would need to be provided as enhancement or restoration of fresh marsh habitats (e.g. “in kind” mitigation). Thus, it would have been inappropriate to consider mitigation sites situated in areas dominated by existing intermediate marsh habitats.

During the screening process, potential mitigation sites were excluded from further consideration in cases where the mitigation site was located outside of the applicable mitigation basin. In cases where the applicable mitigation basin boundary ran through a potential mitigation site, such a mitigation site was also excluded from further consideration.

- Justification/Legal and Policy References
    - Mitigation plans shall comply with the standards and policies of the regulatory program. WRDA 2007, Section 2036.

- The mitigation plans are to set forth the mitigation activities that are to be undertaken within the watershed in which the losses occur or in any case in which the mitigation will occur outside the watershed, the mitigation plan shall set forth a detailed explanation for undertaking the mitigation outside the watershed. WRDA 2007, Section 2036.

- In general, the required compensatory mitigation should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services, taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources (including the availability of water rights), trends in land use, ecological benefits, and compatibility with adjacent land uses. 33 CFR Part 332, Section 332.3(b)(1), and; 40 CFR Part 230, Section 230.93(b)(1).

- Where permitted impacts are not in the service area of an approved mitigation bank or in-lieu fee program that has the appropriate number and resource type of credits available, permittee-responsible mitigation is the only option. Where practicable and likely to be successful and sustainable, the resource type and location for the required permittee-responsible compensatory mitigation should be determined using the principles of a watershed approach as outlined in paragraph (c) of this section. 33 CFR Part 332, Section 332.3(b)(4), and; 40 CFR Part 230, Section 230.93(b)(4).

- The district engineer must use a watershed approach to establish compensatory mitigation requirements in DA permits to the extent appropriate and practicable. Where a watershed plan is available, the district engineer will determine whether the plan is appropriate for use in the watershed approach for compensatory mitigation. In cases where the district engineer determines that an appropriate watershed plan is available, the watershed approach should be based on that plan. Where no such plan is available, the watershed approach should be based on information provided by the project sponsor or available from other sources. The ultimate goal of a watershed approach is to maintain and improve the quality and quantity of aquatic resources within watersheds through strategic selection of compensatory mitigation sites. 33 CFR Part 332, Section 332.3(c)(1), and; 40 CFR Part 230, Section 230.93(c)(1)

- The size of watershed addressed using a watershed approach should not be larger than is appropriate to ensure that the aquatic resources provided through compensation activities will effectively compensate for adverse environmental impacts resulting from activities authorized by DA permits. The district engineer should consider relevant environmental factors and appropriate locally developed standards and criteria when determining the appropriate watershed scale in guiding compensation activities. 33 CFR Part 332, Section 332.3(c)(4), and; 40 CFR Part 230, Section 230.93(c)(4).

No known HTRW risk

- Definition/Application

Hazardous, toxic, and radioactive waste (HTRW) includes various materials defined in Section 4.a.(1) of ER 1165-2-132 (USACE, 1992). Examples of such materials include, but are not limited to any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act (42 U.S.C. 9601 et seq.).

In screening potential mitigation sites, CEMVN reviewed various information sources to determine if there could be Recognized Environmental Conditions (REC) present within a particular site. The term "REC" is defined in Section 1.1.1 of ASTM Standard Practice E 1527-05 (ASTM, 2005). This term basically refers to the presence or likely presence of HTRW on a property under conditions which indicate an existing or past release, or a material threat of a release of HTRW into structures on the property or into the ground, ground water, or surface water of the property. It does not include *de minimis* conditions that commonly do not present a threat to human health or the environment.

The following information sources (databases) were consulted and searched as part of the review process: (a) Federal records - United States Environmental Protection Agency's (USEPA) National Priorities List; USEPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS); USEPA No Further Remedial Action Planned Sites (NFRAP); USEPA Resource Conservation and Recovery Information System (RCRIS-LG); USEPA Emergency Response Notification System (ERNS); USEPA Corrective Action Report (CORRACTS); USEPA Biennial Reporting System (BRS); USEPA Superfund (CERCLA) Consent Decrees (CONSENT); USEPA Facility Index System/Facility Identification Initiative Program Summary Report (FINDS); USDOT Hazardous Materials Information Reporting System (HMIRS); USNRC Material Licensing Tracking System (MLTS); USEPA Federal Superfund Liens (NPL LIENS); USEPA PCB Activity Database System (PADS); USEPA RECRA Administrative Action Tracking System (RAATS); USNTIS Records of Decision (ROD); USEPA Toxic Chemical Release Inventory System (TRIS); USEPA Toxic Substances Control Act (TSCA); (b) State and local records - Solid and Hazardous Waste Sites (SHWS); Solid Waste Facilities/Landfill Sites (SWF/LF); LDEQ Approved Debris Sites (DEBRIS); Recycling Sites (SWRCY); Leaking Underground Storage Tanks (LUST); Historic Leaking Underground Storage Tanks (HIST LUST); Louisiana Underground Storage Tank Database (UST); Environmental Liens (LIENS); Spills and Releases (SPILLS); Listing of institutional and/or engineering controls (AUL); Voluntary Remediation Program Sites (VCP); Drycleaner Facility Listing (DRYCLEANERS); LPDES Permits Database (NPDES).

If a potential mitigation site was determined to have the risk for REC (risk for HTRW), then the site was further evaluated to determine whether the boundaries of the site could be adjusted to exclude the area(s) posing a risk for REC. If the boundaries could be adjusted to exclude the problem area(s) and still satisfy other applicable screening criteria, then the boundaries were adjusted accordingly and the resultant site was retained as a potential location for mitigation measures. If the boundaries could not be adjusted in this manner, then the site was excluded from further consideration.

- Justification/Legal and Policy References

    - Construction of Civil Works projects in HTRW-contaminated areas should be avoided where practicable. USACE ER 1165-2-132, 6.b.

    - Alternative project plans may consider avoidance of HTRW as well as possible responses. At least one alternative should be formulated to avoid HTRW sites to the maximum extent possible, consistent with project objectives. USACE ER 1165-2-132, 8.a.

    - Civil Works plan formulation and plan selection may be substantially influenced by the presence of HTRW in the project area. HTRW sites will be avoided whenever practicable. USACE ER 1165-2-132, 8.d.

    - The development of a response plan for dealing with HTRW, as well as response measures to relocate HTRW or to treat the HTRW in place is 100% Non-Federal cost. USACE ER 1165-2-132, Table 1.

In kind replacement of impact AAHUs by habitat type (exception: BLH-Dry can be mitigated as BLH-Wet)

- Definition/Application

This criterion specifies that impacts must be mitigated by replacing the same habitat type as was originally impacted. In kind is defined as a resource of a similar structural and functional type to the impacted resource (40 CFR 230.92). Functions mean the physical, chemical and biological processes that occur in ecosystems (40 CFR 230.92). The application of this criterion eliminated projects that attempted to mitigate fresh/intermediate marsh impacts with anything other than a fresh/intermediate project, brackish/saline marsh impacts with anything other than a brackish/saline marsh project, swamp impacts with anything other than a swamp project, BLH-dry impacts with anything other than a BLH project, and BLH-wet impacts with anything other than a BLH-wet project. In addition, protected side projects for flood side impacts were eliminated since a loss of functions and values inherent in flood side habitats would occur resulting in out of kind mitigation. These definitions of in-kind for the pursposes of HSDRRS mitigation were developed in coordination with Federal and state resource agencies.

- Justification/Legal and Policy References

    - Comply with the Fish and Wildlife Coordination Act by giving full consideration to reports and recommendations furnished by the Secretary of the Interior (U. S. Fish and Wildlife Service), the Secretary of Commerce (National Marine Fisheries Service), and the appropriate head of the State agency exercising administration over the fish and wildlife resources. ER 1105-2-100, Section d(3)(b).
    - Mitigation plans shall ensure that impacts to bottomland hardwood forests are mitigated in kind, to the extent possible. WRDA 1986, 33 U.S.C 2283(a).

- Other habitat types are mitigated to not less than in kind condition to the extent possible. WRDA 2007, Section 2036(a).

- (1) In general, in-kind mitigation is preferable to out-of-kind mitigation because it is most likely to compensate for the functions and services lost at the impact site. For example, tidal wetland compensatory mitigation projects are most likely to compensate for unavoidable impacts to tidal wetlands, while perennial stream compensatory mitigation projects are most likely to compensate for unavoidable impacts to perennial streams. Thus, except as provided in paragraph (e)(2) of this section, the required compensatory mitigation shall be of a similar type to the affected aquatic resource. (2) If the district engineer determines, using the watershed approach in accordance with paragraph (c) of this section that out-of-kind compensatory mitigation will serve the aquatic resource needs of the watershed, the district engineer may authorize the use of such out-of-kind compensatory mitigation. The basis for authorization of out-of-kind compensatory mitigation must be documented in the administrative record for the permit action. 40 CFR Part 230.93(e)

- (5) Permittee-responsible mitigation through on-site and in-kind mitigation. In cases where a watershed approach is not practicable, the district engineer should consider opportunities to offset anticipated aquatic resource impacts by requiring on-site and in-kind compensatory mitigation. The district engineer must also consider the practicability of on-site compensatory mitigation and its compatibility with the proposed project. (6) Permittee-responsible mitigation through off-site and/or out-of-kind mitigation. If, after considering opportunities for on-site, in-kind compensatory mitigation as provided in paragraph (b)(5) of this section, the district engineer determines that these compensatory mitigation opportunities are not practicable, are unlikely to compensate for the permitted impacts, or will be incompatible with the proposed project, and an alternative, practicable off-site and/or out-of-kind mitigation opportunity is identified that has a greater likelihood of offsetting the permitted impacts or is environmentally preferable to on-site or in-kind mitigation, the district engineer should require that this alternative compensatory mitigation be provided. 33 CFR Part 332.3(b).

- The Secretary of Commerce is required to obtain the views of Federal agencies affected by the program, including the Department of the Interior, and to ensure that these views have been given adequate consideration before approval of Coastal Zone Management Plans. 16 U.S.C. 1451-1464.

- It is preferable, in most cases, to recommend ways to replace such habitat value losses in-kind. FR Vol 46. No. 15. 23 Jan 1981.

- Mitigation plans shall ensure that adverse impacts to bottomland hardwood forests are mitigated in-kind, to the extent possible. The intent is that the bottomland hardwood forest as an ecological system be mitigated rather than mitigating for faunal species in an upland hardwood forest habitat type. In this instance "to the

> extent possible" shall take into consideration the availability of manageable units of existing or restorable bottomland hardwood forests and the practicability and feasibility of implementing management measures to accomplish in-kind mitigation. In-kind does not necessarily mean acre-for-acre, but may be restoration or the increased management of bottomland hardwood forests to compensate for the loss of biological productivity (habitat quality). Consultation with appropriate Federal and non-Federal agencies is required in complying with this requirement. ER 1105-2-100, C-3 e(6).

Under the above provision of WRDA 1986, the PDT considered that BLH-D habitat could be mitigated with BLH-W habitat in cases where it is not possible to mitigate BLH-D. The PDT sees this habitat exchange as providing equal habitat value to that which was lost through BLH-BLH-W habitat is a more diverse habitat while still supporting the species found in BLH-D habitat. BLH-W also has wetland functions and values not found in BLH-D habitat. BLH-W is thus seen as more valuable habitat because it can support both BLH-W and BLH-D species and has added habitat functions and values. It is not acceptable to mitigate BLH-W impacts with BLH-D habitat because the wetland functions and values as well as some diversity would be lost. The justification for eliminating the use of protected side projects for flood-side impacts stems from the notion that aquatic ecosystems lose habitat value when the natural hydrology of the ecosystem is altered by impoundment. This notion is supported by the metrics used in the Wetland Value Assessment Methodology Community Models used to quantify impacts and benefits for the HSDRRS system.

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Bottomland Hardwood Community Model - Variable V4, Hydrology: Bottomland hardwood stands in the Louisiana Coastal Zone generally occur in one of four basic hydrology classes or water regimes: 1) efficient forced drainage system, 2) irregular periods of inundation due to an artificially lowered water table, 3) extended inundation or impoundment because of artificially raised water table, and 4) essentially unaltered. The optimum bottomland hardwood hydrology (SI= 1.0) is one that is essentially unaltered, allowing natural wetting and drying cycles which are beneficial to vegetation and associated fish and wildlife species. When a bottomland hardwood stand is part of an efficient forced drainage system, the vegetative component provides some habitat value, but wildlife species which are dependent on water would essentially be excluded year round, and the area would not in any way serve to promote fish production (SI = 0.1). With a moderately lowered water table, the vegetative component of the site could provide excellent habitat for many wildlife species and temporary habitat for wildlife species which are dependent on water, but fish would generally be excluded (SI = 0.5). With a raised water table, fish habitat and habitat for water-dependent wildlife could be equivalent to an unaltered system; however, other wildlife species could be adversely affected because of water-related impacts to the vegetative components of the stand (SI = 0.5).

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Swamp Community Model - Variable V3, Water regime: This variable considers the duration and amount of water flow/exchange. Four flow/exchange and four flooding duration categories are described to characterize the water regime. The optimal water regime is assumed to be seasonal flooding with abundant and consistent riverine/tidal input and water flow-through (SI=1.0). Seasonal flooding with periodic drying cycles is assumed to contribute to increased nutrient cycling (primarily through oxidation and decomposition of accumulated detritus), increased vertical structure complexity (due to growth of other plants on the swamp floor), and increased recruitment of dominant overstory trees. In addition, abundant and consistent input and water flow-through is optimal, because under that regime the full functions and values of a swamp in providing fish and wildlife habitat are assumed to be maximized. Temporary flooding is also assumed to be desirable. Habitat suitability is assumed to decrease as water exchange between the swamp and adjacent systems is reduced. The combination of permanently flooded conditions and no water exchange (e.g., an impounded swamp where the only water input is through rainfall and the only water loss is through evapotranspiration and ground seepage) is assumed to be the least desirable (SI=0.1).

- Coastal Wetlands Planning, Protection and Restoration Act, Wetland Value Assessment Methodology, Coastal Marsh Community Models for Brackish and Intermediate Marsh - Variable V6, Aquatic Organism Access: Access by estuarine aquatic organisms (i.e., transient and resident species), is considered to be a critical component in assessing the quality of a given marsh system. Additionally, a marsh with a relatively high degree of access by default also exhibits a relatively high degree of hydrologic connectivity with adjacent systems, and therefore may be considered to contribute more to nutrient exchange than would a marsh exhibiting a lesser degree of access. Optimal conditions are assumed to exist when all of the study area is accessible and the access points are entirely open and unobstructed.

Technically viable (e.g. salinity suitable for target habitat type)

- Definition/ Application

As applied to HSDRRS Mitigation, technically viable means capable of achieving ecological functionality from a scientific or engineering standpoint. As specifically applied during screening, alternatives were only screened under this criterion if the conditions in the vicinity of the proposed alternative were not supportive of a target habitat type. In addition, projects that did not produce positive mitigation benefits were not considered further.

- Justification/Legal and Policy References

WRDA 2007 requires that mitigation for water resources projects achieve ecological success. Additionally, USACE regulations specify that civil works projects must be implementable, feasible, constructible, reliable, and functional. Specific excerpts of WRDA 2007 and these regulations are provided below:

  - MITIGATION REQUIREMENTS…INCLUSIONS.—A specific mitigation plan for a water resources project … shall include, at a minimum—(i) a plan for monitoring the implementation and ecological success of each mitigation measure, including the cost and duration of any monitoring, and, to the extent practicable, a designation of the entities that will be responsible for the monitoring; (ii) the criteria for ecological success by which the mitigation will be evaluated and determined to be successful based on replacement of lost functions and values of the habitat, including hydrologic and vegetative characteristics; … and (v) a contingency plan for taking corrective actions in cases in which monitoring demonstrates that mitigation measures are not achieving ecological success in accordance with criteria under clause (ii)… DETERMINATION OF SUCCESS…CONSULTATION.—In determining whether a mitigation plan is successful under subparagraph (A), the Secretary shall consult annually with appropriate Federal agencies and each State in which the applicable project is located on at least the following: (i) The ecological success of the mitigation as of the date on which the report is submitted. (ii) The likelihood that the mitigation will achieve ecological success, as defined in the mitigation plan. (iii) The projected timeline for achieving that success. (iv) Any recommendations for improving the likelihood of success. WRDA 2007, Section 2036 (a) (3) (a).

  - [Principles and Guidelines] Evaluation Criteria: (1)… Two primary dimensions to acceptability are implementability and satisfaction. 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. USACE ER 1105-2-100, E-3. General Policies a. The Planning Process, (4) Step 4- Evaluate alternative plans.

  - Evaluation of Alternatives. Engineering staff shall assist in the evaluation of alternatives to identify those that are constructible and the degree to which safety, reliability, and functional requirements and objectives are met including operations and maintenance. The type and extent of HTRW contamination shall be determined and alternatives and costs for remedial action developed. Proposed alternatives that do not satisfy the

constructability, reliability, safety, or functional requirements shall be recommended for withdraw[al] from further consideration. This recommendation shall be discussed and agreed upon by the full PDT. USACE ER 1110-2-1150, Section 13.4.

- …habitat-based evaluation methodologies, supplemented with production, user-day, population census, and/or other appropriate information, shall be used to the extent possible to describe and evaluate ecological resources and impacts associated with alternative plans. ER 1105-2-100, Section C-3 d(5).

- Mitigation plan components include documentation of the functions and values that will result from the mitigation. WRDA 2007, Section 2036(a).

Screen out measures that are in the Future Without Project Condition

- Definition/Application

The Future Without Project Condition for HSDRRS Mitigation is defined in part by the measures (projects) that would likely exist in the absence of the implementation of the HSDRRS Mitigation. Projects included in the Future Without Project Condition are displayed in Attachment 1. Projects included in the Future Without Project Condition were screened out as potential HSDRRS Mitigation projects.

- Justification/Legal and Policy References

Establishment of the Future Without Project Condition is required for alternative plan evaluation in USACE civil works planning, as described in the below bullets. The impacts of alternatives, including benefits, are qualitatively or quantitatively described as the different between the Future Without and Future With Project Condition. Specific excerpts of these regulations are provided below:

- The second step of the planning process is to develop an inventory and forecast of critical resources (physical, demographic, economic, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information is used to further define and characterize the problems and opportunities. A quantitative and qualitative description of these resources is made, for both current and future conditions, and is used to define existing and future without-project conditions. Existing conditions are those at the time the study is conducted. The forecast of the future without-project condition reflects the conditions expected during the period of analysis…The future without-project condition provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the without-project condition are essential. Gathering information about historic and existing conditions requires an inventory. Gathering information about potential future

conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities. Information gathering and forecasts will most likely continue throughout the planning process. USACE ER 1105-2-100, Section 2-3 b.

- The without-project condition is the most likely condition expected to exist in the future in the absence of a proposed water resources project. Proper definition and forecast of the future without-project condition are critical to the success of the planning process. The future without-project condition constitutes the benchmark against which plans are evaluated. Forecasts of future without-project conditions shall consider all other actions, plans and programs that would be implemented in the future to address the problems and opportunities in the study area in the absence of a Corps project. Forecasts should extend from the base year (the year when the proposed project is expected to be operational) to the end of the period of analysis. ER 1105-2-100, Section 2-4 b (1).

Must have independent utility (not dependent on implementation of or modification to other projects)

- Definition/ Application

The project would not be dependent on implementation of or modification to other projects for ecological success and fulfillment of Average Annual Habitat Unit (AAHU) requirement. If the sustainability or technical viability would be reliant upon another project, the net benefits of the project could not be guaranteed such that mitigation credit could be secured.

- Justification/Legal and Policy References

  - Evaluation of management features shall be based upon the features' completeness, effectiveness, efficiency and acceptability in fulfilling established management (mitigation or enhancement) objectives. ER 1105-2-100, Section C-3 d(1)(b).

A project without independent utility may not meet the P&G “completeness” criteria. Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. If the success of a project depends upon factors beyond the control of the planning team that are required to make the plan’s effects (benefits) a reality, it would not meet the completeness criteria.

- …mitigation, including acquisition of the lands or interests – (A) shall be undertaken or acquired before any construction of the project …,or (B) shall be undertaken or acquired concurrently with lands and interests in lands for project purposes (other than mitigation of fish and wildlife losses)… WRDA 1986, 33 U.S.C. 2283(a).

If a project's ecological success relies upon the implementation or modification of another project, there is increased risk in delay of mitigation implementation.

- Temporal loss is the time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site. Higher compensation ratios may be required to compensate for temporal loss. When the compensatory mitigation project is initiated prior to, or concurrent with, the permitted impacts, the district engineer may determine that compensation for temporal loss is not necessary, unless the resource has a long development time. 33 CFR Part 332.2.

The potential time lag in implementation of mitigation for such projects could reduce their cost effectiveness due to higher compensation ratios and thus increased required acreage.

Can be easily scaled to meet changing mitigation acreage requirements.

- Definition/Application

The size of a given alternative must have the ability to increase or decrease the number of AAHUs it would provide over the 50 year project life in a practical, logical and technically feasible manner. For example, the PDT used aerial photography and GIS capabilities to determine whether adequate acreage was available to increase a particular project polygon in case mitigation requirements were increased.

- Justification/Legal and Policy References

Under the premise laid forth in the Antideficiency Act, 31 USC 1341 et seq., the Corps' ability to expend funds to produce AAHUs is limited to the mitigation requirement for HSDRRS impacts. Funds expended for AAHUs above those required for HSDRRS mitigation could be viewed as a violation of this fiscal law.

The exact HSDRRS mitigation requirement will not be determined until all as-builts become available for HSDRRS Projects and final AAHUs of impact are determined. Early estimates of acreages needed are based on HSDRRS designs rather than as-builts, as well as previous WVAs conducted for similar projects. The number of acres needed to mitigate for HSDRRS unavoidable losses will continue to evolve throughout the planning and design phases, as impact acreage are revised. The selected projects must be scalable such that the mitigation designs can be adjusted to produce only the required AAHUs.

No stand alone BLH-Dry measures (BLH-Dry requirements will be mitigated contiguous with mitigation for other habitat types and can be mitigated on flood side or protected side of levee)

- Definition/Application:

This criterion specifies that the requirement for non-wet bottomland hardwood impacts will be mitigated adjacent to mitigation measures that are designed to address other LPV/WBV HSDRRS mitigation requirements. All other mitigation measures have hydrologic components. Flood side versus protected side does not affect BLH-Dry because BLH-Dry has no hydrologic component. The application of this criterion results in optimized mitigation plan element outputs (as described in the Justification paragraph below) and addresses multiple mitigation requirements in one geographic area.

- Justification/Legal and Policy References*:*

By limiting stand alone BLH-dry mitigation measures, this criterion limits alternative combinations and increases ecological functions and values. The resulting combination requires less land to yield the needed AAHUs when the BLH-Dry component is combined with other wet mitigation features. Without this limitation, the BLH-Dry mitigation requirement could be mitigated on virtually any upland (which yields lower AAHUS outputs) in the Barataria or Pontchartrain Basin (with the exception of portions of the north shore of Lake Pontchartrain which are more suitable for pine and mixed pine habitats) and in areas suitable for BLH-wet habitat (which yield higher AAHU outputs). Forcing BLH-Dry to be mitigated with one of the other mitigation requirements: 1) increases the contiguous habitat area included in the resulting mitigation plan which increases efficiency, i.e. cost effectiveness, (by increasing ecological outputs and taking advantages of cost efficiencies), 2) increases habitat functions and values by adding hydrologic functions adjacent to, and in some cases instead of, an upland system. The BLH WVA assigns increasing benefits as the acres of contiguous forested land increase (V5), and assesses benefits for surrounding land use with other forested areas and marsh receiving the greatest credit (V6). As such, preference is given to large contiguous tracts of forested land over smaller. Without this criterion, the lower outputs from stand alone BLH-D WVAs would show these measures to be less cost effective [i.e. less efficient].

No stand alone unconfined marsh nourishment measures

- Definition/Application:

A given alternative cannot propose to produce all of its AAHUs through unconfined marsh nourishment. Unconfined refers to a design in which no dikes or containment structures are constructed to contain or otherwise restrict the movement of sediment introduced into the project area.

- Justification/Legal and Policy References:

Projects with greater risk and uncertainty are less effective at meeting planning objectives. There is a higher probability that projects with greater risk will incur higher costs over the period of analysis. Reduction of risk and uncertainty is more important for mitigation than for ecosystem restoration because a mitigation project must legally produce a specific number of benefits. However, ecosystem restoration projects are not legally bound to produce their projected benefits. The importance of reducing risk and uncertainty is reflected in the 30% weight for risk and reliability criterion in AEP selection. Because of the weight, projects with high risk and uncertainty (e.g. unconfined marsh nourishment) would not perform well in the plan selection process.
Regarding the implementation limitations of unconfined marsh nourishment, the amount of benefits (marsh enhanced) and detriments (marsh potentially converted to upland) associated with these projects are uncertain until after the initial consolidation and dewatering of fill material is complete. Because sediment is uncontained, target marsh elevations cannot be assured, making calculation and tracking of benefits after initial consolidation and dewatering of fill material difficult and uncertain, and the need for adaptive management activities more likely.

The following are legal and policy requirements for the mitigation of civil works projects:

- Design of mitigation projects. The Secretary shall design mitigation projects to reflect contemporary understanding of the science of mitigating the adverse environmental impacts of water resources projects. WRDA 1986, 33 USC 2283(d)(2).
- Formulate specific ecological resources mitigation and restoration plans using generally known and established techniques to address specific, clearly defined management objectives. ER 1105-2-100, Section C-3 d(3)(i).

Although unconfined marsh nourishment is a valuable ecosystem restoration technique, the Interagency Team, CEMVN Regulatory Branch, and the LPV HSDRRS PDT believe such a technique has limited utility as a mitigation design. Thus, stand alone unconfined marsh nourishment was screened out as a mitigation technique because 1) the use of confined marsh creation was deemed a more cost-effective approach (reduced cost for dredged material and LERRDs) because sediment would be contained on a smaller project area footprint, and 2) because it is less effective at meeting planning objectives due to risk and uncertainty concerns.

No preservation measures

- Definition/Application

Preservation is defined as the removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources typically through the implementation of appropriate legal mechanisms. Preservation does not produce a gain in aquatic resource area or functions.

- Justification/Legal and Policy References

Preservation was not chosen as a mitigation type for HSDRRS mitigation projects because:

1. There are proven methodologies for restoration of the aquatic resource types impacted by HSDRRS such that utilization of preservation as justified in 33 CFR Part 332.3(e)(3) for difficult to replace resources is not justifiable;
2. There are multiple restoration mitigation projects available, which is the preferred mitigation type as stated in 33 CFR Part 332.3(a)(2); and
3. The use of preservation as a mitigation type does not provide an increase in aquatic resource area or functions.

- Compensatory mitigation may be performed using the methods of restoration, enhancement, establishment, and in certain circumstances preservation. Restoration should generally be the first option considered because the likelihood of success is greater and the impacts to potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation. 33 CFR Part 332.

- Preservation may be used to provide compensatory mitigation…when all the following criteria are met:

1. The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
2. The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;
3. Preservation is determined by the district engineer to be appropriate and practicable;
4. The resources are under threat of destruction or adverse modifications; and
5. The preserved site will be permanently protected through an appropriate real estate or other legal instrument

In addition, when preservation is used as compensatory mitigation, to the extent appropriate and practicable the preservation should be done in conjunction with aquatic resource restoration, establishment, and/or enhancement activities. 33 CFR Part 332.3(h).

LPV- Specific Screening Criteria

The portions of measures which address mitigation requirements for impacts to the Bayou Sauvage National Wildlife Refuge (BSNWR) must be located wholly within the boundary or acquisition boundary of a National Wildlife Refuge. (The only exception that could be made would be for uneconomic remnants of tracts that are located partially within the boundary or acquisition boundary of a National Wildlife Refuge.)

- Definition/Application

Impacts occurring on National Wildlife Refuge land must be mitigated for on National Wildlife Refuge land

- Justification/Legal and Policy References

In the USFWS' Fish and Wildlife Coordination Act Reports for projects impacting refuge property, the Service included a position and recommendation that mitigation for impacts to a given national wildlife refuge should occur on that refuge. Individual Environmental Report *7* concurred with this recommendation. Commitment in the approved IER: "CEMVN will coordinate with refuge personnel during all phases of the project and work with refuge personnel to provide the compensatory mitigation for any loss of forested or emergent wetlands on BSNWR Property."

The *Final Policy on the National Wildlife Refuge System and Compensatory Mitigation under the Section 10/404 Program* (FR Vol. 64, No. 175, 10 Sep 1999) states "if compatible activities occurring on a NWR require compensatory mitigation, the mitigation must occur within the boundaries of the NWR being affected and must meet specific criteria."

The Approved DOI USFWS Request (Signed 14 April 2008) for Exemption to the *Final Policy on the National Wildlife Refuge System and Compensatory Mitigation under the Section 10/404 Program* allows mitigation on existing refuge properties for refuges in coastal Louisiana and specifically for BSNWR, lists the standard mitigation policy requirements and establishes additional assessment criteria for the listed NWRs.

Note: The following three criteria share a common "Justification/Legal and Policy References" section found after the third criterion's definition.

The project areas for BLH-Wet and Swamp mitigation measures must be contiguous with (or within) an existing resource-managed area or with the project area of another proposed mitigation measure

- Definition/Application:

This criterion specifies that the LPV HSDRRS requirement for BLH-Wet and Swamp must be mitigated with a project which has a boundary contiguous with or within the boundary of another resource managed area within the LPV watershed; or contiguous with the boundary of mitigation measures designed to address other LPV HSDRRS mitigation requirements. Resource-managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude. The application of this criterion eliminated any BLH-Wet and Swamp LPV projects that were not contiguous with or within an existing resource managed area in the LPV watershed or other LPV HSDRRS mitigation feature. This resulted in optimized mitigation plan element outputs that address multiple mitigation requirements and aligns with policy and ASA(CW) direction as described below in the Justification section.

- Justification/Legal and Policy References:

The following are policy requirements for the mitigation of civil works projects and commitments made by the ASA(CW) for the HSDRRS mitigation:

  - Mitigation, to the extent practicable, shall be developed and implemented on project lands. If project lands cannot fulfill the mitigation requirements, then separable public lands adjacent to project lands, to the extent possible, should be considered next. EP 1165-2-1
  - …we are committed to identifying large-scale projects that will mitigate for the impacts caused by the HSDRRS program and provide the most cost effective benefits to coastal and ecosystem restoration. ASA(CW) letter to Governor Jindal, 19 March 2010.
- This criterion complies with the intent to create larger contiguous areas where proposed mitigation can optimize overall outputs gained by adjacency with existing Federal or state managed areas. Compliance with this policy and the ASA(CW)'s intent resulted in larger contiguous tracts of land for the purposes of greater ecological output within the watershed. In addition, the consolidation of mitigation projects produces cost efficiencies experienced during construction and O&M phases. Mitigation for protected side impacts with flood side mitigation projects was based on additional functions and values assessed for providing a restored hydrology and connectivity with other wetland habitats. The BLH WVA assigns increasing benefits as the acres of contiguous forested land increase (Variable V5), and assesses benefits for surrounding land use with contiguity with other forested and marsh areas that allow for wildlife movement receiving the greatest credit (Variable V6). Thus, non-contiguous measures would garner low WVA outputs and be less cost effective [i.e. efficiency].

- *Detail Regarding Variable V5 – Size of Contiguous Forested Area:*

Although edge and diversity, which are dominant features of small forested tracts, are important for certain wildlife species, it is important to understand four concepts: 1) species which thrive in edge habitat are highly mobile and presently occur in substantial numbers, 2) edge and diversity are readily available because of forest fragmentation and ongoing timber harvesting by man, 3) most species found in "edge" habitat are "generalists" in habitat use and are capable of existing in larger tracts, and 4) those species in greatest need of conservation are "specialists" in habitat use and require large forested tracts. Therefore, the basic assumption for this variable is that larger forested tracts are less common and offer higher quality habitat than smaller tracts. For this model, tracts greater than 500 acres in size are considered large enough to warrant being considered optimal and receive a suitability index of 1. Tracts up to 5 acres receive a SI of 0.2, tracts from 5.1 to 20 acres receive a SI of .4, tracts from 21.1 to 100 receive a SI of .4, and tracts from 100.1 to 500 acres receive a SI of .8.

- *Detail Regarding Variable V6– Suitability and Traversability of Surrounding Land Uses:*

Many wildlife species commonly associated with bottomland hardwoods will often use adjacent areas as temporary escape or resting cover and seasonal or diurnal food sources. Surrounding

land uses which meet specific needs can render a given area of bottomland hardwoods more valuable to a cadre of wildlife species. Additionally, the type of surrounding land use may encourage, allow, or discourage wildlife movement between two or more desirable habitats. Land uses which allow such movement essentially increases the amount of habitat available to wildlife populations. The weighting factor assigned to various land uses reflects their estimated potential to meet specific needs and allow movement between more desirable habitats. For this model, contiguity with other forested areas and marsh receive the greatest suitability (1.0) because of the ability for contiguous habitats to allow wildlife movement.

BLH-Dry, BLH-Wet, and Swamp mitigation measures must be part of proposed mitigation projects that consist of at least 100 contiguous acres of forested habitat unless contiguous with the project area of a proposed marsh mitigation measure or contiguous with or within another resource-managed area

- Definition/Application:

This criterion specifies that any proposed LPV HSDRRS BLH-Dry, BLH-Wet, or Swamp mitigation project must be joined with another LPV HSDRRS BLH-Dry, BLH-Wet, or Swamp project with the conglomeration of such projects resulting in at least 100 contiguous acres of forested habitat unless any of those projects are contiguous with the boundary of a proposed LPV HSDRRS marsh mitigation measure or contiguous with or within the boundary of another resource-managed area in the LPV watershed. Resource managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude. The application of this criterion eliminated stand alone or joined LPV HSDRRS BLH-Dry, BLH-Wet, or Swamp projects that were less than 100 acres contiguous acres of forested habitat unless they were contiguous with the project area of a another LPV HSDRRS marsh mitigation measure or contiguous with or within another resource-managed area in the LPV watershed.

- Justification/Legal and Policy References:

    - Mitigation, to the extent practicable, shall be developed and implemented on project lands. If project lands cannot fulfill the mitigation requirements, then separable public lands adjacent to project lands, to the extent possible, should be considered next. EP 1165-2-1
    - …we are committed to identifying large-scale projects that will mitigate for the impacts caused by the HSDRRS program and provide the most cost effective benefits to coastal and ecosystem restoration. ASA(CW) letter to Governor Jindal, 19 March 2010.
    - This criterion complies with the intent to create larger contiguous areas where proposed mitigation can optimize overall outputs gained by adjacency with existing Federal or state managed areas. Compliance with this policy and the ASA(CW)'s intent resulted in larger contiguous tracts of land for the purposes of greater ecological output within the watershed. In addition, the consolidation of mitigation projects produces cost efficiencies experienced during construction and O&M phases. Mitigation for protected-side impacts with flood-side mitigation projects was based

on additional functions and values assessed for providing a restored hydrology and connectivity with other wetland habitats. The BLH WVA assigns increasing benefits as the acres of contiguous forested land increase (Variable V5), and assesses benefits for surrounding land use with contiguity with other forested and marsh areas that allow for wildlife movement receiving the greatest credit (Variable V6). Measures that consist of less than 100 contiguous acres would have low WVA outputs and be less cost effective [i.e. efficiency] than larger measures.

- *Detail Regarding Variable V5 – Size of Contiguous Forested Area:*

Although edge and diversity, which are dominant features of small forested tracts, are important for certain wildlife species, it is important to understand four concepts: 1) species which thrive in edge habitat are highly mobile and presently occur in substantial numbers, 2) edge and diversity are readily available because of forest fragmentation and ongoing timber harvesting by man, 3) most species found in "edge" habitat are "generalists" in habitat use and are capable of existing in larger tracts, and 4) those species in greatest need of conservation are "specialists" in habitat use and require large forested tracts. Therefore, the basic assumption for this variable is that larger forested tracts are less common and offer higher quality habitat than smaller tracts. For this model, tracts greater than 500 acres in size are considered large enough to warrant being considered optimal and receive a suitability index of 1. Tracts up to 5 acres receive a SI of 0.2, tracts from 5.1 to 20 acres receive a SI of .4, tracts from 21.1 to 100 receive a SI of .4, and tracts from 100.1 to 500 acres receive a SI of .8.

- *Detail Regarding Variable V6– Suitability and Traversability of Surrounding Land Uses:*

Many wildlife species commonly associated with bottomland hardwoods will often use adjacent areas as temporary escape or resting cover and seasonal or diurnal food sources. Surrounding land uses which meet specific needs can render a given area of bottomland hardwoods more valuable to a cadre of wildlife species. Additionally, the type of surrounding land use may encourage, allow, or discourage wildlife movement between two or more desirable habitats. Land uses which allow such movement essentially increases the amount of habitat available to wildlife populations. The weighting factor assigned to various land uses reflects their estimated potential to meet specific needs and allow movement between more desirable habitats. For this model, contiguity with other forested areas and marsh receive the greatest suitability (1.0) because of the ability for contiguous habitats to allow wildlife movement.

Measures must meet 100% of the mitigation requirement by habitat type according to the following groupings unless contiguous with the project area of other proposed mitigation measures as follows (FS=flood side; PS=protected side):hw100% non-refuge BLH-Wet FS + PS (mitigate FS)

- 100% non-refuge Swamp FS + PS (mitigate FS)
- 100% non-refuge Brackish Marsh FS + PS and 100% refuge Brackish Marsh FS (mitigate FS)
- 100% non-refuge Fresh/Intermediate Marsh FS + PS (mitigate FS)
- 100% refuge BLH-Wet PS (mitigate PS)
- 100% refuge BLH-Wet FS (mitigate FS)

- 100% refuge Fresh/Intermediate Marsh PS (mitigate PS)

- Definition /Application

This criterion specifies that the LPV HSDRRS mitigation projects must address the entire mitigation requirement for the habitat type being restored at that site unless contiguous with the boundary of another LPV HSDRRS mitigation project. Specifically: All LPV flood side swamp projects must be able to address the LPV requirements for flood side and protected side non-refuge swamp impacts. All LPV flood side brackish marsh projects must be able to address all the LPV requirements for non-refuge flood side and protected side brackish marsh impacts as well as refuge flood side brackish marsh impacts. All LPV flood side fresh/intermediate marsh projects must be able to address the LPV requirements for non-refuge flood side and protected side fresh/intermediate impacts. All protect side impacts to refuge BLH-Wet will be mitigated for with a protected side BLH-Wet project within the refuge boundary or within the acquisition boundary of the refuge. All flood side impacts to refuge BLH-Wet will be mitigated for with a flood side BLH-Wet project within the refuge boundary or within the acquisition boundary of the refuge. All protect side impacts to refuge fresh/intermediate marsh will be mitigated for with a protected side fresh/intermediate project within the refuge boundaries or within the acquisition boundary of the refuge. Resource-managed area is defined for these purposes as a Federal or state area that is managed in part for fish or wildlife resources (including habitat), or a mitigation bank that has a perpetual conservation easement/servitude.

The application of this criterion eliminated any projects that did not meet the above specifications based on the following table.

LPV Basin		**Non-wet BLH Acres needed**	**Fr/Int Marsh Acres needed**	**Brackish Marsh Acres needed**	**Swamp Acres needed**	**Wetland BLH Acres needed**
Non-Refuge Impacts (IERs 1-11+ Borrow)	**Total PS+FS**					
	Restore	**136.00**	**338.04**	**840.44**	**147.52**	**81.41**
	Enhance	**432.00**			**301.32**	**258.59**
Refuge Impacts (IERs 7&11)	**Protected Side**					
	Restore	**0.00**	**154.63**	**0.00**	**0.00**	**151.30**
	Enhance	**0.00**			**0.00**	**480.59**
	Flood Side					
	Restore	**0.00**	**0.00**	**237.00**	**0.00**	**19.72**
	Enhance	**0.00**			**0.00**	**62.65**

- Justification/Legal and Policy References

    - Mitigation, to the extent practicable, shall be developed and implemented on project lands. If project lands cannot fulfill the mitigation requirements, then separable public lands adjacent to project lands, to the extent possible, should be considered next. EP 1165-2-1

    - …we are committed to identifying large-scale projects that will mitigate for the impacts caused by the HSDRRS program and provide the most cost effective benefits to coastal and ecosystem restoration. ASA(CW) letter to Governor Jindal, 19 March 2010.

These criteria limit alternative plan combinations and work toward identifying projects that will result in large contiguous tracts of land for the purposes of greater ecological output within the watershed. In addition, the consolidation of mitigation projects produces cost efficiencies experienced during construction and O&M phases. Mitigation for protected side impacts with flood side mitigation projects was based on additional functions and values assessed for providing a restored hydrology and connectivity with other wetland habitats. The BLH WVA assigns increasing benefits as the acres of contiguous forested land increase (Variable V5), and assesses benefits for surrounding land use with contiguity with other forested and marsh areas that allow for wildlife movement receiving the greatest credit (Variable V6).

- *Detail Regarding Variable V5 – Size of Contiguous Forested Area:*

Although edge and diversity, which are dominant features of small forested tracts, are important for certain wildlife species, it is important to understand four concepts: 1) species which thrive in edge habitat are highly mobile and presently occur in substantial numbers, 2) edge and diversity are readily available because of forest fragmentation and ongoing timber harvesting by man, 3) most species found in "edge" habitat are "generalists" in habitat use and are capable of existing in larger tracts, and 4) those species in greatest need of conservation are "specialists" in habitat use and require large forested tracts. Therefore, the basic assumption for this variable is that larger forested tracts are less common and offer higher quality habitat than smaller tracts. For this model, tracts greater than 500 acres in size are considered large enough to warrant being considered optimal and receive a suitability index of 1. Tracts up to 5 acres receive a SI of 0.2, tracts from 5.1 to 20 acres receive a SI of .4, tracts from 21.1 to 100 receive a SI of .4, and tracts from 100.1 to 500 acres receive a SI of .8.

- *Detail Regarding Variable V6– Suitability and Traversability of Surrounding Land Uses:*

Many wildlife species commonly associated with bottomland hardwoods will often use adjacent areas as temporary escape or resting cover and seasonal or diurnal food sources. Surrounding land uses which meet specific needs can render a given area of bottomland hardwoods more valuable to a cadre of wildlife species. Additionally, the type of surrounding land use may encourage, allow, or discourage wildlife movement between two or more desirable habitats. Land uses which allow such movement essentially increases the amount of habitat available to wildlife populations. The weighting factor assigned to various land uses reflects their estimated

potential to meet specific needs and allow movement between more desirable habitats. For this model, contiguity with other forested areas and marsh receive the greatest suitability (1.0) because of the ability for contiguous habitats to allow wildlife movement.

REFERENCES

"Coastal Zone Management Act of 1972," Title 16 U.S. Code, Section 1451.2011 ed.

"Appropriations, General," Title 31 U.S. Code, Section 1301. 2007 ed.

ASTM International (ASTM). 2005. Standard practice for environmental site assessments: Phase 1 environmental site assessment process, ASTM E 1527-05. ASTM International, West Concshohocken, PA.

"Compensatory Mitigation for Losses of Aquatic Resources". Title 33 Code of Federal Regulations (CFR), Part 332. 2011 ed.

Executive Order 11990. Protection of Wetlands. May 24, 1977.

"Final Policy on the National Wildlife Refuge System and Compensatory Mitigation under the Section 10/404 Program, Final Policy." Federal Register 64 (10 Sep 1999): 49229-49234. Print.

"Fish and wildlife mitigation," Title 33 U.S. Code Section 2283. 1986 ed.

"Hazardous Substances Releases, Liability, Compensation," Title 42 U.S. Code, Section 9601. 2010 ed.

"Limitations on Expending and Obligating Amounts," Title 31 U.S. Code, Section 1341. 2007 ed.

National Park Service (NPS). 2006. Management policies 2006, the guide to managing the National Park System. US Department of the Interior, NPS, Washington DC.

National Park Service (NPS). 2011. National Park Service Procedural Manual #77-1: wetland protection. US Department of the Interior, NPS, Natural Resources Stewardship and Science, Water Resources Division, Ft. Collins, CO.

Sasser, C.E., Visser, J.M., Mouton, Edmond, Linscombe, Jeb, and Hartley, S.B. 2008. Vegetation types in coastal Louisiana in 2007: U.S. Geological Survey Open-File Report 2008–1224, 1 sheet, scale 1:550,000.

"Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material". Title 40 Code of Federal Regulations (CFR), Part 230. 2010 ed.

US Army Corps of Engineers (USACE). 30 July 1999. EP 1165-2-1; Water Resources Policies and Authorities - Digest of Water Resources Policies and Authorities. Department of the Army, USACE, Washington, DC.

US Army Corps of Engineers (USACE). 1992. ER 1165-2-132; Hazardous, toxic and radioactive waste (HTRW) guidance for civil works projects. Department of the Army, USACE, Washington, DC.

US Army Corps of Engineers (USACE). 31 August 1999. ER 1110-2-1150. Engineering and Design -Engineering and Design for Civil Works Projects. CECW-EP.

US Army Corps of Engineers (USACE). 22 April 2000, ER 1105-2-100; Planning - Planning Guidance Notebook. (Appendix D, Amendment #1, 30 Jun 2004; Appendix F, Amendment #2, 31 Jan 2007; Appendix G, Amendment #1, 30 Jun 2004; Appendix H, Amendment #1, 20 Nov 2007). CECW-P.

US Environmental Protection Agency (EPA). 1985. Final determination of the U.S. Environmental Protection Agency's Assistant Administrator for External Affairs concerning the Bayou aux Carpes Site in Jefferson Parish, Louisiana, pursuant to Section 404(c) of the Clean Water Act. EPA, Washington, DC.

US Environmental Protection Agency (EPA). 2009. Modification to the 1985 Clean Water Act 404(c) final determination for Bayou aux Carpes. EPA, Region 6, Dallas, TX.

"U.S. Fish and Wildlife Service Mitigation Policy; Notice of Final Policy," Federal Register 46 (23 Jan 1981): 7644-7663. Print.

U.S. Fish and Wildlife Service, Regional Director, Southeast Region. 31 Oct 2007. Request for an exception to the Service's Final Policy on the National Wildlife Refuge System and Compensatory Mitigation under Section 10/404 Program Memorandum to Director. Approved 14 Apr 2008.

WRDA 1986. Water Resources Development Act of 1986. Public Law 99-662.

WRDA 1990. Water Resources Development Act of 1990. Public Law 101-640.

WRDA 2007. Water Resources Development Act of 2007. Public Law 110-114.

APPENDIX F

AEP PLAN SELECTION CRITERIA

In brief, plan selection criteria reflect project goals. For instance, if the mission is to buy a car, goals may be to have a low start-up and operating cost. This scenario would have the criteria of retail cost and gas mileage. Note that constraints are not considered criteria (i.e. the retail cost of the car must be under $20K) because alternatives cannot be compared based on this information. Selection criteria vary widely depending on the problem, and can even vary within the umbrella of Civil Works. But for the purposes of HSDRRS Environmental Mitigation, the Project Delivery Team has identified the following plan selection criteria:

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

Risk & Reliability: One of the Chief's 4 priorities is to "employ risk-based concepts in planning, design, construction, operations, and major maintenance." Analysis of alternatives with regard to their risk and reliability is a paradigm shift from deterministic methodologies (e.g. National Economic Development, Benefit/Cost ratios, etc.) to more statistical, probabilistic terms. Though the policy and even the science is still in its nascent stages, enough is usually known to begin making risk-informed decisions, at least qualitatively

AEPs conducted to determine the type of hurricane and storm damage risk reduction features that would be built in a given polder defined risk and reliability primarily in terms of flood risk. The environmental mitigation AEP process has adapted this definition to better capture the risk-based decisions to be made for mitigation projects, such as project sustainability.

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. Moreover, PDTs are only expected to perform Risk & Reliability analysis qualitatively. It is unlikely that PDTs will have fragility curves or event trees when analyzing alternatives. Instead, PDTs should analyze alternatives comparatively. For example,

"Alternative 1 is *much more* reliable than Alternative 2, but only *slightly more* reliable than Alternative 3."

The below risk and reliability subcriteria (see Table C-1) were applied to each mitigation alternative, and qualitative and quantitive data for each alternative under each of the subcriteria are provided in Appendix B, table 2.

Table C-1: Risk and Reliability

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 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

Issue	Explanation
Long-Term Sustainability of Project Benefits	For marsh: Measured by % emergent marsh remaining in TY50, as calculated for Variable 1 in the Marsh WVA model. 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 NCC 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 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 IER records this investigation. However, since a recommended alternative needs to be selected prior to the IER being released for public review and comment, the PDT must attempt to analyze the impacts qualitatively using preliminary information, for those resources which could be impacted to differing degrees by each of the alternatives, focusing only on noteworthy differences between the alternatives. Environmental metrics are displayed in a data matrix in the Environmental Appendix of this EAR.

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 in September 2011).

- Estimated time to NCC milestone (measured from TSP milestone in September 2011).

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 FY09 President's Budget. PDTs should not expect additional appropriations. Therefore, alternatives' costs, excluding escalation and contingency, should not exceed the HSDRRS Current Working Estimate. Life cycle costs are a consideration when evaluating alternatives, but should not drive plan selection. Cost calculations for HSDRRS projects should include construction, engineering and design, construction supervision and administration, Lands, Easements, Rights-of-way, Relocations, & Disposal Areas (LERRDs), and Operation Maintenance Repair Replacement & 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. Once the TSP is identified, assumptions may be changed for the TSP elements to include adaptive management, additional OMRR&R activities, major rehabilitation, etc. in order to sustain ecological success or to address uncertainty. These new assumptions would be reflected in the advanced project design, revised WVA modeling for the TSP, and revised TSP cost estimates,

Watershed & 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 previously 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 first two bullets below aim to capture this guidance. These subcriteria are considered for each alternative, and the outcome of this consideration is shown in the Watershed & Ecological Site Considerations data matrix in Appendix B, table 3.

Watershed Considerations/Significance within the Watershed:

- Consistency with watershed plans (e.g. Coast 2050, LCA, LaCPR, State Master Plan 2007). 40 CFR Part 230 Compensatory Mitigation for Losses of Aquatic Resources includes guidance regarding the siting of mitigation projects. This guidance directs that mitigation should consider existing watershed plans within the project area. Therefore, the selection criteria considers how a given alternative relates to existing watershed plans within the project area. The four watershed plans considered are Coast 2050, LCA, LaCPR and the 2007 State Master Plan. 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 2007, 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, 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 WVA:

- Fragmentation within site boundary (swamp and marsh alternatives only)
- Site habitat connectivity to larger surrounding project area considering future land use trends (swamp and marsh alternatives only)

APPENDIX G

COASTAL MARSH MODULE 1.0
APPROVAL FOR USE

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

CECW-P

28 February 2012

MEMORANDUM FOR Director, National Ecosystem Restoration Planning Center of Expertise (ECO-PCX)

SUBJECT: Wetland Value Assessment Models – Coastal Marsh Module Version 1.0 – Approval for Use

1. The Coastal Marsh Community model is one of seven WVA community models that were developed by the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Environmental Work Group. Based on information provided by the ECO-PCX, it is the understanding of the HQUSACE Model Certification Panel that this model will be used on the following projects over the next five years:

a. MRGO Ecosystem Restoration
b. Barataria Basin Barrier Shoreline
c. Lake Pontchatrain and Vicinity Hurricane Storm Damage Risk Reduction System (HSDRRS) Mitigation
d. West Bank and Vicinity HSDRRS Mitigation
e. HSDRRS IERS –total number unknown
f. Louisiana Coastal Area (LCA) 4 Davis Pond Modification
g. LCA4 Modification to Caernarvon
h. LCA4 Point Au Fer Island
i. LCA4 Caillou Lake Land Bridge
j. LCA Myrtle Grove
k. LCA White Ditch PED
l. LCA Mississippi River Hydrodynamic and Delta Management
m. LCA Caernarvon
n. Larose to Golden Meadow (LGM) Post-Authorization Change (PAC) Study
o. Larose to Golden Meadow Intracoastal Floodwall Reach 2b (LGM-022C).
p. Larose to Golden Meadow Intracoastal Floodwall Reach 2a (LGM-022B).
q. Larose to Golden Meadow C-North Highway 24 Relocation (LGM-001C).
r. Baptiste Collette Bayou Deepening study
s. Barataria Bay Waterway (CAP 204)
t. Buras Marina (CAP 206)
u. Calcasieu River and Pass (CAP 204)
v. Calcasieu Lock Replacement
w. Morganza to the Gulf PAC
x. Morganza to the Gulf Supplemental NEPA documents –total number unknown
y. Southwest Coastal
z. Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) – West Bay Closure
aa. Houma Navigation Canal Deepening
bb. West Shore Lake Pontchartrain Hurricane & Flood Risk Reduction
cc. LCA Terrebonne Basin Barrier Shoreline Restoration
dd. LCA Demonstration Projects Grand Isle and Vicinity Project
ee. CAP 103 Grand Isle Highway 1 Shoreline Stabilization
ff. Donalsonville to the Gulf
gg. NOV Plaquemines Parish
hh. NFL Plaquemines Parish

2. Version 1.0 of the Coastal Marsh Community model is approved for use for the above projects. This approval for use is based on the decision of the HQUSACE Model Certification Panel which considered the ECO-PCX assessment of the model. Adequate technical reviews have been accomplished and the model meets the certification criteria contained in EC 1105-2-412. As indicated by the ECO-PCX, there are a number of unresolved issues related to the form of suitability graphs for Variables 1, 2 and 3 and the aggregation methods used to combine the marsh habitat units and open water habitat units for each sub-model. To increase the understanding of the sensitivity of the model to the unresolved issues and the impact the model differences may have on decision-making, the ECO-PCX is to work with the project delivery teams to conduct sensitivity analyses for each application of the marsh models. A summary of the sensitivity analyses must be presented in the project documentation and Agency Technical Review teams must be charged with reviewing the adequacy and findings of the sensitivity analyses.

3. It is expected that compiliation of the findings of the multiple sensitivity analyses will lead to updates and improvements of the model. As such, version control is imperative. The PCX must ensure that project delivery teams are are utilizing the most appropriate version of the model for their analyses and that they are properly identifiying the version of the model being used.

APPLICABILITY: This approval for use expires 28 February 2017 and is limited to the above studies with the caveat that updated versions of the model be used if appropriate.

HARRY E. KITCH, P.E.
Deputy Chief, Planning and Policy Division
Directorate of Civil Works

APPENDIX H

WVA SENSITIVITY ANALYSIS

Reviewers of Version 1.0 of the Coastal Marsh Community WVA model suggested an alternative treatment for the HSIs for three model variables involved in WVA marsh models: Suitability Index Value (SIV)1 - Percent of wetland area covered by emergent vegetation, SIV2 - Percent of open water area covered by aquatic vegetation, and SIV3 - Marsh edge and interspersion.
The Ecosystem Restoration Planning Center of Expertise (ECO-PCX) and Mississippi Valley Division (MVD) subsequently contacted the Engineering and Research Development Center (ERDC) Environmental Laboratory (EL) for assistance in resolving several comments relating to the review. The ERDC-EL assessed the sensitivity of the WVA marsh model outputs for the LPV and WBV marsh mitigation projects to the suggested changes in SIV1, SIV2 and SIV3. New models for each of the proposed marsh mitigation sites were run with the suggested suitability curves for SIV1 and SIV2. Because current CWPPRA guidelines were originally followed for SIV3 on the LPV sites, no sensitivity analysis was run for SIV3 for the LPV marsh alternatives.

When applying the suggested suitability curves for SIV1 and SIV2, the resulting output in AAHUs decreased by about 25 percent, on average, for the mitigation sites as compared to the output for the previous model runs by CEMVN, which would respectively increase the size of the required mitigation project significantly. One should note, however, that had these criteria also been used to determine the net loss of AAHUs due to HSDRRS impacts, it is likely that impact AAHUs would have changed. It is important that both impacts and corresponding mitigation be calculated using the same methodology; thus, the mitigation outputs calculated using the ERDC-EL approach should not be used unless impacts are re-calculated in the same manner.

ERDC-EL's WVA model sensitivity analysis focused on the net AAHUs generated by the mitigation alternatives (i.e. benefits or outputs). ERDC-EL recommended further comparison based on cost effectiveness (i.e. average annual cost per AAHU). The following tables (Tables C-5-1 and C-5-2), grouped by habitat type, provide an estimate of the cost effectiveness of each marsh mitigation alternative using the AAHU output from the original and revised model runs. This allows one to evaluate how the changes to variables SIV1 and SIV2 affect the ranking of the marsh alternatives based on cost effectiveness. For the Brackish Marsh alternatives, there would be no change in the ranking of the two most cost effective alternatives, although the ranking order for the remaining two alternatives would reverse. The revised models produced a change in the ranking order for all of the Fresh/Intermediate Marsh alternatives, except for one alternative which was neither the most nor the least cost effective alternative.

As the tables below show, the changes in AAHU output would affect the cost effectiveness ranking of the top three Fresh/Intermediate Marsh alternatives, while the changes would make little difference in the Brackish Marsh alternative ranking. However, cost effectiveness is only one plan selection criterion within the larger set of weighted plan selection criteria that will be used in the selection of a mitigation plan. Therefore, this discrepancy in cost effectiveness ranking would have little influence in the overall selection of the plan.

Table C-5-1: Brackish marsh alternatives: comparison of cost effectiveness ranking order using revised WVA models vs. original WVA models.

Alternative	Net AAHUs produced using revised WVA models	Acres used in WVA models	Mitigation Potential using revised WVA models	Acres of resized mitigation features	New AAHUs from revised models and resized mitigation features	Average Annual Cost (AAC)	AAC/New AAHUs	Ranking using revised models	AAC/ Original AAHUs	Ranking using original models
Fritchie-Brackish Marsh	249.54	847	0.29	277	81.61	~33% > least cost	~34% > least cost	3	~33% > least cost	4
Gold Triangle Brackish Marsh	146.77	430.59	0.34	245	83.51	Least cost	least cost	1	Least cost	1
Bayou Sauvage Floodside-Brackish	100.42	386.6	0.26	257	66.76	~25% > least cost	~40% > least cost	4	~25% > least cost	3
Big Branch-Brackish	91.93	285	0.32	251	80.96	~3% > Least cost	~6% > least cost	2	~3% > least cost	2

Notes:

- Revised WVA models = Models run by ERDC-EL
- Original WVA models = Models run by CEMVN
- Mitigation potential = (Net AAHUs produced using revised WVA models)/(acres used in WVA models)
- New AAHUs from revised models and resized mitigation features = (mitigation potential using revised WVA models) x (acres of resized mitigation features upon which cost is based).
- The acreage of mitigation features used in both the original and revised WVA models was based on the preliminary 35% design plans for the various mitigation alternatives. The size of the mitigation features used in these preliminary plans was based on an assumed mitigation potential. Once CEMVN ran WVA models based on these plans, the size of the mitigation features was adjusted (resized) based on the actual mitigation potential determined from the CEMVN WVA models.

Table C-5-2: Fresh/Intermediate marsh alternatives: comparison of cost effectiveness ranking order using revised WVA models vs. original WVA models.

	Net AAHUs produced using revised WVA models	Acres used in WVA models	Mitigation Potential using revised WVA models	Acres of resized mitigation features	New AAHUs from revised models and resized mitigation features	Average Annual Cost (AAC)	AAC/ New AAHUs	Ranking using revised models	AAC/ Original AAHUs	Ranking using original models
Fritchie-Fresh Marsh	243.25	847	0.29	317	91.04	~43% > least cost	~26% > least cost	4	~43% > least cost	4
Big Branch-Intermediate	160.34	519	0.31	292	90.21	~22 % > Least cost	Least cost	1	~22% > least cost	3
Bayou Des Mats Intermediate Marsh	134.18	536	0.25	277	69.34	~ 19% > Least cost	~20% > least cost	3	~19% > least cost	2
Milton Island Intermediate Marsh	103.98	408	0.25	270	68.81	Least cost	~2% > least cost	2	Least cost	1
Caernarvon Marsh	76.2	430	0.18	568	100.65	~64% > Least cost	~48% > least cost	5	~64% > least cost	6
La Branche Intermediate Marsh	75.67	402	0.19	317	59.67	~47% > Least cost	~55% > least cost	6	~47% > least cost	5

- Revised WVA models = Models run by ERDC-EL; Original WVA models = Models run by CEMVN
- Mitigation potential = (Net AAHUs produced using revised WVA models)/(acres used in WVA models)
- New AAHUs from revised models and resized mitigation features = (mitigation potential using revised WVA models) x (acres of resized mitigation features upon which cost is based).
- The acreage of mitigation features used in both the original and revised WVA models was based on the preliminary 35% design plans for the various mitigation alternatives. The size of the mitigation features used in these preliminary plans was based on an assumed mitigation potential. Once CEMVN ran WVA models based on these plans, the size of the mitigation features was adjusted (resized) based on the actual mitigation potential determined from the CEMVN WVA models.Original WVA models = Models run by CEMVN

Analysis of the WVA Model Outputs for the Mitigation of LPV and WBV Projects of the HSDRRS.

J. Kameron Jordan, Bobby McComas and J. Craig Fischenich[1]

Overview

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) must mitigate for impacts associated with Hurricane and Storm Damage Risk Reduction System (HSDRRS) improvements in the Lake Pontchartrain and Vicinity (LPV) and West Bank and Vicinity (WBV) projects. Proposed mitigation to replace lost ecological functions include placement of dredged material to create marsh in areas currently occupied by open water. After screening an array of mitigation options using other criteria, outputs from the Wetlands Value Assessment models (WVA) are being used to select a plan from the final array of alternatives. The CEMVN applied the WVA to assess these alternatives using model input parameters considered appropriate at the time of the model application. Reviewers of the WVA have subsequently suggested an alternative treatment for the habitat suitability indices (HSIs) for three model variables (Suitability Index Value (SIV)1 - Percent of wetland area covered by emergent vegetation, SIV2 - Percent of open water area covered by aquatic vegetation, and SIV3 - Marsh edge and interspersion).

The Engineer Research and Development Center (ERDC) Environmental Laboratory (EL) assessed the sensitivity of the WVA model outputs for the LPV and WBV mitigation projects to the suggested changes in SIV1, SIV2 and SIV3. The treatment of the three variables in the sensitivity analysis for the new model runs was consistent with current application of the WVA to Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects. New models for each of the proposed mitigation sites were run with the alternative suitability curves for SIV1 and SIV2. A separate sensitivity analysis was run to assess the effects of SIV3 on the WBV sites (current CWPPRA guidelines were followed for SIV3 on the LPV sites).

The new models generally had lower average annual habitat unit (AAHU) outputs than the old runs conducted by MVN. Mean change in AAHU output was a 25 percent decrease, and ranged from a 3 percent increase to a 45 percent decrease. These new outputs cannot be directly compared to the required mitigation units because impacts were calculated using the "old" guidelines for the treatment of SIV1, SIV2 and (in the case of WBV) SIV3. The new SIV guidance had little effect on the ranking of the mitigation sites based on AAHU outputs; the maximum change in ranking for LPV sites was -2 and for WBV sites was +/- 1 position. Site prioritization could change when considering costs in addition to the revised AAHU outputs, and the sensitivity of the mitigation outputs to the treatment of the suitability curves in the models should be considered as part of the decision process.

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Background

The CEMVN uses a suite of community-based ecosystem output models titled Wetlands Value Assessment (WVA) in Louisiana for assessing the functional impacts and benefits of actions affecting coastal habitats. These models were developed collaboratively by the US Fish and Wildlife Services (USFWS), Louisiana Department of Natural Resources (LA DNR), and other interagency groups (e.g. the CWPPRA Environmental Workgroup).
The WVA models were evaluated in accordance with EC 1105-2-407 and the Protocols for Certification of Planning Models (July 2007). Comments were furnished in a document titled "Wetlands Value Assessment (WVA) model, addressing model review comments on the application of WVA on the LCA Barataria Basin Barrier Shoreline Restoration Study," dated February 8, 2010. The memorandum identified several concerns regarding model parameters. The Ecosystem Restoration Planning Center of Expertise (ECO-PCX) and Mississippi Valley Division (MVD) subsequently contacted the Engineering and Research Development Center (ERDC) Environmental Laboratory (EL) for assistance resolving several comments relating to that review.

As a consequence of that review and subsequent discussions with the ECO-PCX, MVD, MVN and resource specialists familiar with the WVA and the ecosystems in question, it was determined that future applications of the WVA would employ adjustments to SIV1, SIV2 and SIV3. These adjustments would more closely reflect the original characterization of these model variables and would be consistent with their current treatment in CWRRPA. Figures 1 and 2 show how variables SIV1 and SIV2 were treated in the initial LPV and WBV mitigation models and how they are treated under the revised guidance. The treatment of SIV3 was consistent with current efforts under CWPPRA; carpet marsh was assigned to Class 3 (SI=0.4) instead of Class 1 (SI=1.0) (see Figure 3).

Analysis and Results

The affects of altering SIV1, SIV2, and SIV3 were determined by applying the above adjustments to the model equations to assess the difference in model outputs. To facilitate the analysis and to reduce opportunities for mistakes in data entry, we developed a set of spreadsheets that utilized the existing models as "input templates" for the new models. This allowed us to reference the data input cells of the existing models using the new model equations, and both the "old" and "new" models and results are contained on the same Excel workbook. The revised models are submitted separately with this report for MVN to review and consider. Summary results are presented herein; magnitude of change was quantified in terms of the percent change of the total average annual habitat units (AAHUs), as well as to the emergent marsh and open water habitats. We also assess the effects of the new model outputs on the ranking of alternatives.
Tables 1 through 4 summarize the results of the application of the new HSIs in terms of AAHUs and percent change in net AAHUs relative to the previous model runs by MVN. Percentage differences are as calculated by Equation 1 where the new model reflects the application of HSIs as currently used in CWPPRA, and the old model reflects the HSIs utilized the previous model runs by MVN.

$$\%_{AAHU\ -change} = \frac{AAHU_{NewModel} - AAHU_{OldModel}}{AAHU_{NewModel}} * 100$$ Equation 1

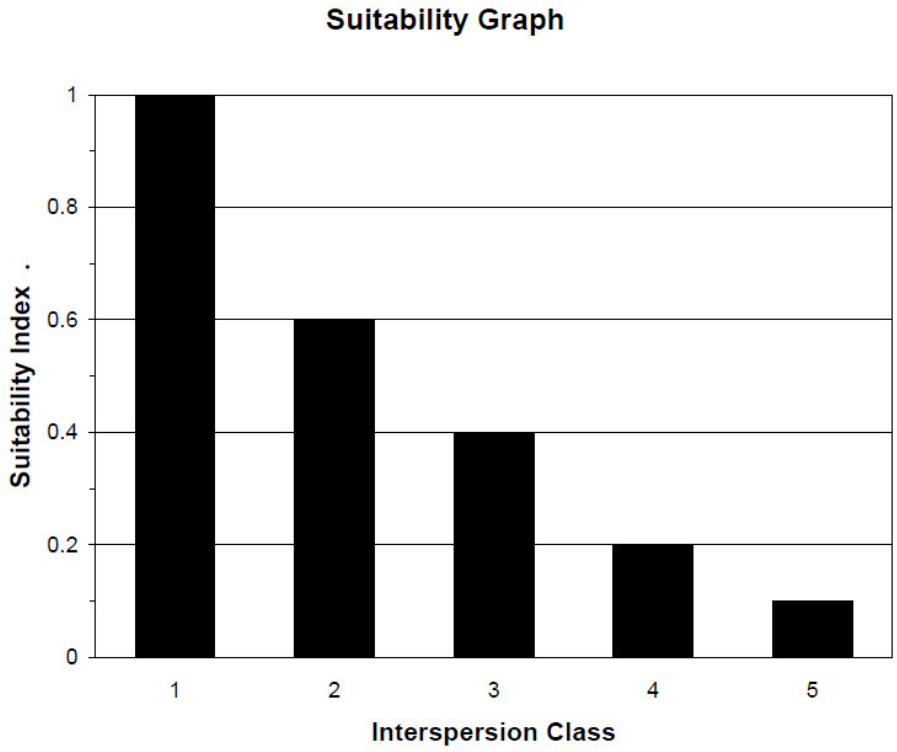

Figure 3. "Carpet Marsh" is treated as Class 3 for projects under CWPPRA.

Table 1: Percent change in model output for LPV sites

	Open Water	**Emergent Marsh**	**Total Net Benefits**
Model	**% Change**	**% Change**	**% Change**
Bayou Des Mats Intermediate Marsh	-42.42%	-14.30%	-35.08%
Big Branch-Brackish	-46.01%	-9.58%	-22.90%
Big Branch-Intermediate	-35.12%	-6.07%	-16.97%
Bayou Sauvage Floodside-Brackish	-20.32%	-19.65%	-36.00%
Bayou Sauvage Protected Intermediate	12.53%	1.93%	3.43%
Caernarvon Marsh	-34.16%	2.71%	-7.11%
Fritchie-Brackish Marsh	-41.79%	-8.79%	-22.63%
Fritchie-Fresh Marsh	-29.73%	-5.12%	-16.13%
Gold Triangle Brackish Marsh	-70.68%	-9.16%	-20.19%
La Branche Intermediate Marsh	-45.72%	-18.65%	-45.37%
Milton Island Intermediate Marsh	-40.57%	-18.30%	-39.73%

Maximum=	**12.53%**	**2.71%**	**3.43%**
Minimum=	**-70.68%**	**-19.65%**	**-45.37%**
Mean=	**-35.82%**	**-9.54%**	**-23.52%**
Standard Deviation=	**0.2034**	**0.0774**	**0.1461**

Table 2. Percent change in model output for WBV sites.

	Open Water	**Emergent Marsh**	**Total Net Benefits**
	% Change	**% Change**	**% Change**
Dufrene Pond M1	-10.46%	-20.50%	-25.31%
Dufrene Pond M2	-10.46%	-21.78%	-26.80%
Jean Lafitte M1	-40.29%	-8.10%	-20.93%
Jean Lafitte M2	-21.73%	-7.19%	-12.95%
Jean Lafitte M3	-20.31%	-7.64%	-12.91%
Jean Lafitte M4A	-25.75%	-22.80%	-33.11%
Jean Lafitte M4B	-10.84%	-21.20%	-25.17%
Plaquemines Alternative 1	14.65%	-23.61%	-27.47%
Salvador Timken	-40.69%	-21.77%	-42.38%
Simoneaux Ponds	-28.65%	-21.78%	-33.57%
Maximum=	**14.65%**	**-7.19%**	**-12.91%**
Minimum=	**-40.69%**	**-23.61%**	**-42.38%**
Mean=	**-19.45%**	**-17.64%**	**-26.06%**
Standard Deviation=	**0.1638**	**0.0695**	**0.0911**

Table 3: Side-by-side ranking of the LPV mitigation sites for the original total net benefits model runs and model runs using the CWPPRA suitability curves.

Model	Original Ranking	New Ranking	Difference	Original Net Benefits AAHUs	New Net Benefits AAHUs
Fritchie-Brackish Marsh	1	1	0	322.54	249.54
Fritchie-Fresh Marsh	2	2	0	290.02	243.25
Big Branch-Intermediate	4	3	+1	193.11	160.34
Gold Triangle Brackish Marsh	5	4	+1	183.90	146.77
Bayou Des Mats Intermediate Marsh	3	5	-2	206.70	134.18
Milton Island Intermediate Marsh	6	6	0	172.51	103.98
Bayou Sauvage Floodside-Brackish	7	7	0	156.91	100.42
Big Branch-Brackish	9	8	+1	119.24	91.93

Caernarvon Marsh	10	9	+1	82.04	76.20
La Branche Intermediate Marsh	8	10	-2	138.51	75.67
Bayou Sauvage Protected Side Intermediate Marsh	11	11	0	34.16	35.33

Table 4: Side-by-side ranking of the WBV mitigation alternative sites for the original total net benefits model runs and model runs using the CWPPRA suitability curves.

Model Run	Old Ranking	New Ranking	Difference	Original Total Benefits	New Suitability Graphs Total Benefits
Simoneaux Ponds	1	1	0	152.15	101.07
Plaquemines Alternative 1	3	2	+1	131.91	95.67
Salvador Timken	2	3	-1	146.78	84.58
Dufrene Pond M2	4	4	0	114.76	84.01
Jean Lafitte M3	5	5	0	88.48	77.06
Jean Lafitte M2	6	6	0	86.54	75.33
Jean Lafitte M1	8	7	+1	66.59	52.65
Jean Lafitte M4B	7	8	-1	70.09	52.45
Dufrene Pond M1	9	9	0	55.7	41.6
Jean Lafitte M4A	10	10	0	12.08	8.08

The results were generally similar for LPV and WBV in terms of the percentage change. The net effect of changing the HSI values to reflect current CWPPRA practice is a reduction in the total benefits on the order of about 25%. The mean change is virtually identical for the LPV and WBV sites, but there is greater variation among the LPV sites. The effects of the adjustments to SIV1 and SIV2 are especially significant and variable in terms of the open water habitat; changes in outputs range from +13% to -71% for the LPV sites and +15% to -41% for the WBV sites. Changes to emergent marsh habitat varied from +3% to -20% for LPV sites and from -7% to -24% for WBV sites.

Application of the new suitability curves had little effect on the ranking of the mitigation sites based on AAHU outputs. For LPV, Bayou Des Mats Intermediate Marsh and La Branche Intermediate Marsh each dropped two rankings while four sites increased one place and five sites remained unchanged. For WBV, two sites dropped a place, two increased one place and six remained unchanged. Note that these changes do not account for the costs for each site, and the changes to site prioritization could change when both costs and benefits are considered.

Under the "new" guidelines, carpet marsh should be regarded as Class 3 (SI=0.4) for SIV3 as opposed to Class 1 (SI=1.0) under the "old" approach. The new approach was applied to both the LPV and WBV sites by MVN in the existing models, but there are apparently some question regarding the assumptions applied to the WBV sites. Model input was treated as follows for the

future with project condition on fresh marsh: 100% open water (Class 5) for years 0 and 1; 100% carpet marsh (Class 3) in year 3; 50% carpet marsh (Class 3) and 50% Class 1 in year 5; and 100% Class 1 in years 6 through 50. For other marsh types, SIV3 was set at 100% Class 1 for years 5-50. Given the relatively low loss rates for these sites, it seems unlikely that the carpet marsh would deteriorate in two years sufficiently to merit reclassification as Class 1.

The above approach is predicated on the assumption that marsh construction will include measures to optimize interspersion within each mitigation feature as part of the construction process. Meandering trenasses and scattered shallow depressions would be created within the marsh feature at or near the time that sediments pumped into the feature have settled to the desired grade and containment dikes are being degraded. These interspersion features could be established, for example, by tracking a marsh buggy or backhoe through the sediments and/or to excavate shallow depressions or trenasses.

We evaluated several alternatives to the above scenario to assess the sensitivity of the model output to assumptions regarding SIV3 using the models for Salvador Timken and Plaquemines. To bracket conditions, we made model runs assuming 100% Class 1 (SI=1.0) for the full 50 years, 100% Class 5 (SI=0) for the full 50 years, conversion of the carpet marsh to Class 1 in year 25 (as opposed to year 6), and a more gradual transition of carpet marsh to Class 1 ending with 50% each of Classes 1 and 3 at 50 years.

The results of the analyses, shown in Table 5, confirm previous sensitivity assessments. SIV3 has relatively little influence on the model results. Although it can influence model output by up to 14%, (all Class 1 versus all Class 5), the range of more probable conditions is considerably less than this. Our assessment shows that the conditions used in the "old" models may have overestimated the output by about 6 percent when compared to a more gradual conversion to Class 1, or by up to 9 percent if carpet marsh persiste for the full 50 years.

Table 5. Sensitivity of model outputs (in net AAHUs) to various scenarios in the treatment of carpet marsh for two WBV sites.

	Salvador Timken	**Plaquemines**
Current "Old" Model	147	132
100% Class 5 for 50 yrs	126	114
100% Class 1 for 50 yrs	147	133
100% Class 3 for 50 yrs	134	120
Conversion 3 to 1 in 25 yrs	137	126
Gradual Conversion to 50/50	137	124

Discussion

Our assessment demonstrates that the LPV and WBV models are sensitive to assumptions regarding the treatment of SIV1 and SIV2. When applying the criteria used in the original WVA CWPPRA models for these parameters, the resulting output in AAHUs decreases by about 25 percent, on average, for the mitigation sites as compared to the output for the previous model runs by MVN. However, the same model assumptions would likely result in a decrease in overall impacts requiring mitigation when applied to the assessment of HSDRRS measures. The magnitude of the difference is uncertain and if these new model runs are to be used to directly assess mitigation credit, the impacts should be assessed using the same model assumptions.

Although the model assumptions had a significant impact on the magnitude of the outputs, it had relatively little effect on the ranking of mitigation sites based on the net AAHU output. This is especially true for the WBV sites. Costs for the mitigation sites weren't available for our assessment, and should be factored into the ranking of the alternatives. Finally, our assessment suggests that assumptions regarding the treatment of carpet marsh and SIV3 for sites in WBV might have resulted in a slight over prediction of benefits. A more realistic assumption regarding the eventual degradation of the marsh would yield about 6 percent reduction in AAHUs. This conclusion is based on an assessment of only two sites, but should hold for the remainder of the WBV sites.

The revised models and sensitivity analyses developed as part of this assessment are provided separately with this report. These "new" model results should be considered in addition to the old model assessments when making decisions regarding the mitigation of HSDRRS measures. If that assessment suggests a possible discrepancy between the mitigation benefits and likely impacts large enough to affect decisions, it may be necessary to run the impact assessment using the same model assumptions. We also recommend that future model assessments made with WVA apply ranges of likely future values for the model variables, and apply a more strict adherence to rules for significant digits.

APPENDIX I

LPV & WBV HSDRRS MITIGATION:
WETLAND VALUE ASSESSMENT (WVA) MODEL ASSUMPTIONS AND RELATED GUIDANCE
(Revised/Updated: 3 March 2012)

PREFACE

Several of the assumptions set forth in this document are based on mitigation implementation schedules. Many sections include specified WVA model target years (TYs) and calendar years applicable to assumptions, and a few sections outline anticipated mitigation construction (i.e. mitigation implementation) schedules. It is critical for the WVA analyst to understand that this document has not been revised to account for changes to the mitigation implementation/construction schedules. It is therefore imperative for the analyst to obtain the most recent mitigation implementation/construction schedule for a particular mitigation project from CEMVN prior to running WVA models. The analyst may then need to modify some of the WVA model assumptions and guidelines presented herein to account for differences between the present mitigation implementation/construction schedule and the schedule(s) that were assumed in generating this document. A separate document will be generated to address model assumptions applicable to evaluating impacts to open water habitats.

1.1 BOTTOMLAND HARDWOOD MODEL – GENERAL ASSUMPTIONS

V1 – Tree Species Association/Composition (in canopy stratum – percentage of trees that are hard mast or other edidble-seed producing trees and percentage that are soft mast, non-mast/inedible seed producing trees)

BLH-Wet restore, FWP scenario:

- Of the total trees initially planted, 60% will be hard mast-producing species and 40% will be soft mast-producing species. Assume this species composition ratio (i.e. 60% of trees are hard mast-producing and 40% are soft mast-producing) will remain static over the entire period of analysis (i.e. remains the same from time of planting throughout all subsequent model target years).
- Assume Class 5 is achieved once the planted trees are 10 years old. This class remains the same thereafter (i.e. Class 5 for all subsequent target years). Note that trees will be approximately 1 year old at the time they are initially planted. Thus, Class 5 is achieved 9 years after the time of initial planting.

General Notes:

- Do not classify Chinese tallow as a "mast or other edible-seed producing tree". Consider it a non-mast producing tree. Although it is an invasive species, one must still include this species regarding its contribution to percent cover in the canopy, midstory, and ground cover strata when it is present on a site (applicable to FWP scenario at TY0 and applicable to FWOP scenario for all model target years).

V2 – Stand Maturity (average age or dbh of dominant and codominant canopy trees)

BLH-Wet and BLH-Dry restore and enhance, FWP scenario -----

- Guidance as to how factors like subsidence and sea level rise might affect this variable (especially if the mitigation site becomes flooded for long durations, since the growth of trees may be adversely affected and certain tree species could die) -----
  If the mitigation feature (polygon) is designed such that flooding at the end of the project life will not impact tree survival, i.e. flooding is <12% of the growing season (33 days) and is no more than 20% to 30% of the non-growing season, then trees should not be adversely affected. However, if the site design does not achieve this goal, then adjust the tree growth spreadsheet such that typical growth is reduced by at least 10% once flooding exceeds 20-30% of the non-growing season or is 12% or more of the growing season (Conner et al.; Francis 1983).

General Notes:

- Include the DBH of Chinese tallow when working with this variable (for FWOP scenario in all model target years and for FWP scenario at TY0). The same guidance would apply to other invasive species in the canopy stratum.
- For planted trees – You can use the age of the trees in lieu of their DBH when running the model (applies to all target years from time of planting throughout model run). Assume trees planted will be approximately 1 year old when they are first installed.

V3 – Understory/Midstory (percent cover)

BLH-Wet and BLH-Dry restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades:

TY	Year	Assumption	
0	2013	Understory = 0% // Midstory = 0%	Refer to Note 1
1	2014	Understory = 0% // Midstory = 0%	
2	2015	Understory = 100% // Midstory = 0%	
20	2033	Understory = 25% // Midstory = 60%	
50	2063	Understory = 35% // Midstory = 30%	Refer to Note 2

Notes:

1. This assumption is applicable to restoration features built in existing open water areas. For restoration polygons built in other areas that are not open water or are only partially open water, values for cover in the understory and midstory strata must be based on site-specific conditions existing prior to the start of construction.
2. The specified values are based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). These values will need to be adjusted if sea-level rise is anticipated to increase flooding of the particular mitigation polygon to a degree whereby growth and/or survival of plant species in the understory and/or midstory strata are adversely impacted.
3. Keep in mind that canopy and midstory species will not be planted in restoration features built in open water areas until 1 year after the initial fill (borrow) has been placed in the mitigation feature. This allows 1 year of fill settlement prior to plantings.

BLH-Wet restore and BLH-Dry restore, FWP scenario --
Assumptions applicable to restoration features that do not require deposition of fill to achieve target grades:

TY	Year	Assumption	
0	2013	Refer to Note 1	
1	2014	Understory = 100% // Midstory = 0%	
20	2033	Understory = 25% // Midstory = 60%	
50	2063	Understory = 35% // Midstory = 30%	Refer to Note 2

Notes:

1. Values for cover in the understory and midstory strata must be based on site-specific conditions existing prior to the start of construction.
2. The specified values are based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). These values will need to be adjusted if sea-level rise is anticipated to increase flooding of the particular mitigation polygon to a degree whereby growth and/or survival of plant species in the understory and/or midstory strata are adversely impacted.

General Notes:

- Cover accounted for by Chinese tallow and other invasive and nuisance plant species must be included in the percent cover data (applicable to FWOP scenario in all model target years and to FWP scenario at TY0).
- Changes in hydrology could result from factors such as sea-level rise and subsidence. An increase in the duration of flooding will typically decrease the understory cover and, to a lesser degree, decrease the midstory cover.

V4 – Hydrology (flooding duration and water flow/exchange)

BLH-Wet restore, FWP scenario -----
Assumptions applicable to restoration features built in existing open water areas and for restoration features that require deposition of fill to achieve target grades.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = dewatered // Exchange = none
2	2015	Duration = temporary Refer to Note 1
20	2033	Duration = temporary Refer to Note 1
50	2063	Duration = temporary Refer to Notes 1 and 2

Notes:
1. Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated.
2. The specified value for flooding duration is based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). This value will need to be adjusted if sea-level rise is anticipated to significantly increase the duration of flooding in the particular mitigation polygon. In many cases, it is probable that the duration may shift from temporary to seasonal.

BLH-Wet restore & BLH-Wet enhance, FWP scenario -----
Assumptions applicable to restoration features that do not require deposition of fill to achieve target grades and to BLH-Wet enhancement features where hydrologic enhancement is a component of the mitigation design.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = temporary Refer to Note 1
2	2015	Duration = temporary Refer to Note 1
20	2033	Duration = temporary Refer to Note 1
50	2063	Duration = temporary Refer to Notes 1 and 2

Notes:
1. Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated.
2. The specified value for flooding duration is based on the assumption that normal flooding conditions are present (i.e. desirable depth and duration of inundation). This value will need to be adjusted if sea-level rise is anticipated to significantly increase the duration of flooding in the particular mitigation polygon. In many cases, it is probable that the duration may shift from temporary to seasonal.
3. For BLH-Wet enhancement features that do not include measures to enhance existing hydrology as part of the mitigation design, the scoring of variable V4 must be based on site-specific conditions hence no general assumptions are applicable.

BLH-Dry restore or enhance, FWP scenario -----
- Score flooding duration as “dewatered” during all target years used in the model.

V5 – Size of Contiguous Forested Area

BLH-Wet & BLH-Dry restore, FWP scenario:
- Do not consider the mitigation polygon to classify as “forested” until the planted trees are 10 years old. Remember that trees will be 1 year old when they are first installed; hence, the mitigation polygon would classify as forested 9 years following the year of initial planting. Prior to this target year, the trees initially planted in the mitigation polygon will be considered as either understory or midstory cover. For the target year when the planted trees reach 10 years old and for all model target years thereafter, the planted trees will be considered large enough for the mitigation polygon to be considered a forest. Hence at the target year planted trees reach 10 years old and all target years thereafter, the mitigation polygon can be

included in the calculation of forested acreages (along with contiguous forested areas outside the mitigation polygon).

BLH-Wet and BLH-Dry restoration or enhancement, FWP and FWOP scenarios:

- For areas outside the mitigation polygons, assume the conditions present at TY0 will remain unchanged throughout the life of the mitigation project. As used here, the term "mitigation polygons" refers to all proposed mitigation polygons regardless of the target habitat proposed. For example, a particular mitigation site could contain both a BLH-wet restoration polygon and a swamp restoration polygon. Under the FWP scenario, one would assume that the 2 restoration polygons would become forested over time but existing forested areas outside the limits of these polygons would remain forested throughout the period of analysis. Under the FWOP scenario, existing conditions would prevail in both the 2 restoration polygons and in the areas outside the limits of these polygons throughout the period of analysis.

General Notes:

- When scoring this variable for the FWP scenario, the area within the mitigation polygon itself as well as the adjacent "non-mitigation" areas are combined to generate the total forested acreage. However, remember the assumption that planted trees in restoration features will not be considered large enough for the feature to classify as a forest until the planted trees are 10 years old.
- When evaluating the size of contiguous forested areas, non-forested corridors <75 feet wide will not constitute a break in the forest area contiguity.

V6 – Suitability and Traversability of Surrounding Land Uses (within 0.5 mile of site perimeter)

BLH-Wet and BLH-Dry restoration or enhancement, FWP scenario:

- When scoring a given BLH mitigation polygon, include the nearby or adjacent mitigation polygons in your assessment of land use types by assuming their land use type is the habitat type proposed (i.e. the target habitat type). However, one must consider the TY that the nearby/adjacent mitigation polygon will actually shift from its existing habitat type to the target habitat type. For example, if the adjacent mitigation polygon is a marsh restoration feature then the change from the existing habitat type (open water typically) to the target marsh habitat would not occur until TY2 (2015).

BLH-Wet and BLH-Dry restoration or enhancement, FWP and FWOP scenarios:

- When evaluating this variable, typically assume that land uses in lands outside the mitigation polygons will score the same under the FWP and FWOP scenarios. In other words, typically assume that the existing conditions present in TY0 will remain unchanged over the life of the mitigation project. One would typically not consider potential future land development rates when scoring this variable due to the uncertainty of long-term development trends. Exceptions to this general approach would include:
    - Situations where there is a high level of confidence that a particular area is slated for a significant change in land use (ex. construction of I-49 through the Dufrene Ponds mitigation site).
    - Situations where it is anticipated that the "land use" (habitat type) will significantly change over time due to the effects of sea-level rise and land loss (ex. existing adjacent marsh lands rated as highly suitable/traversable changing to open water, a much lower score, due to shoreline erosion or other land loss factors).

V7 – Disturbance (sources of disturbance vs. distance from site perimeter to disturbance source)

BLH-Wet and BLH-Dry restoration or enhancement, FWP and FWOP scenarios:

- For consistency purposes, assume baseline conditions affecting the scoring of this variable will not change over time. In other words, typically assume that the existing conditions present in TY0 will remain unchanged over the life of the mitigation project. For the WBV mitigation alternatives, there will be two exceptions to this general approach:
    - Bayou Signette – The variable score will need to change over time to account for building the nearby racetrack project.
    - Dufrene Ponds -- The variable score will need to change over time to account for the construction of the I-49 highway.

General Notes:

- When scoring this variable, all distances are measured from the perimeter of the BLH mitigation polygon itself.

1.2 NOTES REGARDING CONSTRUCTION & PLANTING OF BLH MITIGATION AREAS

Typical Estimated Project Construction Timelines -----

All projects – Begin construction around September 2013.

For BLH restoration areas built in existing open water features and for any other BLH restoration areas that require deposition of fill material as part of the construction process:

- Sept. 2013 – Begin construction.
- May 2014 – Complete construction.
- May 2015 – Initial grade settles to desired target grade (1 year after end of construction). If applicable, perimeter dikes constructed are degraded or gapped at this time.
- Dec. 2015 – Install plants (or could be installed in Jan. or Feb. of 2016).

For BLH restoration that do not require deposition of fill as part of the construction process:

- Sept. 2013 – Begin construction.
- Feb. 2014 – End construction (but could be as late as March or April of 2014 if much is earthwork required).
- March. 2014 – Install plants (earliest scenario for site requiring minimal earthwork).
- Dec. 2014 – Install plants (earliest scenario for site requiring substantial earthwork).

For BLH enhancement areas:

- Sept. 2013 – Begin construction (includes start of invasive plant eradication).
- Jan. 2014 – End construction (but could be as late as Feb. or March of 2014).
- March 2014 – Install plants.

Notes:

1. All of the above timelines are preliminary and are subject to refinement as plans are refined for a particular mitigation site.
2. Planting of canopy and midstory species in March should be avoided if possible since conditions could be adversely dry, thereby decreasing the survival of plantings.
3. Chemical eradication of invasive/nuisance hardwood species such as Chinese tallow should be done during the growing season. Greatest effectiveness may be realized if chemical treatment is applied from August through October when most energy is being used for root development.

Planting of BLH-Wet and BLH-Dry Restoration Areas -----

Initial plantings will be:

- Canopy species: plant on 9-foot centers (538 trees/acre); of total trees planted, 60% will be hard mast-producing species and 40% will be soft mast-producing species.
- Midstory species (shrubs and small trees): plant on 20-foot centers (109 seedlings per acre).
- Stock size (canopy and midstory species): 1 year old, 1.5 feet tall (minimum).

Planting of BLH-Wet and BLH-Dry Enhancement Areas -----

Initial plantings will follow the same guidelines as for BLH-Wet and BLH-Dry restoration areas regarding the general density of installed plants and the stock used. Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The typical guideline of having 60% of the canopy species planted be hard mast-producing and 40% of the canopy species planted be soft mast-producing may be altered in situations where several native trees remain after eradicating invasive/nuisance species. For example if the remaining native trees are predominantly soft mast-producing species, then a greater proportion of the planted trees would be hard-mast producing. The objective would be to have the ultimate canopy composition (planted trees after reaching canopy strata plus existing trees) be close to a 60%:40% ratio of hard mast to soft mast species.

1.3 BOTTOMLAND HARDWOOD WVA MODEL – TARGET YEARS FOR MODELS

Use the target years specified below when analyzing BLH restoration polygons built in existing open water features and for any other BLH restoration polygons that require deposition of fill material as part of the construction process:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. No plants installed.
2	2015	Restoration feature settles to desired target grade. Any associated perimeter containment dikes are degraded or gapped. Plants installed. Temporary flooding duration (target flooding duration/target hydroperiod) achieved.
11	2024	Class 5 is achieved re V1. Planted areas class as forested re V5.
20	2033	For V3, Understory = 25% // Midstory = 60%
50	2063	End of project life for a HSDRRS mitigation feature.

Use the target years specified below when analyzing BLH restoration polygons that do not require deposition of fill material as part of the construction process, and when analyzing BLH enhancement polygons:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. Initial eradication of invasive & nuisance plant species is started and completed. Plants are installed (either in March or in December depending on construction activities. Appropriate planting season extends from November through February). Temporary flooding duration (target flooding duration/target hydroperiod) achieved.
10	2023	Class 5 is achieved re V1. Planted areas class as forested re V5.
20	2033	For V3, Understory = 25% // Midstory = 60%
52	2065	End of project life for a HSDRRS mitigation feature (adjusted end to be consistent with final TY used in impact WVAs).

NOTE:
The user of these guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

2.1 SWAMP MODEL – GENERAL ASSUMPTIONS

V1 – Stand Structure (percent closure or Cover: overstory, midstory, herbaceous)

Swamp restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades. If construction involves substantial excavation and grading rather than filling, use the next assumptions table rather than this one.

TY	Year	Assumption
0	2013	Baseline conditions (site-specific)
1	2014	Class 1
2	2015	Class 1
3	2016	Class 2
15	2028	Class 6
35	2048	Class 6
50	2063	Refer to Note 1

Notes:

1. Over time, sea-level rise and possibly subsidence could adversely affect the hydrologic regime (increased flooding duration, increased depth of inundation). Salinity could increase in some areas concurrent with sea-level rise. These factors are anticipated to adversely affect plant growth and survival. Thus, cover in the midstory and herbaceous (ground cover) strata are anticipated to decrease over time, as could percent cover in the canopy stratum to a lesser degree. This potential reduction must be evaluated on a site-specific basis, factoring in considerations such as the proposed grade of the mitigation polygon relative to the projected sea-level rise elevation, changes in salinity, etc. As a general "rule of thumb", one may anticipate the stand structure to decrease from Class 6 in TY35 to Class 4 by TY50. However, it is emphasized that the decrease in class score over time must be evaluated on a case-by-case basis.

Swamp restore, FWP scenario --
Assumptions applicable to restoration features involving substantial excavation and grading as part of the initial construction efforts. If fill is required via pumping of sediments into the feature, use the preceding assumptions table.

TY	Year	Assumption
0	2013	Baseline conditions (site-specific)
1	2014	Class 1
2	2015	Class 1
15	2028	Class 6
35	2048	Class 6
52	2065	Refer to Note 1 in preceding assumptions table

General Notes:

- Include the cover accounted for by Chinese tallow and other invasive plant species when working with this variable (for FWOP scenario in all model target years and for FWP scenario at TY0).
- For swamp enhancement features, FWP scenario --- The evaluation of existing canopy, midstory, and understory will be done via field data collection for this variable. The growth of planted species will be estimated from a growth calculator that is based on pertinent research. Assumptions will have to be made about the correlation between plant growth and observed coverage. The values will be averaged to get a single HSI for this variable. Planted canopy species should not be factored into the overstory coverage estimate until TY15. They will be considered either as part of understory cover (earlier) or midstory cover (later) prior to TY15.

V2 – Stand Maturity (average DBH of canopy trees; plus total basal area all trees)

Swamp restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades. If construction involves substantial excavation and grading rather than filling, use the next assumptions table rather than this one.

TY	Year	Assumptions – Density of Trees	Assumptions – DBH of Planted Trees
0	2013	Baseline conditions.	N/A
1	2014	0 trees/ac.	N/A
2	2015	538 trees/ac. (trees installed, initial density)	Cypress = 0.2" // Tupelo = 0.3"
3	2016	269 trees/ac. (50% survival of planted trees)	Cypress = 0.2" // Tupelo = 0.5"
4	2017	258 trees/ac. (48% survival of planted trees)	
15	2028	215 trees/ac. (40% survival of planted trees)	Cypress = 3.5" // Tupelo = 4.1"
35	2048	161 trees/ac. (30% survival of planted trees)	Cypress = 8.2" // Tupelo = 9.6"
50	2063	161 trees/ac. (30% survival of planted trees)	Cypress = 11.9" // Tupelo = 14.0"

Swamp restore, FWP scenario --
Assumptions applicable to restoration features, or the portions thereof, involving substantial excavation and grading as part of the initial construction efforts. If fill is required via pumping of sediments into the feature, use the preceding assumptions table concerning tree densities.

TY	Year	Assumptions – Density of Trees	Assumptions – DBH of Planted Trees
0	2013	Baseline conditions.	N/A
1	2014	538 trees/ac. (trees installed; initial density)	Cypress = 0.2" // Tupelo = 0.3"
2	2015	269 trees/ac. (50% survival of planted trees)	Cypress = 0.2" // Tupelo = 0.5"
3	2016	258 trees/ac. (48% survival of planted trees)	
15	2028	215 trees/ac. (40% survival of planted trees)	Cypress = 3.5" // Tupelo = 4.1"
35	2048	161 trees/ac. (30% survival of planted trees)	Cypress = 8.2" // Tupelo = 9.6"
52	2065	161 trees/ac. (30% survival of planted trees)	Cypress = 11.9" // Tupelo = 14.0"

Swamp restore, FWP scenario ---

- Assume 70% of the trees planted will be cypress and that 30% of the trees planted will be tupelo or other non-cypress species. Assume that this ratio will remain constant over time once the trees are planted.

Swamp enhance, FWP scenario ---

- Do not factor planted trees into the site DBH calculations until TY15. Prior to TY15, the planted trees will be considered as being in the understory or midstory strata.

General Notes:

- Factors such as sea-level rise and increased salinity over time may adversely affect the growth and/or survival of planted trees and existing trees. These factors must be considered when assessing this variable and may require adjustments to the assumed density of planted trees (as regards survival of trees) and the assumed dbh of planted trees indicated in the preceding tables. The FWS spreadsheet used to predict tree growth (reference the "BLH Site Ingrowth" spreadsheet) includes correction factors used to adjust typical growth rates to account for trees subject to stressors like excessive inundation or salinity. These correction factors should be used for target years in which one anticipates the stress factors may significant enough to affect tree growth. The stage in the project life that the effects become significant must be determined on a case-by-case basis.

V3 – Water Regime (flooding duration and water flow/exchange)

Swamp restore, FWP scenario --
Assumptions applicable to restoration features built in existing open water areas and for any restoration features that require deposition of fill to achieve target grades. If construction involves substantial excavation and grading rather than filling, use the next assumptions table rather than this one.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = permanent // Exchange = none
2	2015	Duration = seasonal Refer to Note 1
15	2028	Duration = seasonal Refer to Note 1
35	2048	Duration = seasonal or semi-permanent Refer to Notes 1 and 2
50	2063	Duration = semi-permanent or permanent Refer to Notes 1 and 2

Notes:
1. Scoring of water flow/exchange component of hydrology must be based on site-specific conditions anticipated.
2. During the latter portions of the project life, flooding duration may be affected by sea-level rise. Swamp mitigation features are designed to have seasonal flooding once the features are constructed and have reached the desired target grade elevation. Sea-level rise will likely increase the duration of flooding. This effect will be site-specific and must be evaluated on a case-by-case basis. Sea-level rise will also likely affect the water flow/exchange. For a site that has limited exchange during early years, this may actually improve exchange for a period of years (ex. increase from low exchange in TY2 to moderate exchange in TY15). As the sea-level rise continues over time, however, the effect may be to reduce exchange (ex. decrease from moderate exchange in TY35 to low exchange in TY50). The degree to which sea-level rise affects flow/exchange over time must also be evaluated on a case-by-case basis.

Swamp restore, FWP scenario --
Assumptions applicable to restoration features, or the portions thereof, involving substantial excavation and grading as part of the initial construction efforts. If fill is required via pumping of sediments into the feature, use the preceding assumptions table.

TY	Year	Assumption
0	2013	Baseline conditions (score based on existing hydrology)
1	2014	Duration = seasonal Refer to Note 1
2	2015	Duration = seasonal Refer to Note 1
15	2028	Duration = seasonal Refer to Note 1
35	2048	Duration = seasonal or semi-permanent Refer to Notes 1 and 2
50	2063	Duration = semi-permanent or permanent Refer to Notes 1 and 2

Notes:
Notes 1 and 2 are the same as in the preceding table.

V4 – Mean High Salinity During the Growing Season (salinity re baldcypress & other trees)

General Notes:
- For current and near-term salinities, use the Coastwide Reference Monitoring System (CRMS) data (website http://www.lacoast.gov/crms%5Fviewer/) and USGS gage data (website http://waterdata.usgs.gov/la/nwis/rt) where available. Future salinities should be forecast using reasonable estimates and best professional judgment (in the absence of hydrologic and hydrodynamic modeling).

Other WVA Swamp Model Guidance

The WVA procedural manual and Swamp Community Model text advises that habitat classification data and aerial photos should be used to determine a conversion rate of swamp to marsh. Based on this evaluation, the guidance states that areas of swamp converting to fresh marsh should be evaluated as open water habitat using the fresh marsh model. The determination of appropriate conversion rates would be quite complicated in the project area. Hence, this issue will not be addressed as part of the WVA analyses.

2.2 NOTES REGARDING CONSTRUCTION & PLANTING OF SWAMP MITIGATION AREAS

Typical Estimated Project Construction Timelines -----

All projects – Begin construction around September 2013.

For swamp restoration areas built in existing open water features and for any other swamp restoration areas that require deposition of fill material as part of the construction process:

- Sept. 2013 – Begin construction.
- May 2014 – Complete construction.
- May 2015 – Initial grade settles to desired target grade (1 year after end of construction). If applicable, perimeter dikes constructed are degraded or gapped at this time.
- Dec. 2015 – Install plants (or could be installed in Jan. or Feb. of 2016).

For swamp restoration areas involving extensive excavation and earthwork but that do not require deposition of fill as part of the construction process:

- Sept. 2013 – Begin construction.
- March 2014 – End construction (but could be as late as May of 2014; also, subsequent grading may be required in some areas after an as-built survey completed in order to correct any deficiencies).
- Dec. 2014 – Install plants.

For swamp enhancement areas:

- Sept. 2013 – Begin construction (includes start of invasive plant eradication).
- Jan. 2014 – End construction (but could be as late as Feb. or March of 2014).
- March 2014 – Install plants.

Note: All of the above timelines are preliminary and are subject to refinement as plans are refined for a particular mitigation site.

Planting of Swamp Restoration Areas -----

Initial plantings will be:

- Canopy species: plant on 9-foot centers (538 trees/acre); of total trees planted, approximately 70% will be cypress while the remaining trees will consist of tupelo and other non-cypress species.
- Midstory species (shrubs and small trees): plant on 20-foot centers (109 seedlings per acre).
- Stock size (minimums): Canopy species = 1 year old, 3 feet tall, 0.5” root collar; Midstory species = 1 year old, 3 feet tall.

Planting of Swamp Enhancement Areas -----

Initial plantings will follow the same guidelines as for swamp restoration areas regarding the general density of installed plants and the stock used. Where initial enhancement activities include the eradication of invasive and nuisance plant species, significant numbers of native canopy and/or midstory species may remain, but in a spatial distribution that leaves relatively large “gaps” in the canopy stratum and/or the midstory stratum. In such cases, areas measuring approximately 25 feet by 25 feet that are devoid of native canopy species should be planted and areas measuring approximately 45 feet by 45 feet that are devoid of native midstory species should be planted.

The typical guideline of having roughly 70% of the canopy species planted be cypress and 30% of the canopy species planted be tupelo and other non-cypress species may be altered in situations where several native trees remain after eradicating invasive/nuisance species. For example, if the remaining native trees are almost all cypress, then a greater proportion of the planted trees may consist of non-cypress species. Similarly, the composition of the species planted might also be altered to be more representative of the species composition present in nearby healthy swamp habitats.

2.3 SWAMP WVA MODEL – TARGET YEARS FOR MODELS

Typically use the target years specified below when analyzing swamp restoration polygons built in existing open water features and for any other swamp restoration polygons that require deposition of fill material as part of the construction process:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. No plants installed. V1 = Class 1; V3 = permanent duration.
2	2015	Restoration feature settles to desired target grade. Any associated perimeter containment dikes are degraded or gapped. Plants installed. V1 = Class 1; V2 = 538 trees/ac.; V3 = seasonal duration.
3	2016	V1 = Class 2; V2 = 269 trees/ac.; V3 = seasonal duration.
4	2017	V1 = Class 2; V2 = 258 trees/ac.; V3 = seasonal duration.
15	2028	V1 = Class 6; V2 = 215 trees/ac.; V3 = seasonal duration.
35	2048	V1 = Class 6; V2 = 161 trees/ac.; V3 = seasonal or semi-permanent duration.
50	2063	End of project life for a HSDRRS mitigation feature. V2 = 161 trees/ac.; V3 = semi-permanent or permanent duration.

Typically use the target years specified below when analyzing swamp restoration polygons that do not require deposition of fill material as part of the construction process, and when analyzing BLH enhancement polygons:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. Initial eradication of invasive & nuisance plant species is started and completed. Plants are installed (either in March or in December depending on construction activities. Appropriate planting season extends from November through February). V1 = Class 1; V2 = 538 trees/ac.; V3 = seasonal duration.
2	2015	V1 = Class 2; V2 = 269 trees/ac.; V3 = seasonal duration.
3	2016	V1 = Class 2; V2 = 258 trees/ac.; V3 = seasonal duration.
15	2028	V1 = Class 6; V2 = 215 trees/ac.; V3 = seasonal duration.
35	2048	V1 = Class 6; V2 = 161 trees/ac.; V3 = seasonal or semi-permanent duration.
50	2063	End of project life for a HSDRRS mitigation feature (adjusted end to be consistent with final TY used in impact WVAs). V2 = 161 trees/ac.; V3 = semi-permanent or permanent duration.

The user of these guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

3.1 FRESH MARSH MODEL – GENERAL ASSUMPTIONS

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions.
1	2014	10% credit.
3	2016	50% credit.
5	2018	100% credit.
6	2019	100% credit.

Note: Assume the created elevation settles to target grade by TY3. After TY5, cover of the land acres after land loss is applied will remain optimal until conditions in the mitigation polygon shift to open water (based on Ronny magic spreadsheet calculations).

FWOP scenario:
2010 land rolled forward by applying 3 years of loss.

General Notes:

1. Typically, no existing project benefits are considered under FWOP. Project sites were typically selected to avoid overlap with existing non-diversion projects. In the case of existing diversions, either the effect of the diversion is assumed to be captured in the historic loss rate or the diversion would have to substantially fill in the project site FWOP to affect the net changes under V1 and V4, plus marsh creation gets optimal credit on its own if or until accretion does not keep pace with RSLR. Doing marsh creation in diversion areas may be more sustainable. However, not capturing that potential higher sustainability effect within the WVA would be more conservative for compensatory purposes (i.e., would generate less AAHUs and require more acres), but would not allow differentiation between sites with or without existing diversion influence where that influence is not captured in the historic loss rate.

   In limited cases, some existing project benefits are indeed considered under FWOP. Coordinate directly with CEMVN to determine whether any benefits from existing projects should be considered under the FWOP scenario.
2. Under the FWP scenario, begin applying land loss once the marsh fill has settled to the desired target grade (i.e. in TY2, one year after completion of initial fill placement). The USGS loss rates derived from a linear regression will be applied using a linear loss rate.
3. For the FWP scenario, one must subtract the acreage of interior borrow areas (borrow used to build dikes) from the total acreage of marsh land to derive the percentage of the total feature acreage that will count as marsh land. These borrow areas will have a greater settlement rate than will other portions of the mitigation feature. Seek engineering input as to what percentage of the borrow area footprint will settle to an elevation whereby the area would be considered as shallow open water rather than marsh land.
4. For the FWP scenario, one must also subtract the acreage of any trenasses initially constructed from the total acreage of marsh land to derive the acreage that will count as marsh land. These trenasses will count as shallow open water areas (assuming they are not excavated over 1.5 feet deep in relation to the marsh surface elevation).
5. For the FWP scenario, only those portions of earthen retention dikes that fall within the intertidal range can be included in the marsh restoration feature acreage. Portions of such dikes that are not degraded such that their crest elevation is equal to the final marsh target elevation cannot be counted in the acreage of the marsh feature, nor can portions of the dikes that will remain underwater. Similarly, the footprints occupied by proposed foreshore dikes (rock dikes) cannot be counted in the acreage of the marsh feature.
6. It is assumed that proposed fresh marsh restoration features will not be planted. Instead, it is assumed that suitable vegetative cover will develop rapidly via natural recruitment and colonization of the feature.
7. For the FWP scenario, land loss will be assumed to begin once the restored marsh feature has settled to the desired target grade. This will occur 1 year after the initial construction (dike construction, placement of fill as slurry) has occurred.

V2 – Percent Open Water Area Covered by Submerged Aquatic Vegetation

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	0%
3	2016	0%
5	2018	Same as baseline cover by SAV.
6	2019	Increase baseline SAV cover by 15%, then hold this through TY25 (i.e. the SI value plateaus).
25	2038	See guidance for TY6.
50	2063	50% of baseline cover by SAV.

Marsh restore, FWOP scenario:
TY50 (2063) = 30% of baseline

Note:
Base the SAV cover estimates on the average cover during the peak of the growing season. SAVs do not include floating aquatics (but do include floating-leaf aquatics).

General Notes:
Fresh and intermediate marshes often support diverse communities of floating-leaved and submerged aquatic plants that provide important food and cover to a wide variety of fish and wildlife species. A fresh/intermediate open water area with no aquatics is assumed to have low suitability (SI=0.1). Optimal conditions (SI=1.0) are assumed to occur when 100 percent of the open water is dominated by aquatic vegetation. Habitat suitability may be assumed to decrease with aquatic plant coverage approaching 100 percent due to the potential for mats of aquatic vegetation to hinder fish and wildlife utilization; to adversely affect water quality by reducing photosynthesis by phytoplankton and other plant forms due to shading; and contribute to oxygen depletion spurred by warm-season decay of large quantities of aquatic vegetation. These effects are highly dependent on the dominant aquatic plant species, their growth forms, and their arrangement in the water column; thus, it is possible to have 100 percent cover of a variety of floating and submerged aquatic plants without the above-mentioned problems due to differences in plant growth form and stratification of plants through the water column. Because predictions of which species may dominate at any time in the future would be tenuous, at best, the EnvWG decided to simplify the graph and define optimal conditions at 100 percent aquatic cover.

SAV coverage is site specific and should be considered on a case-by-case basis. However, in an attempt to provide some general assumptions, the following project specific conditions should be considered when assessing SAV coverage for FWP and FWOP:

- Water depth
- Project area location: inland/protected vs. open to lake or bay processes
- Salinity levels
- Nutrient input (e.g. within diversion outfall area)
- Rate of land loss and RSLR

Restoring marsh within open water areas will reduce wave fetch, increase shallow open water and buffer inland areas increasing tidal lag. Generally, SAV coverage should increase as a result. In some cases existing conditions are already optimal for SAV coverage and, therefore, under FWP conditions percent cover should be maintained.

Consideration of the rate of land loss and RSLR for the project life should also be factored in. For FWOP, an area supporting SAV coverage will likely continue to experience subsidence and marsh loss resulting in reduced SAV coverage, and potentially reaching a point of habitat collapse where SAV is not supported. While under FWP conditions the area will continue to experience subsidence and marsh loss, it is assumed that the rate of loss has been reduced as a result of bringing in external sediment.

For sites located in freshwater diversion outfall areas, SAV coverage will likely be maintained for FWP and FWOP conditions due to nutrient input. Consideration should still be given for land loss rates, RSLR, and juxtaposition to and coalescence with large open water areas.

V3 – Marsh Edge and Interspersion

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	100% Class 5
3	2016	100% Class 3
5	2018	50% Class 3 and 50% Class 1
6	2019	100% Class 1

Notes:
When assigning SI values to variable V3, the percent marsh values (variable V1) should also be considered and interspersion classes developed accordingly. This could result in assumptions that differ from those indicated above.
Between TY6 and TY50, one must use best professional judgment coupled with land loss projections to determine appropriate SI values for variable V3.

V4 – Percent of the Open Water Area ≤ 1.5 Feet Deep (in relation to marsh surface)

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	Any marsh lost becomes shallow open water.
3	2016	Any marsh lost becomes shallow open water.
5	2018	Any marsh lost becomes shallow open water.
6	2019	Any marsh lost becomes shallow open water.
50	2063	$1/6^{th}$ of the shallow open water becomes deep based on 0.5 feet of subsidence.

Marsh restore, FWOP scenario:

- Marsh lost between TY1 & TY50 becomes shallow open water.
- At TY50, 1/3 of existing shallow water becomes deep (based on subsidence rate used in determining SLR adjustment).

V5 – Salinity

Assume salinity scores will be the same for FWP and FWOP scenarios.

Assume salinity values will not change enough over time to force a shift from the fresh marsh model to the brackish marsh model.

Data Source --
CRMS site http://www.lacoast.gov/crms2/Home.aspx - Click on Basic Viewer under the Mapping link. Click on the nearest data station and then select the Water tab to get the salinities. The data are approximately average annual and most appropriate for the Brackish Marsh and Saline Marsh models if the period of record doesn't have an anomalous event (e.g., drought, unusual FW diversion operation). Average annual salinity may be accepted on a case-specific basis for the Fresh Marsh/Intermediate Marsh model as well.

V6 – Aquatic Organism Access (% wetland accessible & type of access)

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	0.0001 (supratidal; retention dikes not gapped or degraded)
3	2016	0.0001 (supratidal; retention dikes have been gapped or degraded)
5	2018	1.0 (intertidal)
6	2019	1.0 (intertidal)
50	2063	1.0 (intertidal)

Note:
Suggested minimum standard for "gapping" containment dikes or similar dikes is no less than one 25-foot wide gap (bottom width) every 1,000 feet, with the "gap" excavated to the desired average marsh elevation. The preferred standard is one 25-foot wide gap (bottom width) every 500 feet, with the "gap" excavated to the pre-project elevation (i.e. the water bottom). If the project design does not provide the minimum gapping, then the organism access values indicated above will need to be adjusted accordingly (re the maximum score attained as of TY5).

Marsh restore, FWOP scenario:
The structure rating is based on site specific, existing conditions and how those may change over time with land loss.

3.2 INTERMEDIATE MARSH MODEL – GENERAL ASSUMPTIONS AS THEY DIFFER FROM FRESH MARSH MODEL ASSUMPTIONS

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Marsh restore, FWP scenario:

Calendar Year	TY	Planted Marsh Platform (credit)	50% planting rate (credit)	Unplanted Marsh Platform (credit)
2013	0 (baseline)			
2014	1 (supratidal)	10%	5%	0%
2016	3 (supratidal)	25%	17.5%	15%
2018	5 (intertidal)	100%	50%	50%
2019	6 (intertidal)	100%	100%	100%

Note: Assume 7-ft center planting densities.

3.3 BRACKISH MARSH MODEL – GENERAL ASSUMPTIONS AS THEY DIFFER FROM FRESH MARSH MODEL ASSUMPTIONS

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Marsh restore, FWP scenario:

Calendar Year	TY	Planted Marsh Platform (credit)	50% planting rate (credit)	Unplanted Marsh Platform (credit)
2013	0 (baseline)			
2014	1 (supratidal)	10%	5%	0%
2016	3 (supratidal)	25%	17.5%	15%
2018	5 (intertidal)	100%	50%	50%
2019	6 (intertidal)	100%	100%	100%

Note: Assume 7-ft center planting densities.

V2 – Percent Open Water Area Covered by Submerged Aquatic Vegetation

Marsh restore, FWP scenario:

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	0%
3	2016	0%
5	2018	Same as baseline conditions.
6	2019	Increase baseline by 10%, then maintain this through TY25 (i.e. SI value plateaus).
25	2038	See guidance for TY6.
50	2063	25% of baseline conditions.

Marsh restore, FWOP scenario:
TY50 (2063) = 15% of baseline conditions.

General Notes:
Brackish marshes also have the potential to support aquatic plants that serve as important sources of food and cover for several species of fish and wildlife. Although brackish marshes generally do not support the amounts and kinds of aquatic plants that occur in fresh/intermediate marshes, certain species, such as widgeon-grass, and coontail and milfoil in lower salinity brackish marshes, can occur abundantly under certain conditions. Those species, particularly widgeon-grass, provide important food and cover for many species of fish and wildlife. Therefore, the V_2 Suitability Index graph in the brackish marsh model is identical to that in the fresh/intermediate model.

3.4 ADDITIONAL GUIDANCE FOR MARSH RESTORATION FEATURES PROPOSED IN AREAS WHERE THERE IS NO SIGNIFICANT LAND LOSS OVER TIME

The guidance provided herein is only applicable to proposed marsh restoration (marsh creation) features located in areas where data indicate no land loss will occur over the life of the mitigation project. For proposed marsh restoration features located in areas where there will be land loss, the general assumptions previously provided for use in running WVA marsh models will remain applicable.

V1 - % of Wetland Area Covered by Emergent Vegetation

Guidance for determining how much of the restored marsh feature will be land and how much will be shallow open water:

- Assume 1% of the total feature acreage will be open water in TY1 and 99% of the total acreage will be land.
- After TY1, increase the open water area by 0.075% each year using the total feature acreage to determine the acreage increase. Decrease the total acreage of land accordingly.

Example Calculation:
Assume the proposed marsh restoration feature encompasses 100 acres that can all be counted as marsh land. At TY1, the land area will be 99% of the 100 acres while the open water area will be 1% of the 100 acres. The increase in the open water area per year after TY1 and the decrease in the land area per year after TY1 will be: 0.075% X 100 acres = 0.075 acre per year.

Determination of land area and open water area:

TY	Land Acres	Open Water Acres	Open Water Calculation	Land Calculation
1	99.00	1.00	100 ac.*0.01	100 ac.*0.99
3	98.85	1.15	(1.0 ac. at TY1) + (2 yrs * 0.075 ac./yr.) = A	(99.0 ac. at TY1) - A
5	98.70	1.30	(1.0 ac. at TY1) + (4 yrs * 0.075 ac./yr.) = B	(99.0 ac. at TY1) - B
6	98.625	1.375	(1.0 ac. at TY1) + (5 yrs * 0.075 ac./yr.) = C	(99.0 ac. at TY1) - C
21	97.50	2.50	(1.0 ac. at TY1) + (20 yrs * 0.075 ac./yr.) = D	(99.0 ac. at TY1) - D
25	97.20	2.80	(1.0 ac. at TY1) + (24 yrs * 0.075 ac./yr.) = E	(99.0 ac. at TY1) - E
50	95.325	4.675	(1.0 ac. at TY1) + (49 yrs * 0.075 ac./yr.) = F	(99.0 ac. at TY1) - F

Determination of land area covered by emergent vegetation (marsh area):

TY	Land Acres	Marsh Acres	Marsh Area Calculation
1	99.00	9.9	99.0 ac. land * 0.10 (i.e. 10% of land covered by emergent vegetation)
3	98.85	49.425	98.85 ac. land * 0.50 (i.e. 50% of land covered by emergent vegetation)
5	98.70	98.70	98.70 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
6	98.625	98.625	98.70 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
21	97.50	97.50	97.50 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
25	97.20	97.20	97.20 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)
50	95.325	95.325	95.325 ac. land * 1.00 (i.e. 100% of land covered by emergent vegetation)

Notes:

1. Values for TY0 will be based on existing conditions within the marsh restoration features.
2. The general assumptions applicable to determining the percentage of the marsh feature acreage (e.g. land acreage) that is covered by emergent vegetation remain the same as those set forth in the original fresh marsh WVA model guidance. These assumptions are: TY1 = 10%; TY3 = 50%; TY5 = 100%; TY6 = 100%.
3. Refer to the notes under the variable V1 assumptions for fresh marsh models concerning how features such as dikes, interior borrow areas, and constructed trenasses must be handled as regards the acreage of marsh land.

V4 – Percent of the Open Water Area ≤1.5 Feet Deep (relative to marsh surface)

Assume all of the open water areas that develop within the marsh feature (see variable V1 guidance) will be less than or equal to 1.5 feet deep. This assumption is applicable to target years 1 through 50.

3.5 PROJECT CONSTRUCTION NOTES FOR RESTORED MARSHES

The typical anticipated schedule for initial construction associated with the proposed marsh restoration features is as follows:

- Sept. 2013 – Begin construction
- May 2014 – Complete construction
- May 2015 – Initial marsh grade settles to target grade (1 year after end of construction). Degrade containment dikes, and/or install “fish gaps”, and or establish gaps in other dikes.
- 2015 – Install plants (intermediate marsh and brackish marsh features only).

Note that none of the proposed fresh marsh restoration features will be planted. It was assumed that these areas would be sufficiently vegetated via natural recruitment and colonization. Planting would only occur if sufficient vegetative cover (herbaceous) does not develop through natural processes.

Remember that it is very important to review the most detailed design plans available (e.g. initial 35% design plans (drawings), or 65%+ design plans), and the project description narrative associated with these plans. These descriptions and drawings contain important information for specific mitigation features/sites that will affect assumptions used in the WVA models.

3.6 MARSH MODELS – MODEL TARGET YEARS

Typically use the target years specified below when analyzing marsh restoration polygons built in existing open water features:

TY	Year	
0	2013	Baseline conditions (assume construction starts in 2014 even though anticipated start is late 2013)
1	2014	Initial construction activities begin and are completed. No plants installed. V1 = 10% credit (but see calcs for areas where there is no land loss). V2 = 0%. V3 = 100% Class 5. V4 = lost land becomes shallow water. V6 = 0.0001.
3	2016	Restoration feature settles to desired target grade. Any associated perimeter containment dikes are degraded or gapped. Plants installed in intermediate and brackish marsh features (no planting in fresh marsh features since none required). V1 = 50% credit (but see calcs for areas where there is no land loss). V2 = 0%. V3 = 100% Class 3. V4 = lost land becomes shallow water. V6 = 0.0001.
5	2018	V1 = 100% credit (but see calcs for areas where there is no land loss). V2 = baseline SAV cover. V3 = 50% Class 3 and 50% Class 5. V4 = lost land becomes shallow water. V6 = 1.0
6	2019	V1 = 50% credit (but see calcs for areas where there is no land loss). V2 = increase baseline SAV cover by 15%. V4 = lost land becomes shallow water. V6 = 1.0
25	2038	V2 = increase baseline SAV cover by 15%.
50	2063	End project life. V2 = 50% of baseline SAV (FWP). V3 = 100% Class 3. V4 = 1/6th of shallow open water becomes deep (FWP); but if no land loss, all open water remains shallow. V6 = 1.0

The user of these guidelines is cautioned that the construction schedule for proposed mitigation features may not follow the construction schedule assumed in the preceding sections. If this is the case, the model target years and their associated model assumptions may have to be adjusted accordingly.

4.1 RELATED TOPICS – LAND LOSS AND ACCRETION

LAND LOSS RATES

To remain consistent with the WVAs run for the levees (including those for the 57-year period of analysis), the linear loss rates must be calculated in the linear loss spreadsheet. This requires 1984 to 2010 mitigation analysis/land change data from USGS within which a particular time period is chosen depending on water levels taken at that time with efforts to pick years that allow for the greatest time during this range. Data selection is subject to interagency approval. The rate should be calculated in acres/year for integration with below methods on SLR and accretion.

The land loss rate applied to restored marshes will be 50% of the background (FWOP) loss rate. However, land loss rates will revert back to baseline rates after 10 inches of soil have formed/accreted above the initially created marsh platform. Based on input from Dr. Andy Nyman and other academics, plant roots extend downward a maximum of approximately 10 inches below the marsh surface. Consequently, when the plant roots are no longer in contact with the created platform, loss rates revert back to those of the adjoining marshes (i.e., background loss rate).

Derivation and Application of Land Loss Rates

A linear regression is applied to USGS' hyper-year (hyper temporal) data of the extended boundary. The slope of the regression line provides the acres of marsh lost for the extended boundary during the years of USGS analysis. By dividing the slope (marsh lost in acres) by the acreage at the beginning of the USGS evaluation period (e.g. 1984), the percent loss rate is determined for the extended boundary. (Note: USGS provides a percent loss rate by dividing the marsh lost in acres by the total acres of the extended polygon, which is why the percent loss rates are different.)

The project area FWOP loss rate (in acres/year) is determined by applying the extended boundary percent loss rate to the marsh acres in the project area at the beginning of the USGS period of analysis (e.g. 1984 in this case) under FWOP. The project area FWP loss rate is determined by multiplying the acres of the marsh creation area by the percent loss rate and dividing by 2 to apply the 50% reduction in loss for marsh creation.

ACCRETION

Utilize the following accretion rates when running WVA models:

- Fresh Marsh and Intermediate Marsh = 7.2 mm/year.
- Brackish Marsh = 7.7 mm/year.

Accretion is incorporated into determining when the background loss rate resumes within a created marsh area. Normally, the loss of mechanically created or nourished marsh is considered to be half of background loss rate. In the year when post-construction accretion exceeds 10 inches, the loss rate returns to the background loss rate. However, when created marshes are higher than natural marshes, there could be a delay in the loss rate change. Depending on the mechanically created marsh elevation post-construction, cumulative accretion assumes a 3-year settling period (marsh creation sites are assumed to achieve full functionality and vegetation coverage 3 years after construction).

Marsh collapse is a 10-year period that begins when the calculated cumulative accretion deficit reaches limits determined by staff working on the modeling for the 2012 Coastal Master Plan (see below). Typically, the collapse criteria are reached only during the High SLR scenario, however this generalization may not hold true in all cases.

Collapse Threshold Ranges Used in Master Plan Work

- Intermediate Marsh (cm): Low = 30.7; High = 38.0; Median = 34.4
- Brackish Marsh (cm): Low = 20.0; High = 25.8; Median = 22.9.
- Saline Marsh (cm): Low = 16.0; High = 25.0; Median = 20.5.

Collapse threshold selected as the median range for type of marsh indicated. First year of collapse is the year when the Cumulative Accretion Deficit (inundation) is equal to or greater than the median range.

Accelerated Sea Level Rise

The land loss rates determined as described above, are for the constant historic or low SLR scenario (1.7 mm/yr). Based on water level gages and known historic SLR rates, the Corps has identified RSLR rates under the historic SLR scenario, and under the intermediate and high SLR scenarios. The intermediate and high SLR scenarios would result in gradually accelerating SLR rates and it is assumed that those scenarios would result in accelerating land loss rates. Using Corps-predicted water level rise, RSLR rates can be determined. RSLR rates are then converted into an annual adjustment factor that increases wetland loss rates in proportion to the magnitude of the RSLR rate. The annual wetland loss rate adjustment factors are based on a positive relationship observed between wetland loss rates and RSLR rates from coastwide non-fresh marshes. In this relationship, RSLR was calculated as the sum of subsidence per statewide subsidence zones (see Figure 1) plus a eustatic SLR rate of 1.7 mm/yr. Recent land loss rates in percent per year were plotted against RSLR determined for those subsidence zones.

Although this is approaching the limits of rigor for WVA, each of the above methods carry substantial averaging and compounding uncertainty. Users should be aware of the general limits of accuracy and avoid adding more complexity unless deemed necessary and reasonable.

4.2 RELATED TOPICS - GENERAL SHORELINE PROTECTION ISSUES

Hard structures (foreshore dikes, rock dikes, breakwaters) get credit for preventing 100% of loss from shoreline erosion as long as the structure is maintained. If it is not maintained, then a linear decrease in effectiveness must be assumed beginning after the end of the maintenance period. For example, if a rock dike is assumed to need a lift every 14 years but the last lift was at year 14 (TY14), then beginning TY28 (for the rock) it would have a linear decrease in effectiveness to the point of not reducing shoreline erosion at all by TY42.

Vegetative plantings get credit for reducing shoreline erosion by 50% until TY20. After TY20, the area would revert to 100% of the shoreline erosion rate.

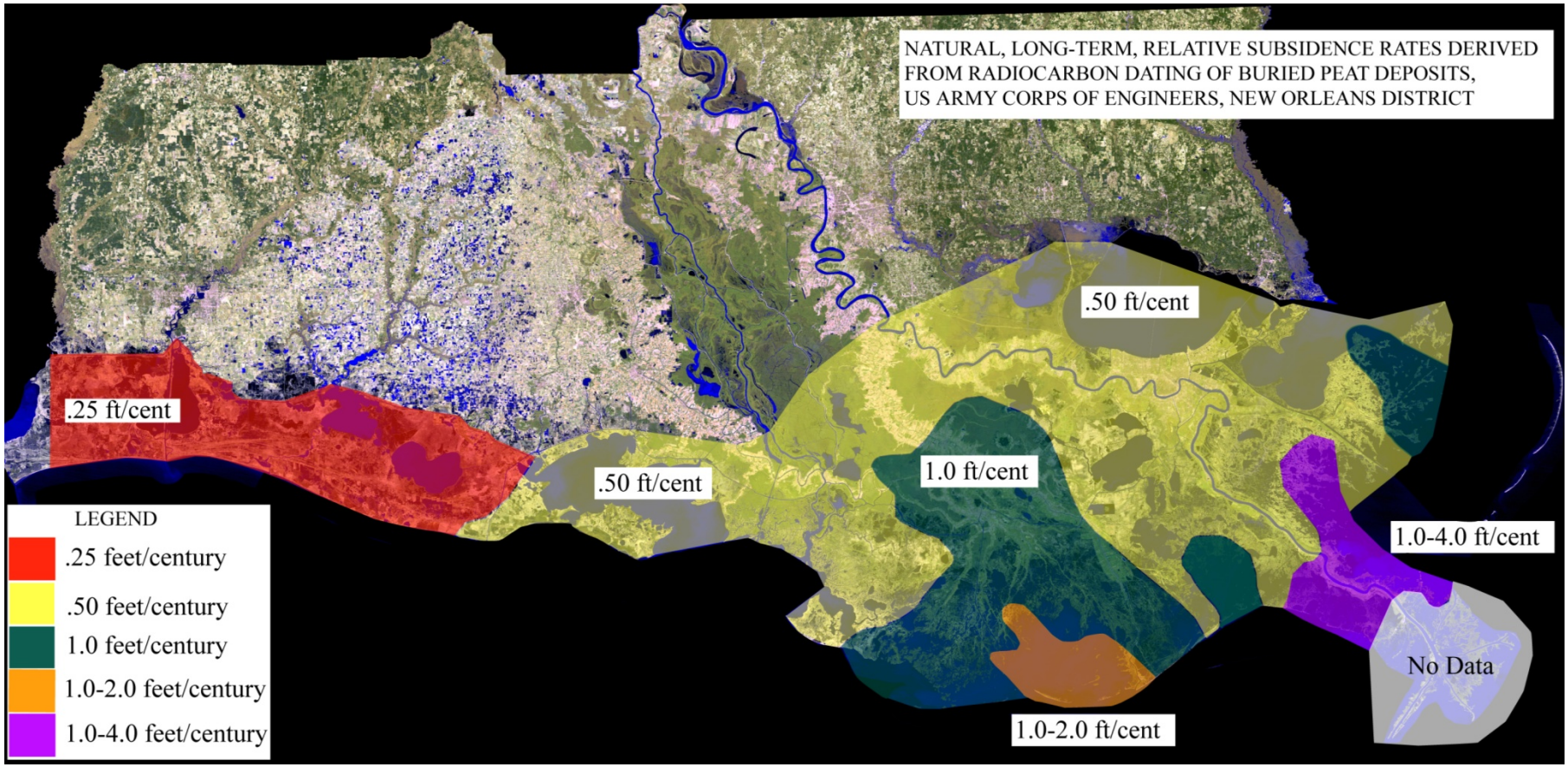

Figure 1. Long-term relative subsidence rates.

APPENDIX J

GENERAL MITIGATION GUIDELINES: PLANTINGS, SUCCESS CRITERIA, MONITORING, AND OTHER GENERAL GUIDANCE

INTRODUCTION

This document contains general mitigation guidelines applicable to both the LPV HSDRRS Mitigation Project and the WBV HSDRRS Mitigation Project. They were developed by the USACE in coordination with the Interagency Team and the Non-Federal Sponsor (NFS). These guidelines served to help develop plans for the final array of mitigation projects considered and also served to help estimate preliminary mitigation construction, mitigation monitoring/reporting, and mitigation management/maintenance costs associated with the final array of mitigation projects considered.

It is important to understand that the guidelines addressed herein were not intended to serve as the final mitigation program/plan for a particular Tentatively Selected Mitigation Project (TSMP) addressed in Section 2 of the Programmatic Individual Environmental Report (PIER) for the LPV HSDRRS Mitigation. More detailed and project-specific mitigation plans for each TSMP will be prepared during the process of preparing the Tiered IER (TIER) covering a particular TSMP. Such mitigation plans, including components such as planting plans, success criteria, monitoring/reporting requirements, management/maintenance plans, etc., will be prepared by the USACE in coordination with the Interagency Team and the Non-Federal Sponsor. However, such final mitigation plans would not deviate substantially as regards the basic tenents set forth in this document.

It is also important to understand that certain provisions will apply to any Corps-constructed mitigation project. Some, but not necessarily all, of these provisions are discussed in the following paragraph.

The proposed mitigation actions will include construction, with the Non-Federal Sponsor responsible for operation and maintenance of functional portions of work as they are completed. On a cost shared basis, USACE will monitor completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve mitigation success. USACE will undertake additional actions necessary to achieve mitigation success in accordance with cost sharing applicable to the project and subject to the availability of funds. Once USACE determines that the mitigation has achieved initial success criteria, monitoring will be performed by the Non-Federal Sponsor 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, USACE will consult with other agencies and the Non-Federal Sponsor to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, USACE will 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.

MITIGATION PLANTING GUIDELINES

PLANTING GUIDELINES FOR BOTTOMLAND HARDWOOD (BLH) HABITATS

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 18-foot centers (average) to achieve a minimum initial stand density of 134 seedlings per acre. Stock will be at least 1 year old, at least 2 feet in height, have a minimum root collar diameter of 3/8 inch, have a root length of at least 8 to 10 inches with at least 4 to 8 lateral roots, and must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however,

unanticipated events such as spring flooding may delay plantings until late spring or early summer. The seedlings will be installed in a manner that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

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

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

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

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

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

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

Common Name	Scientific name	Percent Composition
Drummond red maple	*Acer rubrum* var. *drummondii*	15% - 25%
Sugarberry	*Celtis laevigata*	15% - 25%
Green ash	*Fraxinus pennsylvanica*	15% - 25%
Sweetgum	*Liquidambar styraciflua*	10% - 20%
American elm	*Ulmus americana*	10% - 20%
Bald cypress	*Taxodium distichum*	5% - 15%

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

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

TBD = To Be Determined

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

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

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

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

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

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

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

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

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

TBD = To Be Determined

Deviations from Typical Planting Guidelines

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

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

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

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

Given these uncertainties, initial planting plans specific to enhancement features will be required and must be specified in the Mitigation Work Plan for the mitigation site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting. With the exception of any re-planting actions necessary to attain the initial survivorship success criteria (i.e. survival required 1 year following completion of initial plantings), the NFS will be responsible for preparing re-planting plans and conducting re-planting activities, subject to the provisions mentioned in the Introduction section. Re-planting necessary to achieve the initial survivorship criteria will be the responsibility of the USACE. subject to the provisions mentioned in the Introduction section.

PLANTING GUIDELINES FOR SWAMP HABITATS

Canopy species will be planted on 9-foot centers (average) to achieve a minimum initial stand density of 538 seedlings (trees) per acre. Midstory species will be planted on 18-foot centers (average) to achieve a minimum initial stand density of 134 seedlings per acre. Stock used for canopy species will be at least 1 year old, at least 3 feet tall, and have a root collar diameter that exceeds 0.5 inch. Stock used for midstory species will be at least 1 year old and will be at least 3 feet tall. All stock must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. The plants will typically be installed during the period from December through March 15 (planting season/dormant season); however, unanticipated events may delay plantings until late spring or early summer. The seedlings will be installed in a manner that that avoids monotypic rows of canopy and midstory species (i.e. goal is to have spatial diversity and mixture of planted species). If herbivory may threaten seedling survival, then seedling protection devices such as wire-mesh fencing or plastic seedling protectors will be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Table 3A. The species composition of the plantings should mimic the percent composition guidelines indicated in this table. However, site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated. In general, a minimum of 3 canopy species should be utilized, the plantings must include baldcypress and tupelogum (water tupelo), and baldcypress should typically comprise at least 50% of the total number of seedlings installed.

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

Table 3A: Preliminary Planting List for Swamp Habitat, Canopy Species

Common Name	Scientific name	Percent Composition
Bald cypress	*Taxodium distichum*	60% - 75%
Tupelogum	*Nyssa aquatic*	20% - 25%
Green ash	*Fraxinus pennsylvanica*	10% - 15%
Drummond red maple	*Acer rubrum* var. *drummondii*	5%
Bitter pecan	*Carya x lecontei*	5% - 10%

Table 3B: Preliminary Planting List for Swamp Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Buttonbush	*Cephalanthus occidentalis*	TBD
Roughleaf dogwood	*Cornus drummondii*	TBD
Swamp privet	*Forestiera acuminata*	TBD
Possumhaw	*Ilex decidua*	TBD
Virginia willow	*Itea virginica*	TBD
Wax myrtle	*Myrica cerifera*	TBD
Swamp rose	*Rosa palustris*	TBD
American snowbell	*Styrax americanus*	TBD

TBD = To Be Determined

Deviations from Typical Planting Guidelines

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

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

The initial enhancement actions involved within a particular swamp enhancement mitigation site could include a variety of measures such as the eradication of invasive and nuisance plant species, topographic alterations (excavation, filling, grading, etc.), and hydrologic enhancement actions (alterations to drainage patterns/features, installation of water control structures, etc.). These actions may result in areas of variable size that require planting of both canopy and midstory species using the typical densities/spacing described above. There may also be areas where several native canopy and/or midstory species remain, thus potentially altering the general guidelines described as regards the spacing of plantings, and/or the species to be planted, and/or the percent composition of planted species. Similarly, areas that must be re-planted due to failure in achieving applicable mitigation success criteria may involve cases where the general guidelines discussed above will not necessarily be applicable.

Given these uncertainties, initial planting plans specific to a mitigation site will be required and must be specified in the Mitigation Work Plan for the site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting. With the exception of any re-planting actions necessary to attain the initial survivorship success criteria (i.e. survival required 1 year following completion of initial plantings), the NFS will be responsible for preparing re-planting plans and conducting re-planting activities, subject to the provisions contained in the Introduction section. Re-planting necessary to achieve the initial survivorship criteria will be the responsibility of the USACE, subject to the aforementioned provisions.

PLANTING GUIDELINES FOR MARSH HABITATS

Planting Guidelines for Intermediate and Brackish Marsh Habitats

Herbaceous species will be planted on 7-foot centers (average) to achieve a minimum density of 889 plants per acre. Stock will typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. The required stock size for each plant species proposed for installation must be specified in the Mitigation Work Plan. Plants must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. Plant installation should be conducted during the period from March 15 through June 15. Planting should not be undertaken later than approximately July 15, although planting during the early fall may be deemed acceptable on a case-by-case basis.

Species installed in proposed intermediate marsh habitats will be selected from the species list provided in Table 4. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be dependent on various factors including site conditions and planting stock availability.

Table 4: Preliminary Planting List for Intermediate Marsh Habitats

Common Name	Scientific Name
California bulrush	*Schoenoplectus californicus*
Black needle rush	*Juncus roemerianus*
Giant cutgrass	*Zizaniopsis miliacea*
Marsh-hay cordgrass	*Spartina patens*
Maidencane	*Panicum hemitomon*
Common threesquare	*Schoenoplectus americanus*
Big cordgrass	*Spartina cynosuroides*
Seashore paspalum	*Paspalum vaginatum*

Species installed in proposed brackish marsh habitats will be selected from the species list provided in Table 5. Plantings will consist of at least 2 different species. The species used and the proportion of the total plantings represented by each species will be dependent on various factors including site conditions and planting stock availability.

Table 5: Preliminary Planting List for Brackish Marsh Habitats

Common Name	Scientific Name
Marsh-hay cordgrass	*Spartina patens*
Black needle rush	*Juncus roemerianus*
Smooth cordgrass	*Spartina alterniflora*
Common threesquare	*Schoenoplectus americanus*
Saltmarsh bulrush	*Schoenoplectus robustus*
Salt grass	*Distchilis spicata*

Planting Guidelines for Fresh Marsh Habitats

Planting of fresh marsh habitats is not proposed since it is anticipated that desirable fresh marsh vegetation would rapidly colonize such habitats through natural recruitment. Should the initial vegetation success criteria for such features not be achieved however, supplemental planting of herbaceous species would be conducted to help insure the establishment of sufficient vegetative cover. Stock will typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. The required stock size for each plant

species proposed for installation must be specified in the Mitigation Work Plan. Plants must be obtained from a registered licensed regional nursery/grower and of a regional eco-type species properly stored and handled to ensure viability. Plant installation should be conducted during the period from March 15 through June 15. Planting should not be undertaken later than approximately July 15, although planting during the early fall may be deemed acceptable on a case-by-case basis.

The plant species to be installed would be determined based on field inspections of the mitigation site as would the planting plan (e.g. location of supplemental plantings and density of such plantings). Potential species to be installed could include such plants as maidencane, giant cutgrass, arrowheads (*Sagittaria* spp.), pickerelweed (*Pontederia cordata*), arrow arum (*Peltandra virginica*), smartweed (*Polygonum* spp.), common rush (*Juncus effusus*), pennyworts (*Hydrocotyle* spp.), and spikerush (*Eleocharis* spp.), although other species could be utilized. Typically at least two different species would be utilized.

Deviations from Typical Planting Guidelines

Initial planting plans specific to an intermediate marsh or to a brackish marsh mitigation site will be required and must be specified in the Mitigation Work Plan for the site. The initial planting plans will be developed by the USACE in cooperation with the Interagency Team. Initial plantings will be the responsibility of the USACE, subject to the provisions set forth in the Introduction section. If re-planting of an area is necessary following initial plantings, a specific re-planting plan must also be prepared and must be approved by the USACE in cooperation with the Interagency Team prior to re-planting.

It may be determined that the initial planting of brackish marsh features would best be conducted in phases. Using this approach, a certain percentage of the total number of plants required would be installed in the year that final marsh construction activities are completed while the remainder would be installed in the following year. The determination of whether to use phased planting or to install all the necessary plants upon completion of construction activities will be made during the final design phase of the mitigation project. The proposed planting scheme would be subject to review and approval by the Interagency Team.

As previously discussed, planting of fresh marsh features could be necessary if the initial vegetative cover goal is not achieved. Re-planting of intermediate marsh features and/or brackish marsh features could also be required if the initial plant survivorship goal is not attained or if initial vegetative cover goals are not achieved. In such cases, re-planting or supplemental planting of such mitigation features would be the responsibility of the USACE (subject to the provisions in the Introduction section). Once the initial success criteria are achieved, the NFS will be responsible for conducting any re-planting activities necessary to achieve success, subject to the provisions in the Introduction section. All re-planting plans will be subject to review and approval by the USACE and Interagency Team prior to plant installation. These plans may deviate from the general planting guidelines as regards the density of plantings, the species utilized, or the plant stock size in an effort to rapidly establish appropriate vegetative cover.

ADDITIONAL MITIGATION GUIDELINES

GUIDELINES FOR THE ERADICATION AND CONTROL OF INVASIVE AND NUISANCE PLANT SPECIES

The eradication of invasive and nuisance plant species may incorporate a variety of eradication methods including mechanized removal (ex. hydroaxes, gyro-tracs, heavy machinery used in areas slated for topographic alterations), non-mechanized removal (use of hand implements such as chain saws and machetes, direct uprooting by hand), aerial herbicide applications (applications using aircraft), and ground herbicide applications (on-the-ground applications using backpack sprayers, hypo-hatchet, tube-injector, wick applicators, etc.). Only ground herbicide applications would be used in marsh habitats. Regardless of the methods involved, care will be exercised to avoid damage to desirable native species to the greatest extent practicable.

During the initial eradication process in forested habitats, larger quantities of felled materials may be removed from the mitigation site and disposed in a duly-licensed facility. Some felled woody plants may be chipped

on-site with the chips spread in a layer not exceeding approximately 3 to 4 inches thick. Felled woody plants may also be gathered and stacked "teepee" style in scattered locations. In certain cases, larger invasive trees may be killed and allowed to remain standing if it is determined this would not interfere with mitigation goals. The Mitigation Work Plan must address the specific measures proposed to conduct initial eradication efforts, including handling of vegetative debris, and the recommended measures for the subsequent control of invasive and nuisance plant species.

The USACE will be responsible for the initial eradication of invasive and nuisance plants as well as for any subsequent eradication efforts until such time that the mitigation monitoring responsibilities are transferred to the NFS, pursuant to the provisions contained in the Introduction section. Thereafter, the NFS will be responsible for the successful control and eradication of invasive and nuisance plant species, subject to the cited provisions. The management objectives will be to maintain the mitigation site such that it is essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events.

GUIDELINES FOR CLEARING, GRADING, AND OTHER EARTHWORK ACTIVITIES

Enhancement or restoration activities in certain mitigation areas where the proposed habitat is BLH or swamp may include alterations to existing topography. This includes an array of potential actions such as lowering grades over relatively large areas, breaching or removal of existing berms and spoil banks, filling of drainage canals and ditches, construction of containment berms, etc. The construction process could involve mechanized clearing and grubbing of the areas to be graded followed by the actual grading work.

Prior to the clearing, grubbing, grading, and related earthwork activities, the exact limits of zones requiring clearing and grading/earthwork will be determined in the field and will be marked with protective barriers such as flagging, ropes, stakes, silt fence, enviro-fence, or a combination of such items. These marker barriers will remain in place until grading activities are completed. Prior to initiation of the clearing and grading/earthwork activities, silt fences or similar erosion/sediment control devices will also be installed at appropriate locations adjacent to existing wetlands to control erosion and sediment transport. These erosion/sediment control devices will remain in place until earthwork activities are completed and the disturbed areas are stabilized. Machinery/vehicle ingress and egress routes to the areas requiring earthwork will be restricted to avoid unnecessary damage to nearby upland and wetland areas.

Cleared vegetation will typically be removed from the mitigation site for disposal either within a duly licensed off-site disposal facility. There may be instances, however, where the cleared vegetation may be burned on-site or may be mulched on-site. Soil removed during the grading/earthwork process will either be disposed off-site in a licensed facility or used within the mitigation site as fill if the material is suitable and fill is needed. All other debris generated during the clearing and grading process will be disposed in a duly-licensed off-site facility.

If grading or other earthwork activities are necessary, the Mitigation Work Plan must include detailed plans depicting the required activities (ex. grading contours, cross-sections, stormwater pollution prevention plans, etc.). These plans will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful completion of all initial earthwork activities, subject to the provisions stated in the Introduction section. The NFS will typically be responsible for any subsequent earthwork activities necessary for the proper maintenance of the mitigation site, subject to the provisions stated in the Introduction section. However if the primary purpose of the initial grading/earthwork activities is to enhance site hydrology, then the USACE will typically be responsible for conducting any additional grading/earthwork activities necessary to ensure the hydrologic enhancement objectives (success criteria) are achieved, subject to the provisions contained in the Introduction section. Once it is demonstrated that these objectives have been satisfied, the NFS will then be responsible for any further earthwork activities needed to ensure proper maintenance, subject to the provisions mentioned in the Introduction section.

The construction of all proposed marsh habitats (fresh, intermediate, and brackish marshes) and the construction of some BLH restoration and swamp restoration features will be achieved by adding fill to

existing open water areas. The Mitigation Work Plan for such construction must include a detailed Stormwater Pollution Prevention Plan that minimizes potential impacts to adjacent natural habitats and minimizes degradation of water quality in off-site areas. The USACE will be responsible for preparation of this plan and for the successful completion of all initial construction activities, subject to the provisions found in the Introduction section. Once the applicable topographic success criteria have been achieved, the NFS will thereafter be responsible for any topographic alterations necessary to achieve mitigation success, subject to the provisions set forth in the Introduction section.

GUIDELINES FOR SURFACE WATER MANAGEMENT FEATURES AND STRUCTURES

Enhancement or restoration efforts in some mitigation areas may include construction of surface water management systems and/or installation of water conveyance or water control structures (ex. drainage culverts, flap gates, weirs). If such actions are necessary, the Mitigation Work Plan must include detailed plans for these activities as well as operational specifications if applicable. These plans and specifications will be developed by the USACE in coordination with the Interagency Team. The USACE will be responsible for the successful construction of any surface water management features, drainage structures, and water control structures, subject to the provisions discussed in the Introduction section. The NFS will typically be responsible for the subsequent maintenance and operation activities required, subject to the provisions set forth in the Introduction section.

It is noted that there is a strong preference for mitigation sites that are self-sustaining from a hydrologic perspective. While active water management might be needed in the short-term for establishment of plantings or other reasons, sites that require active hydrologic management to achieve long-term success should generally be avoided.

SWAMP HYDROLOGY GUIDELINES

The optimal hydrologic regime for baldcypress/tupelogum swamps involves both seasonal flooding and good surface water exchange between a particular swamp and adjacent systems. The typical hydroperiod should include several periods of flooding (inundation) and drawdown, or a “pulsing” hydrology. Surface water should be present for extended periods, especially during portions of the growing season, but should be absent (water table at or below the soil surface) by the end of the growing season in most years. At a minimum, standing surface water should be absent for approximately 2 months during the growing season once every 5 years. Abundant and consistent freshwater input from riverine systems is most desirable, as is relatively consistent surface water flow through the swamp during flooded periods. However, other sources of sheetflow into the swamp can be similarly beneficial. The main objective is to have sufficient surface water exchange between the swamp and adjacent habitats. Situations involving permanent flooding and/or no surface water exchange should be avoided when possible.

The following provides some general hydrologic guidelines for mitigation projects involving swamp restoration and for those mitigation projects involving swamp enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program. It is emphasized that these are merely guidelines and the attainment of one or more of these guidelines may not be possible in some situations.

- Strive for a minimum of about 200 consecutive days but no more than roughly 300 consecutive days of inundation (flooding). This period of inundation should overlap a portion of the growing season (preferably the early portion or late portion).
- Strive for a minimum of roughly 40 to 60 consecutive days during the growing season where the water table is at or below the soil surface (i.e. non-inundated period). This non-inundated period should preferably occur during the middle portion of the growing season. The non-inundated period should not exceed approximately 90 to 120 days.
- Strive to achieve an average maximum (peak) water table elevation that ranges between approximately 1.0 feet to 2.0 feet above the soil surface (i.e. depth of average peak inundation is 1.0 to 2.0 feet). Water table elevations greater than 2 feet above the soil surface may occur, however such occurrences should be of relatively short duration (i.e. brief “spikes” in the depth of inundation).

- Locate the mitigation area such that it naturally receives freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the swamp and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the swamp's hydroperiod.

WET BOTTOMLAND HARDWOOD HYDROLOGY GUIDELINES

The optimal hydrologic regime for wet bottomland hardwood (BLH) forests also involves both brief seasonal flooding and sufficient surface water exchange between the forest and adjacent systems. Wet BLH forests (BLH-Wet habitats) are commonly flooded for some portion of the year, although the timing, extent, depth, duration, and source of floodwaters can be highly variable. The hydroperiod commonly includes temporary flooding for brief periods during the growing season; however the water table is typically below the soil surface for the majority of the growing season. When flooding (inundation) does occur, freshwater input from riverine systems is most desirable as is relatively consistent surface water flow through the forest. Having good surface water exchange between the BLH forest and adjacent habitats is the primary objective, thus other sources of sheetflow into the forest besides riverine sources can be similarly beneficial.

The following provides some general hydrologic guidelines for mitigation projects involving BLH-Wet habitat restoration and for those mitigation projects involving BLH-Wet habitat enhancement where enhancement of the existing hydrologic regime is a component of the mitigation work program. These are simply guidelines and the attainment of one or more of these guidelines may not be possible in some situations.

- Avoid extended periods of inundation, particularly during the early portion of the growing season. Brief periods of flooding typically should occur during the winter and early spring, but the water table should be greater than 1 foot below the soil surface for an extended period during the growing season.
- The hydroperiod should be such that the forest is irregularly inundated or soils are saturated to the soil surface for a period ranging from approximately 15 to 30 days during the growing season.
- Locate the mitigation area such that it naturally receives occasional freshwater inputs via surface flow from adjacent lands and such that, during periods of inundation, there is good sheet flow through the mitigation area including a means for surface water discharge from the mitigation area. If the mitigation area cannot be located to attain these goals naturally, then mitigation activities should include actions to achieve these goals to the greatest degree practicable (e.g. include measures to provide for good surface water exchange between the BLH forest and adjacent systems), while at the same time not jeopardizing hydrology objectives pertaining to the forest's hydroperiod.

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING: BOTTOMLAND HARDWOOD MITIGATION FEATURES (BLH-Wet and BLH-Dry)

MITIGATION SUCCESS CRITERIA

The success (performance) criteria described herein are applicable to both proposed BLH-Wet habitats and BLH-Dry habitats, unless otherwise indicated.

1. General Construction

A. As applicable, complete all necessary initial earthwork and related construction activities in Mitigation TY1 (2014), and in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities will vary with the mitigation site. Examples include, but are not 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; construction of perimeter containment dikes and installation of fill (dredged sediments or other soil). These requirements classify as initial success criteria.

B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015), and in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities will vary with the mitigation site. Examples include, but are not limited to: degrading or "gapping" of perimeter retention dikes; construction of water management structures (weirs, etc.). These requirements classify as initial success criteria.

2. Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with the authorized initial planting plan. This requirement classifies as an initial success criterion.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following the year plants are first installed) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 114 seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- The requirements above classify as initial success criteria.

C. 4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 300 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 120 living, native, hard mast-producing species in the canopy stratum but no more than approximately 150 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-mass producing native species. These 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 Interagency Team.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- For BLH-Wet habitats only -- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion (requirement) will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 10 Years Following Completion of Initial Plantings –

- Attain a minimum average cover of 80% by planted canopy species and/or naturally recruited native canopy species. This criterion will thereafter remain in effect for the duration of the overall monitoring period. This requirement to meet the specified minimum average cover within 10 years following completion of initial plantings classifies as an intermediate success criterion. The requirement to meet the specified minimum average cover for the duration of the overall monitoring period classifies as a long-term success criterion.

E. 15 Years Following Completion of Initial Plantings –
- Achieve a minimum average density of 75 living native plants per acre in the midstory stratum (planted midstory and/or naturally recruited native midstory species). This requirement classifies as an intermediate success criterion.

F. 25 Years Following Completion of Initial Plantings –
- Average cover by native species in the midstory stratum must be greater than 20% but cannot exceed 50%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Average cover by native species in the understory stratum must be greater than 30% but cannot exceed 60%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as long-term success criteria.

Note: 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 Interagency Team.

3. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events. Note -These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

4. Topography

A. For mitigation features requiring earthwork to attain desired grades (excluding areas restored from existing open water features) – Following completion of initial construction activities (anticipated in TY1, 2014), demonstrate that at least 80% of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

B. For mitigation features restored from existing open water areas – (a) In the year that final construction activities are completed (anticipated in TY2, 2015), demonstrate that at least 80% of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation), and; (b) In the year after final construction activities are completed, demonstrate that at least 85% of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation. These requirements classify as initial success criteria.

5. Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will be made approximately 15 to 20 years following completion of initial plantings. 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 Interagency Team. 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 of the mitigation site.

6. Hydrology (applicable to BLH-Wet habitats only)

A. In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days. This requirement classifies as an intermediate success criterion.

B. If the mitigation program includes actions intended to enhance site hydrology or hydroperiod, demonstrate that the affected site is irregularly inundated or soils are saturated to the soil surface for a period ranging from 7% to approximately 13% of the growing season during a year having essentially normal rainfall. The Mitigation Work Plan for a specific site may establish more specific hydrologic enhancement goals. If this is the case, demonstrate attainment of the specific goals identified in the plan. These hydrology/hydroperiod requirements classify as long-term success criteria.

MITIGATION MONITORING GUIDELINES

The following guidelines for mitigation monitoring and reporting are applicable to both BLH-Wet and BLH-Dry habitats unless otherwise indicated.

"Time Zero" Monitoring Report (Monitoring Report #1)

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, surface water management system alterations/construction, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report 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.
- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer and staff gage locations.
- An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations. For mitigation areas involving habitat restoration in existing open water areas, the as-built survey must include a topographic survey of the entire restoration feature.
- 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 a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will typically provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and, if applicable, piezometer and staff gage locations.

- 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.

- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken 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 as well as 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. For mitigation features involving habitat enhancement rather than restoration, the permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species, but some may also be located in areas where plantings are not needed.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size or from circular plots having a radius of approximately 53 feet. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average cover by native species in the canopy stratum; 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 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). The permanent monitoring plots will be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots 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. Typically there will be at least one monitoring plot for every 20 acres planted.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as the location and length of each transect 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. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average height of native species in the canopy stratum; average density of 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 height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory 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 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE

with the Interagency Team and will be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native subcanopy species; composition of native subcanopy species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- For BLH-Wet habitats only -- A summary of rainfall data 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, collection and reporting of rainfall data will no longer be required.

- For BLH-Wet habitats only -- A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. Data (water table elevations) will be collected at least bi-weekly. Once the monitoring indicates the water table may be rising to an elevation that would meet hydrologic success criteria, water table elevations will be collected on a daily basis until it is evident the success criteria has been satisfied. The schedule of water table elevation readings can shift back to a bi-weekly basis for the remainder of the monitoring period. The number of piezometers and staff gages required as well as the locations of these devices 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. Once hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

- 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 midstory 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 an as-built topographic survey of all such mitigation features in the year immediately following the “time zero” monitoring event. No additional topographic surveys will typically be required following this second survey. However if the second survey indicates topographic success criteria have not been achieved and 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 Interagency Team.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the Interagency Team, 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 Interagency Team prior to the monitoring events and implementation of the timber management activities.

Monitoring Reports Following Re-Planting Activities

Re-planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include an inventory of the number of each species planted and the stock size used. It must also include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area.

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place in late summer of the year of 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. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. . 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 – 1.A or 1.B, as applicable.
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – A, as applicable, or B, as applicable.

Monitoring events associated with the above will include the “time zero” (first or baseline) monitoring event plus annual monitoring events thereafter until the monitoring responsibilities are transferred to the NFS. The years applicable to these monitoring events will vary depending on the type of mitigation involved (restoration or enhancement) and site conditions present at the time mitigation activities are initiated. For example, the first monitoring event may occur in 2014 (TY2) for certain mitigation sites while this event may not occur until 2015 (TY3) for other mitigation sites.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation will typically be transferred to the Sponsor during the first quarter of the year immediately following submittal of the monitoring report that demonstrates attainment of said criteria, subject to the provisions identified in the Introduction section.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will typically take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis (based on 50-year period of analysis beginning in 2013 (TY0) and ending in 2063 (TY50)).

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criteria 2.B), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). 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 this success criterion, subject to the provisions mentioned in the Introduction section.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. native vegetation success criteria 2.C), 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 conducted in the mitigation features 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).

The year in which mitigation features are first planted, a key milestone triggering the start of mitigation monitoring, may vary depending on the type of mitigation involved and the mitigation construction activities involved. In certain cases, it is also possible that the BLH mitigation features may be established along with other mitigation features like swamp or marsh habitats at the same mitigation site. Such factors make it necessary to develop a reasonable and efficient monitoring schedule 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 in coordination with the Interagency Team and the NFS.

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 Interagency Team.

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING: SWAMP MITIGATION FEATURES

MITIGATION SUCCESS CRITERIA

The success criteria specified herein apply to both swamp restoration projects and swamp enhancement projects unless otherwise indicated.

1. General Construction

A. As applicable, complete all necessary initial earthwork and related construction activities in Mitigation TY1 (2014) and in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities will vary with the mitigation site. Examples include, but are not 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; construction of perimeter containment dikes and installation of fill (dredged sediments or other soil). These requirements classify as initial success criteria.

B. For mitigation features established in existing open water areas, complete all final construction activities in Mitigation TY2 (2015), in accordance with the mitigation work plan as well as the final project plans and specifications. The necessary activities will vary with the mitigation site. Examples include, but are not limited to: degrading or “gapping” of perimeter retention dikes; construction of water management structures (weirs, etc.). These requirements classify as initial success criteria.

2. Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with the authorized initial planting plan. This requirement classifies as an initial success criterion.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following the year plants are first installed) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 114 seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- The requirements above classify as initial success criteria.

C. 4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 125 living baldcypress 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.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 15 Years Following Completion of Initial Plantings –

- Achieve one of the two following vegetative cover requirements:
  1. 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%, and; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
  2. The average percent cover by native species in the canopy stratum is at least 75%, and: (a) the average percent cover by native species in the midstory stratum exceeds 33%, or; (b) the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
- The requirements above classify as intermediate success criteria.

E. Within 45 Years Following Completion of Initial Plantings –

- Demonstrate that the average diameter at breast height (DBH) of living baldcypress trees exceeds 10 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Demonstrate that the average DBH of the other living native trees in the canopy stratum (trees other than baldcypress) exceeds 12 inches. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- 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.
- The requirements above classify as long-term success criteria.

F. 45 Years Following Completion of Initial Plantings –
- Demonstrate that a minimum of 160 living native trees remain in the canopy stratum.
- Demonstrate that either success criteria D.1 or D.2 above have been maintained.
- The requirements above classify as long-term success criteria.

Note: The above requirements may need to be modified later due to factors such as the effects of sea level rise or salinity on vegetative cover. Proposed modifications must first be approved by the USACE in coordination with the Interagency Team.

3. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

4. Topography

A. For mitigation features requiring earthwork to attain desired grades (excluding areas restored from existing open water features – Following completion of initial construction activities (anticipated in TY1, 2014), demonstrate that at least 80% of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

B. For mitigation features restored from existing open water areas – (a) In the year that final construction activities are completed (anticipated in TY2, 2015), demonstrate that at least 80% of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation), and; (b) In the year after final construction activities are completed, demonstrate that at least 85% of the total graded area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation. These requirements classify as initial success criteria.

5. Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the Interagency Team, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will likely be made after it is demonstrated that the average total basal area accounted for by living native canopy species exceeds 170 square feet per acre. 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 Interagency Team. Following approval of the plan, the NFS will perform the necessary thinning operations and will demonstrate the successful completion of these operations. Timber management activities will only be allowed for the purposes of ecological enhancement of the mitigation site.

6. Hydrology

The following applies to mitigation features involving swamp restoration and to those involving swamp enhancement where hydrologic enhancement is a component of the mitigation program.

A. In a year having essentially normal rainfall, demonstrate compliance with each of the following criteria:

- Achieve inundation of the majority of the mitigation area for a minimum of 200 consecutive days but for no more than approximately 300 consecutive days, preferably with periods of inundation overlapping a portion of the growing season.
- Achieve non-inundation of the majority of the mitigation (water table at or below the soil surface) for a minimum of approximately 60 consecutive days but for no more than approximately 90 consecutive days, preferably during the period from June through August.
- The average maximum (peak) water table elevation must range between approximately 1.0 feet to 2.0 feet above the soil surface.
- The requirements above classify as intermediate success criteria.

Note: The specific mitigation work program generated for the mitigation area may include deviations from one or more of the above criteria to better reflect the desired wetland hydroperiod. Such deviations must be approved by the USACE in coordination with the Interagency Team, and would supersede the above criteria once approved.

The following applies to swamp enhancement mitigation areas where hydrologic enhancement is not a component of the mitigation program.

B. In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days. This requirement classifies as an intermediate success criterion.

MITIGATION MONITORING GUIDELINES

"Time Zero" Monitoring Report (Monitoring Report #1)

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, surface water management system alterations/construction, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report 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.

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- An as-built survey of finished grades for any relatively large areas subject to topographic alterations and an as-built survey of any surface water drainage features, drainage culverts, and/or water control structures constructed. Detailed surveys of topographic alterations simply involving the removal of existing linear features such as berms/spoil banks, or involving the filling of existing linear ditches or canals, will not be required. However, the as-built survey will include spot cross-sections of such features sufficient to represent typical conditions. The as-built survey must include a survey of areas where existing berms, spoil banks, or levees have been breached in sporadic locations. For mitigation features involving habitat restoration in existing open water areas, the as-built survey must include a topographic survey of the entire restoration feature.

- 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 a breakdown itemization indicating the number of each species planted in a particular portion of the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will typically provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. planted areas, areas only involving eradication of invasive and nuisance plant species; surface water management features, etc.), monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- 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.

- Photographs documenting conditions in the mitigation site at the time of monitoring. Photos will be taken 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 as well as 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. Permanent photo stations will primarily be established in areas slated for planting of canopy and midstory species. For mitigation involving swamp enhancement, some photo stations may also be located in areas where plantings are not needed.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 80 feet X 80 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the canopy stratum; 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). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre. The permanent monitoring plots will typically be located within mitigation areas where initial planting of canopy and midstory species is necessary. The number of plots required as well as the locations of these plots 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.

- Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive and nuisance plant species will be gathered from permanent sampling quadrats nested within the permanent monitoring plots described above. There will be a total of 4 quadrats with each quadrat measuring approximately 2 meters X 2 meters in size. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- Quantitative plant data collected from either: (1) permanent transects sampled using the point-centered quarter method with a minimum of 20 sampling points established along the course of each transect, or; (2) permanent belt transects approximately 50 feet wide. The number of transects necessary as well as

the location and length of each transect 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. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of 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; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of baldcypress trees; average DBH of all other native tree species excluding baldcypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre.

- 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 2 meters X 2 meters in size. The total number of sampling quadrats needed along each sampling transect will be determined by the USACE with the Interagency Team and will specify be specified in the Mitigation Monitoring Plan. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; composition of native ground cover species and the wetland indicator status of each species; average percent cover by invasive plant species; average percent cover by nuisance plant species.

- A summary of rainfall data 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, collection and reporting of rainfall data will no longer be required.

- A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. The number of piezometers and staff gages required as well as the locations of these devices 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. Data (water table elevations) will be collected at least bi-weekly throughout the year. For mitigation areas involving swamp enhancement where hydrologic enhancement is not a component of the mitigation program, it may also be necessary to collect water table elevations on a daily basis over the course of 3 to 4 weeks in order to demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days during the growing season. Once it is demonstrated that all applicable hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

- 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 ground cover strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species; general observations regarding the growth of non-planted native species in the canopy and midstory strata. 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 an as-built topographic survey of all such mitigation features in the year immediately following the "time zero" monitoring event. No additional topographic surveys will typically be required following this second survey. However if the second survey indicates topographic success criteria have not been achieved and 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 Interagency Team.

- A summary assessment of all data and observations along with recommendations as to actions necessary to help meet mitigation and management/maintenance goals and mitigation success criteria.

- A brief description of anticipated maintenance/management work to be conducted during the period from the current monitoring report to the next monitoring report.

Monitoring Reports Involving Timber Management Activities

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory strata) have been approved by the USACE in coordination with the Interagency Team, 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 Interagency Team prior to the monitoring events and implementation of the timber management activities.

Monitoring Reports Following Re-Planting Activities

Re-planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria. Any monitoring report submitted following completion of a re-planting event must include an inventory of the number of each species planted and the stock size used. It must also include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area.

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place in late summer of the year of 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. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. 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 – 1.A or 1.B, as applicable.
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – A, as applicable, or B, as applicable.

Monitoring events associated with the above will include the “time zero” (first or baseline) monitoring event plus annual monitoring events thereafter until the mitigation monitoring responsibility is transferred to the NFS. The years applicable to these monitoring events will vary depending on the type of mitigation involved (restoration or enhancement) and site conditions present at the time mitigation activities are initiated. For example, the first monitoring event may occur in 2014 (TY2) for certain mitigation sites while this event may not occur until 2015 (TY3) for other mitigation sites.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation 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 said criteria.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis (based on 50-year period of analysis beginning in 2013 (TY0) and ending in 2063 (TY50)).

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criterion 2.B), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). 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 this success criterion.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. native vegetation success criterion 2.C), 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 this success criterion.

If timber management activities conducted in the mitigation features 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).

The year in which mitigation features are first planted, a key milestone triggering the start of mitigation monitoring, may vary depending on the type of mitigation involved and the mitigation construction activities involved. In certain cases, it is also possible that the BLH mitigation features may be established along with other mitigation features like swamp or marsh habitats at the same mitigation site. Such factors make it necessary to develop a reasonable and efficient monitoring schedule 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 in coordination with the Interagency Team and the NFS.

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 Interagency Team.

MITIGATION SUCCESS CRITERIA AND MITIGATION MONITORING:
MARSH MITIGATION FEATURES (Fresh, Intermediate, and Brackish Marsh Habitats)

MITIGATION SUCCESS CRITERIA

The success (performance) criteria described herein are applicable to all proposed marsh habitats (fresh marsh, intermediate marsh, and brackish marsh restoration features), unless otherwise indicated.

1. General Construction

A. Within approximately 8 months following the start of mitigation construction, complete all initial mitigation construction activities (e.g. construction of temporary retention/perimeter dikes, placement of fill (borrow material/dredged material) into mitigation site, construction of permanent dikes if applicable, etc.), in accordance with the mitigation work plan and in accordance with final project plans and specifications. These requirements classify as initial success criteria

B. Approximately 1 year following completion of all initial mitigation construction activities (when the restored marsh feature has attained the desired target soil surface elevation) complete all final mitigation construction activities, in accordance with the mitigation work plan and in accordance with final project plans and specifications. Such activities could include, but are not limited to: degrading temporary retention dikes such that the areas occupied by these dikes have a surface elevation equivalent to the desired target marsh elevation; completion of armoring, if required, of any permanent dikes; "gapping" or installation of "fish dips" in permanent dikes; 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 components will be considered as the "completion of final mitigation construction activities". As noted, this is anticipated to occur approximately 1 year after placement of fill material in the mitigation feature is completed. The requirements stated herein classify as initial success criteria.

2. Topography

A. Upon completion of final mitigation construction activities (approximate Target Year 2) –
- Demonstrate that at least 80% of each mitigation feature has a surface elevation that is within 0.5 feet of the desired target surface elevation. This requirement classifies as an initial success criterion.

B. 1 Year following completion of final mitigation construction activities (approximate Target Year 3) –
- Demonstrate that at least 80% of the mitigation site has a surface elevation that is within 0.5 feet of the desired target surface elevation. This requirement classifies as an initial success criterion.

C. 3 years following completion of final mitigation construction activities (approximate Target Year 5) –
- Demonstrate that at least 90% of the mitigation site has a surface elevation that is within the functional marsh elevation range. This requirement classifies as an intermediate success criterion.

Notes: The desired target elevation for each marsh feature will be determined during the final design phase. 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, will also be determined during the final design phase. The target elevation and functional marsh elevation range will be determined by the USACE in conjunction with the Interagency Team. These determinations will apply to the topographic success criteria above and could potentially alter the marsh area percentages set forth in these criteria.

3. Native Vegetation

A. For intermediate marsh and brackish marsh restoration features only –
- Complete initial marsh planting in accordance with applicable initial marsh planting guidelines. This requirement classifies as an initial success criterion.

B. For fresh marsh restoration features only; 1 year following completion of final mitigation construction activities:
   - Achieve a minimum average cover of 50%, comprised of native herbaceous species.
   - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
   - The requirements above classify as initial success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

C. For intermediate marsh and brackish marsh restoration features only; 1 year following completion of initial plantings–
   - Attain at least 80% survival of planted species, or; Achieve a minimum average cover of 25%, comprised of native herbaceous species (includes planted species and volunteer species).
   - Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
   - The requirements above classify as initial success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. For fresh marsh restoration features only; 3 years following completion of final mitigation construction activities:
   - Achieve a minimum average cover of 85%, comprised of native herbaceous species. This requirement classifies as an intermediate success criterion.

E. For intermediate marsh and brackish marsh restoration features only; 3 years following completion of initial plantings –
   - Achieve a minimum average cover of 75%, comprised of native herbaceous species (includes planted species and volunteer species). This requirement classifies as an intermediate success criterion.

F. For all marsh restoration features (fresh, intermediate, and brackish) –
   - For the period beginning 5 years following completion of final mitigation construction activities and continuing through 20 years following completion of final mitigation construction activities, maintain a minimum average cover of 80%, comprised of native herbaceous species. This requirement classifies as a long-term success criterion.

4. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species within 1 year of completion of final mitigation construction activities. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

MITIGATION MONITORING GUIDELINES

The guidelines for mitigation monitoring provided herein are applicable to all the types of marshes being restored (i.e. fresh, intermediate, and brackish) unless otherwise indicated.

"Time Zero" Monitoring Report (First Monitoring Report)

The mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will typically include the following items:

- A detailed discussion of all mitigation activities completed.

- A plan view drawing of the mitigation site showing the approximate boundaries of the restored marsh features, significant interspersion features established within the marsh features (as applicable), monitoring transect locations, sampling plot locations, photo station locations, and staff gage locations.

- An as-built survey of surface elevations (topographic survey) within each marsh feature, along with an as-built survey of any permanent dikes constructed as part of the marsh restoration features including any "gaps" or "fish dips" established in such dikes. If a particular marsh feature is immediately adjacent to existing marsh habitat, the topographic survey will include spot elevations collected within the existing marsh habitat near the restored marsh feature. In addition to the survey data, an analysis of the data will be provided addressing attainment of topographic success criteria.

- Photographs documenting conditions in each restored marsh feature at the time of monitoring. Photos will be taken at permanent photo stations within the marsh features. 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 as well as 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, there will be at least 4 photo stations established within each marsh feature.

- For restored intermediate marsh and brackish marsh features only -- A detailed inventory of all species planted, including the number of each species planted and the stock size planted. For mitigation sites that include more than one restored marsh feature, provide a breakdown itemization indicating the number of each species planted in each marsh and correlate this itemization to the marsh features depicted on the plan view drawing of the mitigation site.

- Water level elevation readings collected at the time of monitoring from a single staff gage installed within one of the restored marsh features. The location of the staff gage will be determined by the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and will be specified in the Mitigation Monitoring Plan. The monitoring report will provide the staff gage data along with mean high and mean low water elevation data as gathered 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 program.

- 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

All monitoring reports generated after the initial "time zero" report will provide the following information unless otherwise noted:

- All items listed for the "time zero" (baseline) monitoring report with the exception of: (a) the topographic/as-built survey, although additional topographic/as-built surveys are required for specific monitoring reports (see below); (b) the inventory of planted species; although such an inventory must be provided in any monitoring report generated for a year in which a restored intermediate or brackish marsh feature is re-planted to meet applicable success criteria, and such an inventory must be provided in any monitoring report generated for a year in which a restored fresh marsh feature is planted to meet applicable success criteria.

- Quantitative data concerning plants in the ground cover 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 the mitigation site. This will be determined the USACE in coordination with the Interagency Team during the final design phase of the mitigation project and 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: average percent cover by native plant species; average percent cover by invasive plant species; average percent cover by nuisance plant species; composition of plant species and the wetland indicator status of each species. The average percent survival of planted species (i.e. number of living planted species as a percentage of total number of plants installed) will also be recorded in intermediate and brackish marsh features. However, data for percent survival of planted species will only be recorded until such time as it is demonstrated that success criteria for plant survivorship has been achieved.

- A brief description of maintenance and/or management work performed since the previous monitoring report along with a discussion of any other significant occurrences.

- In addition to the above items, the monitoring report prepared for 1 year following completion of mitigation construction activities (estimated TY3) and the monitoring report prepared for 3 years following completion of mitigation construction activities (estimated TY5) will include a topographic survey of each marsh restoration feature. These surveys will cover the same components as described for the topographic survey conducted for the "time zero" monitoring report. In addition to the surveys themselves, each of the two monitoring reports involving topographic surveys will include an analysis of the data as regards attainment of applicable topographic success criteria. If the second survey indicates topographic success criteria have not been achieved and 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 Interagency Team.

Monitoring Reports Following Re-Planting Activities in Intermediate or Brackish Marsh Features & Monitoring Reports Following Planting Activities in Fresh Marsh Features

Re-planting of certain areas within restored intermediate and/or brackish marsh habitats may be necessary to ensure attainment of applicable native vegetation success criteria. Planting of herbaceous species within restored fresh marsh features may also be necessary to attain applicable native vegetation success criteria.

Any monitoring report submitted following completion of a re-planting event (for intermediate and brackish marshes) and any monitoring report submitted following completion of initial plantings (for fresh marshes) must include an inventory of the number of each species planted and the stock size used. 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.

MITIGATION MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring will typically take place in mid to late summer of the year of 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. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the Interagency Team. 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 and B.
3. Native Vegetation – For intermediate marsh and brackish marsh features, criteria 3.A and 3.C; for fresh marsh features, criteria 3.B.
4. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.

Monitoring events associated with the above will include the “time zero” (first or baseline) monitoring event (estimated in TY2, 2015) and a second monitoring event 1 year after the time zero monitoring event (estimated in TY3, 2016). The USACE will be responsible for conducting these monitoring activities and preparing the associated monitoring reports.

The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved. The overall responsibility for management, maintenance, and monitoring of the mitigation 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 said criteria. Once monitoring responsibilities have been transferred to the NFS, the next monitoring event should take place in 2019 (TY5) in order to demonstrate attainment of success criteria 2.C and either 3.D (for fresh marsh) or 3.E (for intermediate and brackish marsh). Thereafter, monitoring will be conducted every 5 years throughout the remaining 50-year period of analysis (based on 50-year period of analysis beginning in 2013 (TY0) and ending in 2063 (TY50)).

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 in coordination with the Interagency Team and the NFS.

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. The following lists instances requiring additional monitoring that would be the responsibility of the USACE:

(A) For intermediate and brackish marsh features –

- If the initial survival criterion for planted species or the initial vegetative cover criterion are not achieved (i.e. the criteria specified in success criteria 3.C), a monitoring report will be required for each

consecutive year until two sequential annual reports indicate that the applicable survival criterion or vegetative cover criteria have been satisfied (i.e. that corrective actions were successful). The USACE would also be responsible for the purchase and installation of supplemental plants needed to attain the success criteria.

(B) For fresh marsh features --

- If the initial vegetative cover criterion is not achieved (i.e. the requirement specified in success criteria 3.B), 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 (i.e. that corrective actions were successful). Since failure to meet the success criterion would mandate planting the subject marsh, the USACE would also be responsible for the purchase and installation of the required plants.

(C) For all types of marsh features (fresh, intermediate, brackish) –

- If topographic success criteria 2.A or 2.B are not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate the applicable criteria have been satisfied. Since failure to meet topographic success criteria would mandate corrective actions such as addition of fill, removal of fill, or other actions to change grades within the subject marsh feature, the USACE would also be responsible for performing the necessary corrective actions.

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 intermediate and brackish marsh features –

- If the vegetative cover criterion specified for 3 years after the initial planting of marsh features is not achieved (i.e. success criterion 3.E), a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the vegetative cover criterion has been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criterion.

(B) For fresh marsh features --

- If the vegetative cover criterion specified for 3 years after completion of mitigation construction activities is not achieved (i.e. success criterion 3.D), a monitoring report will be required for each consecutive year until two sequential annual reports indicate that the vegetative cover criterion has been satisfied. The Sponsor would also be responsible for the purchase and installation of supplemental plants needed to attain the success criterion.

(C) For all types of marsh features (fresh, intermediate, brackish) –

- If the topographic success criterion 2.C is not achieved, a monitoring report will be required for each consecutive year until two sequential annual reports indicate success criteria have been satisfied. Since failure to meet this topographic success criteria would mandate corrective actions such as addition of fill, removal of fill, or other actions to change grades within the subject marsh feature, the Sponsor would also be responsible for performing the necessary corrective actions.

- Native vegetation success criterion 3.F is applicable to the period extending from 5 years through 20 years following completion of mitigation construction activities and is applicable to all marsh features. If this criterion is not satisfied at the time of monitoring, the NFS would be responsible for implementing corrective actions. Such actions could include installing additional plants in the subject marsh (probable course of action), adding sediment to the subject marsh in problem zones (marsh nourishment), or a combination of these activities. Under this scenario, a monitoring report will be required for each consecutive year following completion of the corrective actions until two sequential annual reports indicate that the vegetative cover criterion has been attained. The NFS would be responsible for conducting these additional monitoring events and preparing the associated monitoring reports.

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. Twenty years following completion of mitigation construction activities, 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 in coordination with the Interagency Team.

DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following section.

Interagency Team
The "Interagency Team" consists of representatives from the following resource agencies; US Fish and Wildlife Service, National Marine Fisheries Service, US Environmental Protection Agency, Louisiana Department of Wildlife and Fisheries, State of Louisiana Office of Coastal Protection and Restoration, Louisiana Department of Natural Resources. In cases where proposed mitigation features will be established within Jean Lafitte National Historical Park and Preserve, representatives from the National Park Service would also comprise the Interagency Team.

Non-Federal Sponsor (NFS)
This term refers to the Non-Federal Sponsor for the mitigation projects. In this case, the NFS is the Louisiana Coastal Protection & Restoration Authority Board (CPRAB).

Target Year
This document often refers to mitigation "target years" or a particular mitigation "target year" (abbreviated "TY"). Target Year 0 (TY0) is the year in which mitigation construction activities are anticipated to commence, which is presently estimated to occur in calendar year 2013. Target years increase from this time forward. Hence, based on construction beginning in 2013, target year 1 (TY1) would be calendar year 2014, target year 2 (TY2) would be calendar year 2015, etc.

Invasive Plant Species
All plant species identified as invasive or as non-indigenous (exotic) in the following two sources:

> Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
> (Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)
>
> Barataria-Terrebonne National Estuary Program (BTNEP). 2012. Exotic Invasive Species of the Barataria-Terrebonne, Invasive Species in Louisiana. BTNEP, Thibodaux, LA. (Website - http://invasive.btnep.org/invasivesvsnatives/invasivesinla2list.aspx)

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazilian vervain (*Verbena litoralis* var. *brevibrateata*), coral ardisia (*Ardisia crenata*), Japanese ardisia (*Ardisia japonica*), cogon grass (*Imperata cylindrical*), golden bamboo (*Phyllostachys aurea),* and rescuegrass (*Bromus catharticus*).

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium* spp.), ragweed (*Ambrosia* spp.), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The

determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the Non-Federal Sponsor and Interagency Team.

Native Plant Species
This category includes all plant species that are not classified as invasive plant species and are not considered to be nuisance plant species.

USACE Hydrophytic Vegetation Criteria
Reference to satisfaction of USACE hydrophytic vegetation criteria (i.e. plant community is dominated by hydrophytic vegetation) shall mean that sampling of the plant community demonstrates that one or more of the hydrophytic vegetation indicators set forth in the following reference is achieved:

> USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0); ERDC/EL TR-10-20. USACE Engineer Research and Development Center, Vicksburg, MS.

Wetland Indicator Status of Plant Species
The wetland indicator status of plants is a means of classifying the estimated probability of a species occurring in wetlands versus non-wetlands. Indicator categories include; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). The wetland indicator status of a particular plant species shall be as it is set forth in the following reference (the "2012 National Wetland Plant List), using the Region 2 listing contained therein. However, if the USACE approves and adopts a new list in the future, then the currently approved list will apply.

> Lichvar, Robert W. and J.T. Kartesz. 2009. North American Digital Flora: National Wetland Plant List, version 2.4.0 (https://wetland_plants.usace.army.mil). USACE, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH and BONAP, Chapel Hill, NC.

Growing Season
As used herein, the growing season is considered to be the period from April through October of any given year, although some deviation from this typical range is allowed.

Planting Season
This is generally considered to be the period from approximately December 15 through March 15, although some deviation from this typical range is allowed.

Point-Centered Quarter Method
A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

> Cottam, Grant and J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer
Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes should be constructed in general accordance with the following reference, unless otherwise approved by the USACE:

> U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center. (website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

Interspersion Features

This term refers to shallow open water features situated within marsh habitats. Examples include tidal channels, creeks, trenasses, and relatively small, isolated ponds. Emergent vegetation is typically absent in such features although they may contain submerged aquatic vegetation. They provide areas of foraging and nursery habitat for fish and shellfish along with associated predators, and provide loafing areas for waterfowl and other waterbirds. The marsh/open water interface forms an ecotone where post-larval and juvenile organisms can find cover and where prey species frequently concentrate.

APPENDIX K

BONNET CARRE BLH-WET RESTORATION PROJECT: MITIGATION PROGRAM FOR LPV HSDRRS & TFG GENERAL IMPACTS TO BOTTOMLAND HARDWOOD HABITATS

PREFACE

A mitigation program (mitigation plan) was developed by the USACE, in coordination with the Interagency Environmental Team (IET), to compensate for LPV HSDRRS and Task Force Guardian (TFG) impacts to bottomland hardwood (BLH) habitats. These impacts occurred on lands outside of national wildlife refuge boundaries and are thus referred to as non-refuge or "general" impacts. These impacts affected wet bottomland hardwood (BLH-Wet) and dry bottomland hardwood (BLH-Dry) habitats situated on both the flood side (FS) and protected side (PS) of the HSDRRS levee system. It was determined that mitigation for the BLH-Dry impacts could be accomplished through restoration of BLH-Wet habitats and that mitigation for the BLH-Wet impacts could be accomplished in the same manner. This appendix provides detailed information concerning the proposed mitigation program.

As discussed in Section 2 of the PIER, the Tentatively Selected Mitigation Project (TSMP) for mitigating the cited impacts would involve the purchase of BLH-Wet mitigation credits from a mitigation bank. The mitigation program (mitigation project) discussed herein would only be implemented if the TSMP cannot be implemented (refer to PIER Section 2). Certain details of the Bonnet Carre BLH-Wet Restoration Project (the mitigation program) discussed herein may be slightly refined and modified if it is necessary to implement this project. The USACE will coordinate with the IET, the Non-Federal Sponsor (NFS), and other members of the Project Delivery Team (PDT) in making any refinements and modifications to the mitigation program. Such modifications, if necessary, would ensure that the mitigation program fully compensates for the cited BLH impacts. It is highly unlikely that these modifications would significantly alter the environmental impacts assessment for this mitigation project as discussed in Sections 4 and 5 of the PIER. If this should not be the case however, a supplemental NEPA document would be prepared by the USACE in coordination with the IET, NFS, and PDT prior to implementing the mitigation project.

The proposed mitigation actions will include construction (summarized below), with the Non-Federal Sponsor responsible for operation and maintenance of functional portions of work as they are completed. On a cost shared basis, USACE will monitor completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve mitigation success. USACE will undertake additional actions necessary to achieve mitigation success in accordance with cost sharing applicable to the project and subject to the availability of funds. Once USACE determines that the mitigation has achieved initial success criteria, monitoring will be performed by the Non-Federal Sponsor 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, USACE will consult with other agencies and the Non-Federal Sponsor to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, USACE will 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. The reader should be aware that the provisions set forth in this paragraph are applicable to the entire proposed mitigation program (mitigation plan) discussed herein.

The figure cited herein is provided at the end of this appendix. Section 9 contains definitions of certain terms used in this appendix. All elevations mentioned herein are expressed in feet NAVD88(2004.65).

1. MITIGATION OBJECTIVES

The primary objective of the proposed mitigation project is to restore approximately 156.2 acres of BLH-Wet forest at the mitigation site in order to compensate for LPV HSDRRS general impacts to a total of approximately 89.9 acres of BLH-Wet habitats and to compensate for LPV HSDRRS and TFG general

impacts to a total of approximately 267.4 acres of BLH-Dry habitats. The USFWS ran Wetland Value Assessment (WVA) models for the impacts and for the proposed mitigation project. As indicated in the table below, these models predicted that the habitat functions and values, expressed in Average Annual Habitat Units (AAHUs), lost as a result of the impacts would be fully compensated by the net gain in habitat functions and values that would be realized via the mitigation project over the course of the 50-year period of analysis.

……Table 1-1. General Impacts to BLH Habitats Compared to Proposed Mitigation.

Habitat	Acres Impacted	Net AAHUs Lost via Impacts	Acres Restored in Mitigation Plan	Net AAHUs Gained via Mitigation Plan
BLH-Wet	89.9	41.07	156.2	98.41
BLH-Dry	267.4	52.78	0	0
Totals	**357.2**	**93.85**	**156.2**	**98.41**

The proposed restoration of BLH-Wet habitats will occur within various mitigation features, which are essentially separate geographic areas (polygons) where BLH-Wet forests will be restored. The proposed mitigation features encompass areas that have been severely disturbed by past clearing and excavation activities performed to acquire borrow material for off-site projects. These activities have drastically altered normal topography, creating both depressions and ridges, and have cleared prior wetland forests. Invasive and nuisance plant species, particularly black willow, have since colonized portions of these areas. The proposed mitigation project will restore appropriate topography and native BLH-Wet forests in these areas, thereby increasing the current habitat functions and values provided by the previously disturbed habitats.

One of the secondary objectives of the proposed mitigation project is to eradicate invasive and nuisance plant species within the mitigation features and to control re-infestation of the mitigation features by such plants. Invasive/nuisance plant species have the potential for jeopardizing the growth and development of native BLH-Wet species, thereby reducing typical functions and values associated with BLH-Wet forests. The eradication and control of invasive/nuisance plant species will help ensure the restored BLH-Wet forests provide habitat and habitat functions/values typical of such forests.

2. MITIGATION WORK PLAN

2.1 KEY COMPONENTS OF MITIGATION WORK PLAN

Section 2.9.2.1 in the main body of this PIER provides a detailed description of the proposed mitigation work plan (i.e. mitigation project description). Figure K-1 depicts the four proposed BLH-Wet restoration features (mitigation features BC28 through BC31) discussed herein. The key elements of the proposed work plan or mitigation construction/implementation plan are as follows.

- Initial clearing and grubbing of existing woody vegetation (trees and shrubs) within the proposed mitigation features (e.g. within the “footprints” of the proposed BLH-Wet restoration features) prior to fill placement. These activities will include mechanized removal (mechanized eradication) of invasive and nuisance plant species present within the mitigation features. In addition, certain existing earthen spoil mounds and ridges within each mitigation feature will be degraded to equal the desired final target grade elevation of the mitigation features. Existing spoil ridges along the outer perimeter of each mitigation feature will be left in place at this stage so these ridges can serve as containment berms for the fill that must be placed within the features.

- Initial eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, prior to fill placement.

- Placement of fill (borrow material) within the mitigation features as necessary to attain the desired final target grade elevation of approximately 1.5 feet NAVD88. The borrow material would be dredged from Lake Pontchartrain, just north of the mitigation site. The borrow material would be transported to the mitigation features in a pipeline extending from the borrow sites to the outfall of an existing canal, then down the existing canal until reaching locations near the mitigation features, then across existing disturbed borrow areas to the mitigation features themselves.

- As necessary, follow-up eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, prior to the initial planting of native BLH-Wet species within these features.

- Final grading within the mitigation features after the fill deposited in these features has settled to the desired final target elevation, prior to initial planting of the features. This grading will be performed to remove any earthen ridges that remain projecting above the target grade elevation, thereby creating a relatively level surface in the mitigation features.

- Initial planting (initial installation) of native BLH-Wet canopy and midstory species in the mitigation features following final grading of the mitigation features. Refer to the planting specifications that follow. The successful completion of this initial planting event will mark the end of the mitigation construction phase.

- One re-planting of native BLH-Wet canopy and midstory species in the mitigation features following completion of the initial planting event. It was assumed that approximately 20% of the total number of canopy species and approximately 20% of the total number of midstory species initially planted would have to be re-planted in order to satisfy the plant survival requirements set forth in native vegetation success criterion 2.B (see Section 6). However, this re-planting event will not be performed if the applicable success criteria are satisfied.

- As necessary, follow-up eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, following the initial planting cited above. There will likely be multiple invasive/nuisance plant species eradication events performed during various years following completion of the initial planting event.

The USACE will be responsible for conducting all mitigation construction activities, although the costs associated with these activities will be cost shared with the NFS, subject to the provisions addressed in the Preface section above. Refer to the following sections for a discussion of responsibilities for other activities required as part of the proposed mitigation program.

2.2 INITIAL PLANTING OF MITIGATION FEATURES

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

The canopy species installed will be in general accordance with the species list provided in Table 2-1. Plantings will be conducted such that the total number of plants installed in a given mitigation feature consists of approximately 60% hard mast-producing species and approximately 40% soft mast-producing species. Site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in this table. Any deviations would have to first be approved by the USACE in coordination with the IET and NFS.

The midstory species installed will be in general accordance with the species list provided in Table 2-2. The species used and the proportion of the total midstory plantings represented by each species (percent composition) may vary somewhat from the data provided in Table 2-2 depending on various factors including

site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability. Any deviations would have to first be approved by the USACE in coordination with the IET and NFS.

Table 2-1. Planting List for Native Canopy Species.

Common Name	Scientific name	Percent Composition
Hard Mast-Producing Canopy Species (60% of Total Canopy Plants Installed)		
Nuttall oak	*Quercus nuttalli, Q. texana*	40%
Willow oak	*Quercus phellos*	30%
Water oak	*Quercus nigra*	10%
Overcup oak	*Quercus lyrata*	10%
Water hickory	*Carya aquatica*	10%
Soft Mast-Producing Canopy Species (40% of Total Canopy Plants Installed)		
Drummond red maple	*Acer rubrum* var. *drummondii*	20%
Sugarberry	*Celtis laevigata*	20%
Green ash	*Fraxinus pennsylvanica*	20%
American elm	*Ulmus americana*	20%
Common persimmon	*Diosypros virginiana*	10%
Bald cypress	*Taxodium distichum*	10%

Note:
Percent composition values indicated represent the percentage of the total number of plants that will be installed for each of the two categories of canopy species, i.e. hard mast-producing category and soft mast-producing category.

Table 2-2. Planting List for Native Midstory Species.

Common Name	Scientific name	Percent Composition
Saltbush	*Baccharis halimifolia*	10%
Buttonbush	*Cephalanthus occidentalis*	10%
Mayhaw	*Crataegus opaca*	20%
Green hawthorn	*Crataegus viridis*	20%
Possumhaw	*Ilex decidua*	10%
Dahoon holly	*Ilex cassine*	10%
Wax myrtle	*Myrica cerifera, Morella cerifera*	20%

The initial planting of the mitigation features will be the responsibility of the USACE. Costs associated with this initial planting will be cost shared with the NFS, subject to the provisions addressed in the Preface section above.

3. MAINTENANCE AND MANAGEMENT PLAN

The primary maintenance and management activities anticipated involve the short-term and long-term eradication and control of invasive and nuisance plant species. It is anticipated that there will be 1 invasive/nuisance plant eradication event during the year mitigation construction begins, 2 such events in the following year, 2 such events during the year the mitigation features are first planted, and at least 2 such events during each of the three years following the year of initial planting. It is anticipated that there will be at least 1 invasive/nuisance plant eradication event per year in the fourth and fifth year following the year of initial planting. Thereafter, it is anticipated that there will be one invasive/nuisance plant eradication event every three to five years.

One should note that the actual frequency of invasive/nuisance plant eradication events may differ from the frequency discussed above. The frequency and intensity of these events will largely be determined based on the degree of invasive/nuisance plant infestation observed during mitigation monitoring activities, as well as that observed during periodic inspections of the mitigation features conducted outside the framework of prescribed mitigation monitoring events.

The methods used to eradicate invasive and nuisance plant species will vary. Mechanized clearing and removal of such species may be employed during eradication events occurring prior to the initial planting of native species, using equipment such as hydro-axes, gyro-tracs, bulldozers, etc. Hand-held equipment such as chain saws and machetes may also be used. It is doubtful that mechanized clearing/removal of invasive/nuisance plants will be employed once the initial planting of native species has occurred. Instead, invasive/nuisance plants will be eradicated using ground-based applications of appropriate herbicides to the target plants. The specific equipment (e.g. backpack sprayers, hand application, hypo-hatchet, tube-injector, ATVs with boom sprayers, etc.) and methods (e.g. cut stump treatment, basal bark application, hack and squirt, etc.) used to apply the herbicides will be determined by the contractor to maximize effectiveness. Note that ground-based applications of herbicides would also be employed to treat any stumps or other above-ground portions of invasive/nuisance plants remaining following mechanized clearing and removal of such plants. Ground-based herbicide applications will typically occur during the early part of the growing season in cases where there will be 1 or 2 application events during a given year, and will typically occur again during the latter part of the growing season in cases where there will be 2 application events during a given year.

As mentioned in Section 2, short-term maintenance/management activities may include one re-planting event conducted after the initial planting of native canopy and midstory species. It was assumed that this event, involving the re-planting of approximately 20% of the total number of canopy species and 20% of the total number of midstory species first installed, would be necessary to satisfy native vegetation success criterion 2.B (see Section 6). However if the referenced success criterion is satisfied, this re-planting event will not be performed. It is not anticipated that subsequent re-planting of native canopy and/or midstory species will be necessary, with the potential exception of re-planting required for adaptive management (see Section 4). Should additional re-plantings be necessary to satisfy applicable mitigation success criteria, then these re-plantings would become part of the long-term management/maintenance activities.

Several years following the initial planting of the mitigation features, it may be determined that the density of living native canopy species and/or the density of living native midstory species is excessive in one or more of the mitigation features. This determination would be made by the USACE and NFS in coordination with the IET based on monitoring reports. Assuming such a determination was made, based strictly on the need for density reduction in order to sustain a healthy forest, a Timber Stand Improvement/Timber Management Plan addressing removal/thinning of native canopy and/or midstory species will be developed by the NFS. The actions called for in this plan would be implemented by the NFS following approval of the plan by the USACE and IET.

The USACE will be responsible for performing invasive/nuisance plant eradication events, as necessary, until mitigation success criteria 1, 2.A., 2.B., 3.A., and 4.A are all satisfied (refer to Section 6). During this period of responsibility, the USACE will also be responsible for ensuring mitigation success criterion 3.B. is satisfied (refer to Section 6). The cost of performing the activities conducted as the responsibility of the USACE will be cost shared with the NFS, subject to the provisions addressed in the Preface section above. The NFS will be responsible for performing invasive/nuisance plant eradication events once the cited success criteria are satisfied. The costs for performing these events will be borne solely by the NFS.

Subject to the provisions addressed in the Preface, the USACE will be responsible for performing the single re-planting event discussed above, including provision of the necessary plants, and the cost of this re-planting will be cost shared with the Non-Federal Sponsor. It is again emphasized that this re-planting event may not be necessary and thus would not be performed if re-planting is not required. The NFS will be responsible for any subsequent re-plantings required to meet applicable mitigation success criteria and the cost for such re-plantings will be borne solely by the NFS. As mentioned above, the NFS will be responsible for conducting any authorized Timber Stand Improvement/Timber Management activities and the cost for such activities will be borne solely by the NFS.

4. ADAPTIVE MANAGEMENT PLAN

Since the Bonnet Carre spillway was completed in 1931, the spillway has been opened 10 times thus far resulting in the spillway being open an average of once every 8.1 years. However, the number of years between openings has varied from as little as 2 years to as much as 23 years and there have been four occasions when the number of years between openings has been 4 years or less. This history indicates a probability of roughly 40% that the time span between spillway openings may be less than or equal to 4 years. The spillway has 350 bays and the number of bays opened during a particular opening event has varied from 160 to 350, while the number of days the spillway has been opened during each opening event has varied from approximately 13 days to 75 days and has averaged approximately 42 days. When all spillway bays are opened, the depth of standing water in the general area encompassing the proposed mitigation features can reach as much as roughly 12 feet, although such peak stages generally last only 2 to 3 days.

It is estimated that planted BLH species would be able to tolerate flooding events caused by opening of the spillway once the plants are 6 to 7 years old. However, as evidenced by past plantings of BLH species in the spillway outfall area, near total mortality of planted BLH seedlings could occur if such a flooding event occurs before seedlings reach this age. Given the relatively high probability of the spillway being open within 4 years or less following completion of the initial plantings proposed in the mitigation features, the adaptive management plan for this mitigation project assumes that the canopy and midstory species initially planted will have to be completely re-planted on two separate occasions. The first re-planting event is based on the assumption that the spillway would be open within 4 years following the initial installation of seedlings. The second re-planting event is based on the assumption that the spillway could be open again within 4 years of the first re-planting event.

The two re-planting events called for in the adaptive management plan would each involve total re-planting of both the native canopy and the native midstory species in accordance with the initial planting specifications (see Section 2). The adaptive management plan also calls for the performance of two annual monitoring events following each re-planting event along with the preparation of monitoring reports for each of these monitoring events.

Note that implementation of the adaptive management plan would only be required under the following circumstances:

(1) Opening of the spillway results in failure to achieve native vegetation success criterion 2.B (see Section 6), or;
(2) Opening of the spillway results in failure to achieve native vegetation success criterion 2.C (see Section 6).

Note also that the adaptive management plan assumes the need for two separate actions; one re-planting event and additional monitoring required due to this event, plus a second re-planting event and additional monitoring required due to this second event. If a spillway opening triggers implementation of the first action (first complete re-planting and associated monitoring), it is quite possible that a subsequent spillway opening would not trigger the need for implementing the second action (i.e. second complete re-planting and associated monitoring). Under this scenario, the second action of the adaptive management plan would not be required.

Any expenditure made under the adaptive management plan will be cost shared with the NFS, in accordance with EC 1105-2-409, Section 9.c, and subject to the provisions addressed in the Preface. The NFS will be responsible for actually implementing/conducting actions required by the adaptive management plan.

One should note that the complete re-planting events called for in the adaptive management plan are in addition to the single re-planting event already accounted for in the mitigation work plan (see Section 2). Similarly, the mitigation monitoring and reporting events called for in the adaptive management plan are also in addition to the additional mitigation monitoring and reporting events discussed in the mitigation monitoring and reporting section (see Section 7.1). The mitigation monitoring and reporting events discussed in Section 7.1 are based on the assumption that two annual monitoring events will be necessary simply due to the single re-planting event mentioned above.

One should note that the re-planting events called for in the adaptive management plan are in addition to the single re-planting event already accounted for in the mitigation maintenance and management plan (see Section 3). Similarly, the mitigation monitoring and reporting events called for in the adaptive management plan are also in addition to the -mitigation monitoring and reporting events discussed in the mitigation monitoring and reporting section (see Section 7.1).

It is possible that the adaptive management plan (AMP) described above might have to be amended in the future to include additional adaptive management activities. Should the need for an amendment arise, changes to the AMP would be developed by the NFS in coordination with CEMVN and the IET. Any such changes would also be coordinated with HQUSACE prior to finalizing and implementing the changes.

5. LAND ACQUISITION & PRESERVATION/PROTECTION OF MITIGATION SITE

The land encompassing the proposed mitigation features themselves as well as the land encompassing areas required for mitigation construction access and future mitigation maintenance/management access is currently owned by the federal government (i.e. USACE). Thus, this mitigation project does not require land acquisition.

The NFS will be required to preserve and protect the mitigation features in perpetuity. This requirement will be assured via the existing Project Partnership Agreement (PPA) between the USACE and the NFS, as well as through appropriate language in the Operation and Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) manual that will be prepared for this project by CEMVN and provided to the NFS. In addition to the requirement concerning preservation/protection of the mitigation features, the OMRR&R manual will provide the NFS with the appropriate rights necessary for the NFS to manage and maintain the mitigation features and to access the mitigation features.

6. MITIGATION SUCCESS CRITERIA

The ecological success (performance) criteria applicable to the proposed mitigation are described in the sub-sections that follow.

1. General Construction

A. Complete all necessary initial clearing, grubbing, earthwork, grading, and related construction activities in accordance with the mitigation work plan and in accordance with final project plans and specifications. This requirement classifies as an initial success criterion.

2. Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with Section 2.2. This requirement classifies as an initial success criterion.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following the year plants are first installed) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 living seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent re-plantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 114 living seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent re-plantings necessary to achieve this initial success requirement.
- The requirements above classify as initial success criteria.

C. 4 Years Following Completion of Initial Plantings –
- Achieve a minimum average density of 300 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- Achieve a minimum average density of 120 living, native, hard mast-producing species in the canopy stratum but no more than approximately 150 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. These 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 and NFS.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion (requirement) will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 10 Years Following Completion of Initial Plantings –
- Attain a minimum average cover of 80% by planted canopy species and/or naturally recruited native canopy species. This criterion will thereafter remain in effect for the duration of the overall monitoring period. This requirement to meet the specified minimum average cover within 10 years following completion of initial plantings classifies as an intermediate success criterion. The requirement to meet the specified minimum average cover for the duration of the overall monitoring period classifies as a long-term success criterion.

E. 15 Years Following Completion of Initial Plantings –
- Achieve a minimum average density of 75 living native plants per acre in the midstory stratum (planted midstory and/or naturally recruited native midstory species). This requirement classifies as an intermediate success criterion.

F. 25 Years Following Completion of Initial Plantings –
- Average cover by native species in the midstory stratum must be greater than 20% but cannot exceed 50%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- Average cover by native species in the understory stratum (ground cover stratum) must be greater than 30% but cannot exceed 60%. This criterion will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as long-term success criteria.

Note: 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 and NFS.

3. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events. Note -These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

4. Topography

A. In the year after initial construction activities are completed (i.e. year following completion of initial clearing, grubbing, and fill placement), demonstrate that at least 85% of the total area within each feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

5. Hydrology

A. In a year having essentially normal rainfall, demonstrate that the water table is less than or equal to 12 inches below the soil surface for a period of at least 14 consecutive days. This requirement classifies as an intermediate success criterion.

B. In a year having essentially normal rainfall, demonstrate that the mitigation features are irregularly inundated or soils are saturated to the soil surface for a period ranging from 7% to approximately 13% of the growing season. Note that this success criterion is more of a goal than it is a specific criterion; hence, some latitude is allowed as regards attaining this criterion, which classifies as a long-term success criterion.

6. Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the IET, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will be made approximately 15 to 20 years following completion of initial plantings. 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 of the mitigation site.

7. MITIGATION MONITORING AND REPORTING

7.1 STANDARD MITIGATION MONITORING AND MITIGATION MONITORING REPORTS

7.1.1 "Time Zero" Monitoring Report (Monitoring Report #1)

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, grading, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

- A detailed discussion of all mitigation activities completed.
- A description of the various features and habitats within the mitigation site.
- A plan view drawing of the mitigation site showing the approximate boundaries of the different mitigation features, monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.
- An as-built survey of finished grades in the mitigation features, along with an assessment of whether the topography success criterion has been satisfied. The topographic as-built survey may be conducted using LiDAR or conventional ground-survey methods. Note that this topographic survey would be performed prior to the initial planting of mitigation features and would be evaluated by the USACE prior to installing plants. If this evaluation indicates the topography success criterion has been achieved, then plants would be installed. However, if this evaluation indicates success has not been achieved, then supplemental topographic alterations would be performed by the USACE (subject to the provisions

contained in the Preface), a second as-built topographic survey of the affected areas would be conducted following completing of the supplemental topographic alterations, and plants would not be installed until the topography success criterion is achieved. Should this scenario arise, the time-zero monitoring report would not be submitted until the year plants are installed.

- 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 a breakdown itemization indicating the number of each species planted in each separate mitigation feature within the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

7.1.2 Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of the different mitigation features, monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- 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.

- Photographs documenting conditions in the mitigation features at the time of monitoring. Photos will be taken at permanent photo stations within these features. 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 permanent photo stations in each mitigation feature will be as follows:

  - BLH-Wet feature BC28 = 3 photo stations.
  - BLH-Wet feature BC29 = 3 photo stations.
  - BLH-Wet feature BC30 = 5 photo stations.
  - BLH-Wet feature BC31 = 3 photo stations.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and, for BLH-Wet restoration features only, the wetland indicator status of each species; average percent cover by native species in the canopy stratum; average density of all native species in the midstory stratum, the total number of each species present, and, for BLH-Wet restoration features only, 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).

  The number of permanent monitoring plots in each mitigation feature will be as follows:

  - BLH-Wet feature BC28 = 1 plot.
  - BLH-Wet feature BC29 = 2 plots.
  - BLH-Wet feature BC30 = 3 plots.
  - BLH-Wet feature BC31 = 1 plot.

- Quantitative plant data collected from permanent transects sampled using the point-centered quarter method with sampling points established at approximately 100-foot intervals along the course of each transect. Data recorded from the sampling transects will include: average density of living planted

canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of native species in the midstory stratum and 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 height of native species in the midstory stratum; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined).

The number of permanent transects and sampling points along each transect for each mitigation feature will be as follows:

- BLH-Wet feature BC28 = 1 transect with 20 sampling points.
- BLH-Wet feature BC29 = 1 transect with 20 sampling points.
- BLH-Wet feature BC30 = 1 transect with 27 sampling points.
- BLH-Wet feature BC31 = 1 transect with 20 sampling points.

- Quantitative data concerning plants in the understory (ground cover) will be gathered from sampling quadrats. These sampling quadrats will be established at each of the sampling points established along the point-centered quarter transects discussed above. Each sampling quadrat will be approximately 2 meters X 2 meters in size. 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; average percent cover by nuisance plant species.

  The number of sampling quadrats for each mitigation feature will be as follows:

  - BLH-Wet feature BC28 = 20 quadrats.
  - BLH-Wet feature BC29 = 20 quadrats.
  - BLH-Wet feature BC30 = 27 quadrats.
  - BLH-Wet feature BC31 = 20 quadrats.

- A summary of rainfall data 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, collection and reporting of rainfall data will no longer be required.

- A summary of water table elevation data collected from piezometers, possibly coupled with staff gages, installed within the mitigation features. Data (water table elevations) will be collected at least bi-weekly. Once the monitoring indicates the water table may be rising to an elevation that would meet hydrologic success criteria, water table elevations will be collected on a daily basis until it is evident the success criteria has been satisfied. The schedule of water table elevation readings can shift back to a bi-weekly basis for the remainder of the monitoring period. Once hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

  The number of piezometers in each mitigation feature will be as follows:

  - BLH-Wet feature BC28 = 2 piezometers.
  - BLH-Wet feature BC29 = 3 piezometers.
  - BLH-Wet feature BC30 = 4 piezometers.
  - BLH-Wet feature BC31 = 2 piezometers.

- 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

estimates of the average height of planted canopy and midstory species; general estimates of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory 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.

- 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.

7.1.3 Monitoring Reports Following Re-Planting Activities

Re-planting of certain areas within the mitigation features 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. It must also include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area.

7.1.4 Monitoring Reports Involving Timber Management Activities

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory 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 Non-Federal Sponsor'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.

7.2 DISTRICT CONSULTATION REPORTS & USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

Section 2036(a) of WRDA 2007 requires the USACE to conduct annual consultation with appropriate Federal and State agencies to assess the success of mitigation plans and to prepare annual reports summarizing the results of the consultations. To satisfy these requirements, annual consultation reports (District Consultation Reports) will be prepared and submitted to the USACE Mississippi Valley Division (MVD), or the reports will be submitted as directed by MVD. Each report will provide the following information:

- List of the types of mitigation implemented.
- Brief description of the mitigation, including acres implemented and acres remaining to be implemented (if any).
- Description of the consultation process (steps taken to consult with other Federal agencies and State agencies).
- Discussion of the status of consultation, identifying the agencies involved and the outcome. If consultation is complete, a listing of the outcome as one of the following: no action needed; no response from Federal or state agencies on consultation; on schedule with no adaptive management implemented due to consultation, or on schedule with adaptive management implemented due to consultation; behind schedule with adaptive management implemented due to consultation, or; behind schedule for reasons not related to consultation.
- Discussion of the outcome of consultation (if completed). This discussion will include: an assessment of the likelihood that the mitigation will achieve the success criteria specified in the mitigation plan (copy of plan provided); the projected timeline for achieving mitigation success, and; any recommendations for improving the likelihood of success.

In addition to the District Consultation Reports discussed above, data and information concerning the mitigation will be entered into the USACE's Civil Works Project Mitigation Database on an annual basis. The data and information required for entry into this database are specified within the database itself (website URL: https://sam-db01mob.sam.ds.usace.army.mil:4443/pls/apex/f?p=107).

7.3 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: STANDARD MONITORING AND REPORTING

Monitoring will typically take place in late summer of the year of 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. 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 Preface.

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.
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – A.

Monitoring events associated with the above will include the "time zero" (first or baseline) monitoring event plus annual monitoring events thereafter until the mitigation monitoring responsibility is transferred to the NFS. The Non-Federal Sponsor will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis.

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criterion 2.B), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). 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 this success criterion.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. native vegetation success criteria 2.C) , 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 in the mitigation features, 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).

The following table indicates the currently anticipated monitoring report schedule and the party responsible for conducting the monitoring and preparing the report.

Table 7-1. Standard mitigation monitoring report schedule and monitoring responsibility.

Year	Monitoring Report Number	Party Responsible for Monitoring and Reporting
0 (start of construction)	N/A	N/A
1 (completion of initial construction activities)	N/A	N/A
2 (completion of final earthwork construction activities; filled areas settle to target grade)	N/A	N/A
3 (complete initial plantings early in year; completion of construction)	1 (Time Zero Report)	USACE
4 (1 year after initial plantings)	2	USACE
5 (re-planting, if necessary)	2A*	USACE*
6	2B*	USACE*
7	3	CPRA
12	4	CPRA
17	5	CPRA
22	6	CPRA
27	7	CPRA
32	8	CPRA
37	9	CPRA
42	10	CPRA
47	11	CPRA
52	12	CPRA

* Monitoring reports 2A and 2B would only be necessary if re-planting is necessary, as determined by the monitoring results documented in monitoring report #2.

It is again noted that monitoring reports 2A and 2B indicated in the preceding table will only be necessary if the second monitoring report indicates that native vegetation success criterion #2.B pertaining to the survival of planted canopy and midstory species has not been achieved, thereby requiring re-planting in Year #5. If re-planting is unnecessary, there would be no monitoring in years 5 and 6. However, it has been assumed that some re-planting will be necessary. The schedule provided in the table does not account for the need to physically adjust topography in the mitigation features once final construction activities have been completed. Should such adjustments be necessary to achieve applicable topographic success criteria, then the monitoring schedule presented would likely require adjustments.

Although the USACE will be responsible for conducting the monitoring necessary for monitoring reports 1, 2, 2A, and 2B and will be responsible for preparing these reports, the costs for these activities will be cost shared with the NFS, subject to the provisions stated in the Preface. The costs associated with conducting the monitoring and preparing monitoring reports for all subsequent monitoring reports will be solely borne by the NFS, pursuant to the provisions stated in the Preface.

It is not feasible at this time to accurately estimate the actual calendar year when mitigation construction activities will be initiated. This explains why the years indicated in the preceding table are not actual calendar years. Should it be necessary to implement the subject mitigation project rather than the current TSMP, this mitigation plan will be revised to include a monitoring/reporting schedule using estimated calendar years.

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.

7.4 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: DISTRICT CONSULTATION REPORTS AND USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

The USACE will be responsible for preparing and submitting all District Consultation Reports. These reports will be submitted on annual basis beginning in the year the mitigation plan is implemented (i.e. start of mitigation construction) and continuing throughout the 50-year period of analysis. The date for submittal of each report will be in accordance with guidance provided by MVD and/or HQUSACE (USACE Headquarters). Presently, MVD guidance is each annual report must be submitted at least 14 working days prior to October 1st each year; however, this guidance is subject to change.

The agencies involved in the consultation process will include, at a minimum: USACE, Mississippi Valley Division, New Orleans District (CEMVN); the Non-Federal Sponsor (i.e. CPRA); US Fish and Wildlife Service (USFWS); Louisiana Department of Natural Resources (LDNR). The USACE will be responsible for conducting the consultation until the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for conducting the consultation and for providing results of the consultation to USACE (i.e. NFS will be responsible for obtaining and providing to USACE all information necessary for preparing the District Consultation Report).

The USACE will be responsible for inputting all information required for the USACE's Civil Works Mitigation Project Database as regards this mitigation project. This information will be input by CEMVN on an annual basis beginning in the year the mitigation is implemented and continuing throughout the 50-year period of analysis. The information will be input by the deadline(s) established by HQUSACE. The USACE will be responsible for gathering the information necessary for database input until the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for gathering this information and providing it to CEMVN for input.

7.5 COST OF MITIGATION MONITORING AND REPORTING

The total cost of mitigation monitoring and reporting activities addressed herein is currently estimated to be approximately $651,000. This preliminary estimate includes all mitigation monitoring and reporting costs throughout the 50-year period of analysis. This estimate also includes the cost of conducting the additional monitoring required due to the need for one re-planting event following the initial planting event. It was assumed that one re-planting event would be necessary to meet the initial survival success criteria for planted native vegetation. If this assumption is erroneous, the estimated monitoring and reporting cost would decrease (a reduction in the Federal share of total cost). These cost estimates do not account for any further topographic alterations following completion of the final mitigation construction activities since it is not anticipated that such physical alterations will be necessary. If this assumption is violated, the estimated mitigation monitoring and reporting cost would increase due to the need for additional monitoring/reporting events. Note that this cost estimate also does not include additional monitoring and reporting costs that would be incurred should the adaptive management plan need to be implemented.

8. FINANCIAL ASSURANCES

Financial assurances are required to ensure that the compensatory mitigation project would be successful. In this case the LPV HSDRRS Project Partnership Agreement between the CPRA of Louisiana (the Non-Federal Sponsor) and the Federal Government provides the required financial assurance for this mitigation project. In the event that the Non-Federal Sponsor fails to perform, the CEMVN has the right to complete, operate, maintain, repair, rehabilitate or replace any project feature, including mitigation features, but such action would not relieve CPRA of its responsibility to meet its obligations and would not preclude the US from pursuing any remedy at law or equity to ensure CPRA's performance.

9. DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following subsections.

Interagency Environmental Team (IET)
The "Interagency Environmental Team" consists of representatives from the following resource agencies; US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), US Environmental Protection Agency (EPA), State of Louisiana Office of Coastal Protection and Restoration (CPRA), Louisiana Department of Natural Resources (DNR), Louisiana Department of Wildlife and Fisheries (LDWF).

Non-Federal Sponsor (NFS)
This term refers to the Non-Federal Sponsor for the mitigation project, which is CPRA.

Invasive Plant Species
All plant species identified as invasive or as non-indigenous (exotic) in the following two sources:

> Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
> (Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)
>
> Barataria-Terrebonne National Estuary Program (BTNEP). 2012. Exotic Invasive Species of the Barataria-Terrebonne, Invasive Species in Louisiana. BTNEP, Thibodaux, LA. (Website - http://invasive.btnep.org/invasivesvsnatives/invasivesinla2list.aspx)

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazilian vervain (*Verbena litoralis* var. *brevibrateata*), coral ardisia (*Ardisia crenata*), Japanese ardisia (*Ardisia japonica*), cogon grass (*Imperata cylindrical*), golden bamboo (*Phyllostachys aurea),* and rescuegrass (*Bromus catharticus*).

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium capillifolium, Eupatorium compositifolium*), marsh thoroughwort (*Eupatorium leptophyllum*), late-flowering thoroughwort (*Eupatorium serotinum*), common ragweed (*Ambrosia artemisiifolia*), giant ragweed (*Ambrosia trifida*), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), blue vervane (*Verbena hastata*), white vervane (*Verbena urticifolia*), wingstem (*Vervesina alternifolia*), frostweed (*Verbesina virginica*), tall ironweed (*Vernonia gigantea*), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the NFS and IET.

Native Plant Species
This category includes all plant species that are not classified as invasive plant species and are not considered to be nuisance plant species.

USACE Hydrophytic Vegetation Criteria
Reference to satisfaction of USACE hydrophytic vegetation criteria (i.e. plant community is dominated by hydrophytic vegetation) shall mean that sampling of the plant community demonstrates that one or more of the hydrophytic vegetation indicators set forth in the following reference is achieved:

USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0); ERDC/EL TR-10-20. USACE Engineer Research and Development Center, Vicksburg, MS.

Wetland Indicator Status of Plant Species

The wetland indicator status of plants is a means of classifying the estimated probability of a species occurring in wetlands versus non-wetlands. Indicator categories include; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). The wetland indicator status of a particular plant species shall be as it is set forth in the following reference (the "2012 National Wetland Plant List") using the Region 2 listing contained therein. However, if the USACE approves and adopts a new list in the future, then the currently approved list will apply.

Lichvar, Robert W. and J.T. Kartesz. 2009. North American Digital Flora: National Wetland Plant List, version 2.4.0 (https://wetland_plants.usace.army.mil). USACE, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH and BONAP, Chapel Hill, NC.

Growing Season

As used herein, the growing season is considered to be the period from April through October of any given year, although some deviation from this typical range is allowed.

Planting Season

This is generally considered to be the period from approximately December 15 through March 15, although some deviation from this typical range is allowed.

Point-Centered Quarter Method

A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

Cottam, Grant and J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer

Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes will be constructed in general accordance with the following reference, unless otherwise approved by CEMVN:

U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center. (website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

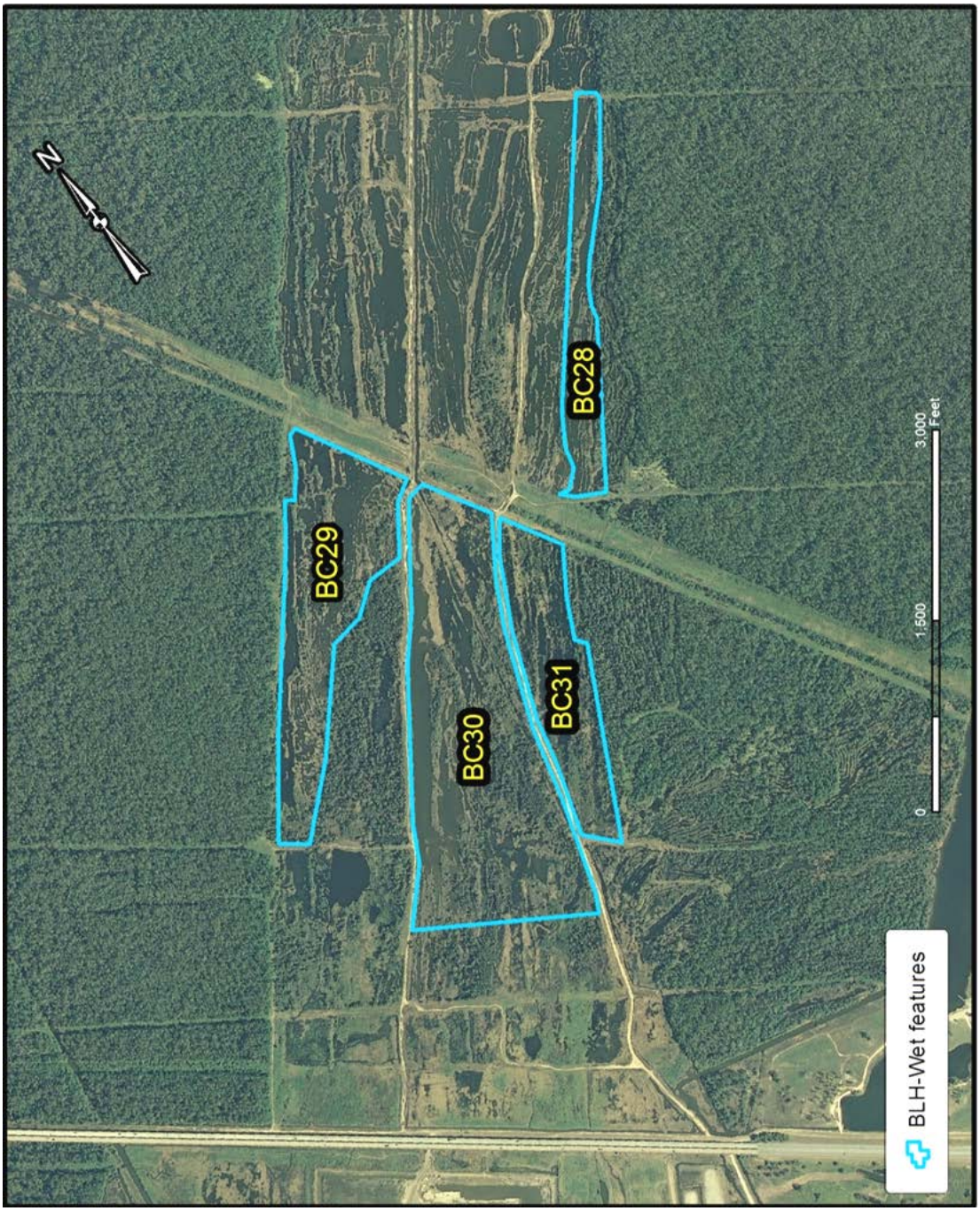

Figure K-1. Proposed BLH-Wet restoration features BC28 (16.9 ac.), BC29 (39.4 ac.), BC30 (74.4 ac.), and BC31 (25.5 ac.).

APPENDIX L

BONNET CARRE SWAMP RESTORATION PROJECT: MITIGATION PROGRAM FOR LPV HSDRRS IMPACTS TO SWAMP HABITATS

PREFACE

A mitigation program (mitigation plan) was developed by the USACE, in coordination with the Interagency Environmental Team (IET), to compensate for LPV HSDRRS impacts to swamp habitats. These impacts occurred on lands outside of national wildlife refuge boundaries and are thus referred to as non-refuge or "general" impacts. These impacts affected swamp habitats situated on both the flood side (FS) and protected side (PS) of the HSDRRS levee system. This appendix provides detailed information concerning the proposed mitigation program.

As discussed in Section 2 of the PIER, the Tentatively Selected Mitigation Project (TSMP) for mitigating the cited impacts would involve the purchase of swamp mitigation credits from a mitigation bank. The mitigation program (mitigation project) discussed herein would only be implemented if the TSMP cannot be implemented (refer to PIER Section 2). Certain details of the Bonnet Carre Swamp Restoration Project (the mitigation program) discussed herein may be slightly refined and modified if it is necessary to implement this project. The USACE will coordinate with the IET, the Non-Federal Sponsor (NFS), and other members of the Project Delivery Team (PDT) in making any refinements and modifications to the mitigation program. Such modifications, if necessary, would ensure that the mitigation program fully compensates for the cited swamp impacts. It is highly unlikely that these modifications would significantly alter the environmental impacts assessment for this mitigation project as discussed in Sections 4 and 5 of the PIER. If this should not be the case however, a supplemental NEPA document would be prepared by the USACE in coordination with the IET, NFS, and PDT prior to implementing the mitigation project.

The proposed mitigation actions will include construction (summarized below), with the Non-Federal Sponsor responsible for operation and maintenance of functional portions of work as they are completed. On a cost shared basis, USACE will monitor completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve mitigation success. USACE will undertake additional actions necessary to achieve mitigation success in accordance with cost sharing applicable to the project and subject to the availability of funds. Once USACE determines that the mitigation has achieved initial success criteria, monitoring will be performed by the Non-Federal Sponsor 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, USACE will consult with other agencies and the Non-Federal Sponsor to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, USACE will 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. The reader should be aware that the provisions set forth in this paragraph are applicable to the entire proposed mitigation program (mitigation plan) discussed herein.

The figure cited herein is provided at the end of this appendix. Section 9 contains definitions of certain terms used in this appendix. All elevations mentioned herein are expressed in feet NAVD88(2004.65).

1. MITIGATION OBJECTIVES

The primary objective of the proposed mitigation project is to restore approximately 310.3 acres of swamp forest (e.g. cypress-tupelo forest) at the mitigation site in order to compensate for LPV HSDRRS impacts to approximately 197.4 acres of swamp habitats. The USFWS ran Wetland Value Assessment (WVA) models for the cited impacts and for the proposed mitigation project. As indicated in the table below, these models predicted that the habitat functions and values, expressed in Average Annual Habitat Units (AAHUs), lost as

a result of the impacts would be adequately compensated by the net gain in habitat functions and values that would be realized via the mitigation project over the course of the 50-year period of analysis.

Table 1-1. LPV HSDRRS Impacts to Swamp Habitats Compared to Proposed Mitigation.

Swamp Acres Impacted by HSDRRS	Net AAHUs Lost via HSDRRS Impacts	Swamp Acres Restored in Mitigation Plan	Net AAHUs Gained via Mitigation Plan
197.4	108.01	310.3	121.02

The proposed restoration of swamp habitats will occur within various mitigation features, which are essentially separate geographic areas (polygons) where swamp forests will be restored. The proposed mitigation features encompass areas that have been severely disturbed by past clearing and excavation activities performed to acquire borrow material for off-site projects. These activities have drastically altered normal topography, creating both depressions and ridges, and have cleared prior wetland forests. Invasive and nuisance plant species, particularly black willow, have since colonized portions of these areas. The proposed mitigation project will restore appropriate topography and native swamp forests in these areas, thereby increasing the current habitat functions and values provided by the previously disturbed habitats.

One of the secondary objectives of the proposed mitigation project is to eradicate invasive and nuisance plant species within the mitigation features and to control re-infestation of the mitigation features by such plants. Invasive/nuisance plant species have the potential for jeopardizing the growth and development of native swamp species, thereby reducing typical functions and values associated with swamp forests. The eradication and control of invasive/nuisance plant species will help ensure the restored swamp forests provide habitat and habitat functions/values typical of such forests.

2. MITIGATION WORK PLAN

2.1 KEY COMPONENTS OF MITIGATION WORK PLAN

Section 2.9.2.2 in the main body of this PIER provides a detailed description of the proposed mitigation work plan (i.e. mitigation project description). Figure L-1 depicts the four proposed swamp restoration features (mitigation features BC24 through BC27) discussed herein. The key elements of the proposed work plan or mitigation construction/implementation plan are as follows.

- Initial clearing and grubbing of existing woody vegetation (trees and shrubs) within the proposed mitigation features (e.g. within the “footprints” of the proposed swamp restoration features) prior to fill placement. These activities will include mechanized removal (mechanized eradication) of invasive and nuisance plant species present within the mitigation features. In addition, certain existing earthen spoil mounds and ridges within each mitigation feature will be degraded to equal the desired final target grade elevation of the mitigation features. Existing spoil ridges along the outer perimeter of each mitigation feature will be left in place at this stage so these ridges can serve as containment berms for the fill that must be placed within the features.

- Initial eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, prior to fill placement.

- Placement of fill (borrow material) within the mitigation features as necessary to attain the desired final target grade elevation of approximately 0.5 feet NAVD88. The borrow material would be dredged from Lake Pontchartrain, just north of the mitigation site. The borrow material would be transported to the mitigation features in a pipeline extending from the borrow sites to the outfall of an existing canal, then down the existing canal until reaching locations near the mitigation features, then across existing disturbed borrow areas to the mitigation features themselves.

- As necessary, follow-up eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, prior to the initial planting of native swamp species within these features.

- Final grading within the mitigation features after the fill deposited in these features has settled to the desired final target elevation, prior to initial planting of the features. This grading will be performed to remove any earthen ridges that remain projecting above the target grade elevation, thereby creating a relatively level surface in the mitigation features.

- Initial planting (initial installation) of native swamp canopy and midstory species in the mitigation features following final grading of the mitigation features. Refer to the planting specifications that follow. The successful completion of this initial planting event will mark the end of the mitigation construction phase.

- One re-planting of native swamp canopy and midstory species in the mitigation features following completion of the initial planting event. It was assumed that approximately 20% of the total number of canopy species and approximately 20% of the total number of midstory species initially planted would have to be re-planted in order to satisfy the plant survival requirements set forth in native vegetation success criterion 2.B (see Section 6). However, this re-planting event will not be performed if the applicable success criteria are satisfied.

- As necessary, follow-up eradication of invasive/nuisance plant species within the mitigation features through ground-based application of appropriate herbicides to the target species, following the initial planting cited above. There will likely be multiple invasive/nuisance plant species eradication events performed during various years following completion of the initial planting event.

The USACE will be responsible for conducting all mitigation construction activities, although the costs associated with these activities will be cost shared with the NFS, subject to the provisions addressed in the Preface section above. Refer to the following sections for a discussion of responsibilities for other activities required as part of the proposed mitigation program.

2.2 INITIAL PLANTING OF MITIGATION FEATURES

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

The canopy species installed will be in general accordance with the species list provided in Table 2-1. Site conditions (factors such as hydrologic regime, soils, composition of existing native canopy species, etc.) and planting stock availability may necessitate deviations from the species lists and/or the percent composition guidelines indicated in this table. Any deviations would have to first be approved by the USACE in coordination with the IET and NFS.

The midstory species installed will be in general accordance with the species list provided in Table 2-2. The species used and the proportion of the total midstory plantings represented by each species (percent composition) may vary somewhat from the data provided in Table 2-2 depending on various factors including site conditions (composition and frequency of existing native midstory species, hydrologic regime, soils, etc.) and planting stock availability. Any deviations would have to first be approved by the USACE in coordination with the IET and NFS.

Table 2-1. Planting List for Native Canopy Species.

Common Name	Scientific name	Percent Composition
Bald cypress	*Taxodium distichum*	55%
Tupelogum	*Nyssa aquatica*	20%
Green ash	*Fraxinus pennsylvanica*	10%
Bitter pecan	*Carya x lecontei*	10%
Drummond red maple	*Acer rubrum* var. *drummondii*	5%

Note:
Percent composition values indicated represent the percentage of the total number of plants that will be installed.

Table 2-2. Planting List for Native Midstory Species.

Common Name	Scientific name	Percent Composition
Buttonbush	*Cephalanthus occidentalis*	50%
Swamp privet	*Forestiera acuminata*	20%
Possumhaw	*Ilex decidua*	10%
Wax myrtle	*Myrica cerifera, Morella cerifera*	10%
American snowbell	*Styrax americanus*	10%

The initial planting of the mitigation features will be the responsibility of the USACE. Costs associated with this initial planting will be cost shared with the NFS, subject to the provisions addressed in the Preface section above.

3. MAINTENANCE AND MANAGEMENT PLAN

The primary maintenance and management activities anticipated involve the short-term and long-term eradication and control of invasive and nuisance plant species. It is anticipated that there will be 1 invasive/nuisance plant eradication event during the year mitigation construction begins, 2 such events in the following year, 2 such events during the year the mitigation features are first planted, and at least 2 such events during each of the three years following the year of initial planting. It is anticipated that there will be at least 1 invasive/nuisance plant eradication event per year in the fourth and fifth year following the year of initial planting. Thereafter, it is anticipated that there will be one invasive/nuisance plant eradication event every three to five years.

One should note that the actual frequency of invasive/nuisance plant eradication events may differ from the frequency discussed above. The frequency and intensity of these events will largely be determined based on the degree of invasive/nuisance plant infestation observed during mitigation monitoring activities, as well as that observed during periodic inspections of the mitigation features conducted outside the framework of prescribed mitigation monitoring events.

The methods used to eradicate invasive and nuisance plant species will vary. Mechanized clearing and removal of such species may be employed during eradication events occurring prior to the initial planting of native species, using equipment such as hydro-axes, gyro-tracs, bulldozers, etc. Hand-held equipment such as chain saws and machetes may also be used. It is doubtful that mechanized clearing/removal of invasive/nuisance plants will be employed once the initial planting of native species has occurred. Instead, invasive/nuisance plants will be eradicated using ground-based applications of appropriate herbicides to the target plants. The specific equipment (e.g. backpack sprayers, hand application, hypo-hatchet, tube-injector, ATVs with boom sprayers, etc.) and methods (e.g. cut stump treatment, basal bark application, hack and squirt, etc.) used to apply the herbicides will be determined by the contractor to maximize effectiveness. Note that ground-based applications of herbicides would also be employed to treat any stumps or other above-ground portions of invasive/nuisance plants remaining following mechanized clearing and removal of such plants. Ground-based herbicide applications will typically occur during the early part of the growing season in cases where there will be 1 or 2 application events during a given year, and will typically occur again during the latter part of the growing season in cases where there will be 2 application events during a given year.

As mentioned in Section 2, short-term maintenance/management activities will include one re-planting event conducted after the initial planting of native canopy and midstory species. It was assumed that this event, involving the re-planting of approximately 20% of the total number of canopy species and 20% of the total number of midstory species first installed, would be necessary to satisfy native vegetation success criterion 2.B (see Section 6). However if the referenced success criterion is satisfied, this re-planting event will not be performed. It is not anticipated that subsequent re-planting of native canopy and/or midstory species will be necessary, with the potential exception of re-planting required for adaptive management (see Section 4). Should additional re-plantings be necessary to satisfy applicable mitigation success criteria, then these re-plantings would become part of the long-term management/maintenance activities.

Several years following the initial planting of the mitigation features, it may be determined that the density of living native canopy species and/or the density of living native midstory species is excessive in one or more of the mitigation features. This determination would be made by the USACE and NFS in coordination with the IET based on monitoring reports. Assuming such a determination was made, based strictly on the need for density reduction in order to sustain a healthy forest, a Timber Stand Improvement/Timber Management Plan addressing removal/thinning of native canopy and/or midstory species will be developed by the NFS. The actions called for in this plan would be implemented by the NFS following approval of the plan by the USACE and IET.

The USACE will be responsible for performing invasive/nuisance plant eradication events, as necessary, until mitigation success criteria 1, 2.A., 2.B., 3.A., and 4.A are all satisfied (refer to Section 6). During this period of responsibility, the USACE will also be responsible for ensuring mitigation success criterion 3.B. is satisfied (refer to Section 6). The cost of performing the activities conducted as the responsibility of the USACE will be cost shared with the NFS, subject to the provisions addressed in the Preface section above. The NFS will be responsible for performing invasive/nuisance plant eradication events once the cited success criteria are satisfied. The costs for performing these events will be borne solely by the NFS.

Subject to the provisions addressed in the Preface, the USACE will be responsible for performing the single re-planting event discussed above, including provision of the necessary plants, and the cost of this re-planting will be cost shared with the Non-Federal Sponsor. It is again emphasized that this re-planting event may not be necessary and thus would not be performed if re-planting is not required. The NFS will be responsible for any subsequent re-plantings required to meet applicable mitigation success criteria and the cost for such re-plantings will be borne solely by the NFS. As mentioned above, the NFS will be responsible for conducting any authorized Timber Stand Improvement/Timber Management activities and the cost for such activities will be borne solely by the NFS.

4. ADAPTIVE MANAGEMENT PLAN

Since the Bonnet Carre spillway was completed in 1931, the spillway has been opened 10 times thus far resulting in the spillway being open an average of once every 8.1 years. However, the number of years between openings has varied from as little as 2 years to as much as 23 years and there have been four occasions when the number of years between openings has been 4 years or less. This history indicates a probability of roughly 40% that the time span between spillway openings may be less than or equal to 4 years. The spillway has 350 bays and the number of bays opened during a particular opening event has varied from 160 to 350, while the number of days the spillway has been opened during each opening event has varied from approximately 13 days to 75 days and has averaged approximately 42 days. When all spillway bays are opened, the depth of standing water in the general area encompassing the proposed mitigation features can reach as much as roughly 12 feet, although such peak stages generally last only 2 to 3 days.

It is estimated that planted swamp species would be able to tolerate flooding events caused by opening of the spillway once the plants are 5 to 6 years old. However, as evidenced by past plantings of swamp species in the spillway outfall area, significant mortality of planted swamp seedlings could occur if such a flooding event occurs before seedlings reach this age. Given the relatively high probability of the spillway being open within 4 years or less following completion of the initial plantings proposed in the mitigation features, the adaptive management plan for this mitigation project assumes that the canopy and midstory

species initially planted will have to be completely re-planted on two separate occasions. The first re-planting event is based on the assumption that the spillway would be open within 4 years following the initial installation of seedlings. The second re-planting event is based on the assumption that the spillway could be open again within 4 years of the first re-planting event.

The two re-planting events called for in the adaptive management plan would each involve total re-planting of both the native canopy and the native midstory species in accordance with the initial planting specifications (see Section 2). The adaptive management plan also calls for the performance of two annual monitoring events following each re-planting event along with the preparation of monitoring reports for each of these monitoring events.

Note that implementation of the adaptive management plan would only be required under the following circumstances:

(1) Opening of the spillway results in failure to achieve native vegetation success criterion 2.B (see Section 6), or;
(2) Opening of the spillway results in failure to achieve native vegetation success criterion 2.C (see Section 6).

Note also that the adaptive management plan assumes the need for two separate actions; one re-planting event and additional monitoring required due to this event, plus a second re-planting event and additional monitoring required due to this second event. If a spillway opening triggers implementation of the first action (first complete re-planting and associated monitoring), it is quite possible that a subsequent spillway opening would not trigger the need for implementing the second action (i.e. second complete re-planting and associated monitoring). Under this scenario, the second action of the adaptive management plan would not be required.

Any expenditure made under the adaptive management plan will be cost shared with the NFS, in accordance with EC 1105-2-409, Section 9.c, and subject to the provisions addressed in the Preface. The NFS will be responsible for actually implementing/conducting actions required by the adaptive management plan.

One should note that the complete re-planting events called for in the adaptive management plan are in addition to the single re-planting event already accounted for in the maintenance and management plan (see Section 3). Similarly, the mitigation monitoring and reporting events called for in the adaptive management plan are also in addition to the mitigation monitoring and reporting events discussed in the mitigation monitoring and reporting section (see Section 7.1).

It is possible that the adaptive management plan (AMP) described above might have to be amended in the future to include additional adaptive management activities. Should the need for an amendment arise, changes to the AMP would be developed by the NFS in coordination with CEMVN and the IET. Any such changes would also be coordinated with HQUSACE prior to finalizing and implementing the changes.

5. LAND ACQUISITION & PRESERVATION/PROTECTION OF MITIGATION SITE

The land encompassing the proposed mitigation features themselves as well as the land encompassing areas required for mitigation construction access and future mitigation maintenance/management access is currently owned by the federal government (i.e. USACE). Thus, this mitigation project does not require land acquisition.

The NFS will be required to preserve and protect the mitigation features in perpetuity. This requirement will be assured via the existing Project Partnership Agreement (PPA) between the USACE and the NFS, as well as through appropriate language in the Operation and Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) manual that will be prepared for this project by CEMVN and provided to the NFS. In addition to the requirement concerning preservation/protection of the mitigation features, the OMRR&R manual will provide the NFS with the appropriate rights necessary for the NFS to manage and maintain the mitigation features and to access the mitigation features.

6. MITIGATION SUCCESS CRITERIA

The ecological success (performance) criteria applicable to the proposed mitigation are described in the sub-sections that follow.

1. General Construction

A. Complete all necessary initial clearing, grubbing, earthwork, grading, and related construction activities in accordance with the mitigation work plan and in accordance with final project plans and specifications. This requirement classifies as an initial success criterion.

2. Native Vegetation

A. Complete initial planting of canopy and midstory species in accordance with Section 2.2. This requirement classifies as an initial success criterion.

B. 1 Year Following Completion of Initial Plantings (at end of first growing season following the year plants are first installed) –

- Achieve a minimum average survival of 50% of planted canopy species (i.e. achieve a minimum average canopy species density of 269 seedlings/ac.). The surviving plants must approximate the species composition and the species percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- Achieve a minimum average survival of 85% of planted midstory species (i.e. achieve a minimum average midstory species density of 114 seedlings/ac.). The surviving plants must approximate the species composition percentages specified in the initial plantings component of the Mitigation Work Plan. These criteria will apply to the initial plantings as well as any subsequent replantings necessary to achieve this initial success requirement.
- The requirements above classify as initial success criteria.

C. 4 Years Following Completion of Initial Plantings –

- Achieve a minimum average density of 250 living native canopy species per acre (planted trees and/or naturally recruited native canopy species).
- 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.
- Achieve a minimum average density of 85 living native midstory species per acre (planted midstory and/or naturally recruited native midstory species).
- Demonstrate that vegetation satisfies USACE hydrophytic vegetation criteria. This criterion (requirement) will thereafter remain in effect for the duration of the overall monitoring period.
- The requirements above classify as intermediate success criteria; with the exception that the requirement to demonstrate vegetation satisfies USACE hydrophytic vegetation criteria throughout the duration of the overall monitoring period classifies as a long-term success criterion.

D. Within 15 Years Following Completion of Initial Plantings –

- Achieve one of the two following vegetative cover requirements, which classify as intermediate success criteria:
  1. 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%, and; the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.
  2. The average percent cover by native species in the canopy stratum is at least 75%, and: (a) the average percent cover by native species in the midstory stratum exceeds 33%, or; (b) the average percent cover by native species in the ground cover stratum (herbaceous cover) exceeds 33%.

E. Within 45 Years Following Completion of Initial Plantings –
- 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.
- 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.
- 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.
- The above requirements classify as long-term success criteria.

F. 45 Years Following Completion of Initial Plantings –
- Demonstrate that a minimum of 160 living native trees remain in the canopy stratum.
- Demonstrate that either success criteria D.1 or D.2 above have been maintained.
- The requirements above classify as long-term success criteria.

Note: The above requirements may need to be modified later due to factors such as the effects of sea level rise or salinity on vegetative cover. Proposed modifications must first be approved by the USACE and the Non-Federal Sponsor in coordination with the IET and NFS.

3. Invasive and Nuisance Vegetation

A. Complete the initial eradication of invasive and nuisance plant species. This requirement classifies as an initial success criterion.

B. Maintain all areas such that they are essentially free from invasive and nuisance plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive and nuisance species each constitute less than 5% of the total average plant cover during periods between maintenance events. These criteria must be satisfied throughout the duration of the overall monitoring period. Until such time as that monitoring responsibilities are transferred from the USACE to the NFS, this requirement classifies as an initial success criterion. Following the transfer of monitoring responsibilities, this requirement classifies as a long-term success criterion.

4. Topography

A. In the year after initial construction activities are completed (i.e. year following completion of initial clearing, grubbing, and fill placement), demonstrate that at least 85% of the total area within each mitigation feature is within approximately 0.5 feet of the proposed target soil surface elevation (e.g. the desired soil surface elevation). This requirement classifies as an initial success criterion.

5. Hydrology

A. In a year having essentially normal rainfall, demonstrate compliance with each of the following criteria:

- Achieve inundation of the majority of the mitigation features for a minimum of 200 consecutive days but for no more than approximately 300 consecutive days, preferably with periods of inundation overlapping a portion of the growing season.
- Achieve non-inundation of the majority of the mitigation features (e.g. water table at or below the soil surface) for a minimum of approximately 60 consecutive days but for no more than approximately 90 consecutive days, preferably during the period from June through August.
- The average maximum (peak) water table elevation must range between approximately 1.0 feet to 2.0 feet above the soil surface.
- The above requirements classify as long-term success criteria.

6. Thinning of Native Vegetation (Timber Management)

The USACE, in cooperation with the IET, may determine that thinning of the canopy and/or midstory strata is warranted to maintain or enhance the ecological value of the site. This determination will likely be made after it is demonstrated that the average total basal area accounted for by living native canopy species exceeds 170 square feet per acre. 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 will demonstrate the successful completion of these operations. Timber management activities will only be allowed for the purposes of ecological enhancement of the mitigation site.

7. MITIGATION MONITORING AND REPORTING

7.1 STANDARD MITIGATION MONITORING AND MITIGATION MONITORING REPORTS

7.1.1 "Time Zero" Monitoring Report (Monitoring Report #1)

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive and nuisance plants, first/initial planting of native species, completion of initial earthwork, etc.), the mitigation site will be monitored and a "time zero" or "baseline" monitoring report prepared. Information provided will include the following items:

- A detailed discussion of all mitigation activities completed.
- A description of the various features and habitats within the mitigation site.
- A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features, monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.
- An as-built survey of finished grades in the mitigation features, along with an assessment of whether the topography success criterion has been satisfied. The topographic as-built survey may be conducted using LiDAR or conventional ground-survey methods. Note that this topographic survey would be performed prior to the initial planting of mitigation features and would be evaluated by the USACE prior to installing plants. If this evaluation indicates the topography success criterion has been achieved, then plants would be installed. However, if this evaluation indicates success has not been achieved, then supplemental topographic alterations would be performed by the USACE (subject to the provisions contained in the Preface), a second as-built topographic survey of the affected areas would be conducted following completing of the supplemental topographic alterations, and plants would not be installed until the topography success criterion is achieved. Should this scenario arise, the time-zero monitoring report would not be submitted until the year plants are installed.
- 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 a breakdown itemization indicating the number of each species planted in each separate mitigation feature within the mitigation site and correlate this itemization to the various areas depicted on the plan view drawing of the mitigation site.

7.1.2 Additional Monitoring Reports

All monitoring reports generated after the initial "time zero" report will provide the following information unless otherwise noted:

- A plan view drawing of the mitigation site showing the approximate boundaries of the different mitigation features, monitoring transect locations, sampling plot locations, photo station locations, and piezometer and staff gage locations.

- 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.

- Photographs documenting conditions in the mitigation features at the time of monitoring. Photos will be taken at permanent photo stations within the mitigation features. 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 permanent photo stations in each mitigation feature will be as follows:

  - Swamp feature BC24 = 12 photo stations.
  - Swamp feature BC25 = 6 photo stations.
  - Swamp feature BC26 = 7 photo stations.
  - Swamp feature BC27 = 4 photo stations.

- Quantitative plant data collected from permanent monitoring plots measuring approximately 80 feet X 80 feet in size. Data recorded in each plot will include: number of living planted canopy species present and the species composition; number of living planted midstory species present and the species composition; average density of all native species in the canopy stratum, the total number of each species present, and the wetland indicator status of each species; average percent cover by native species in the canopy stratum; 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). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of bald cypress trees; average DBH of all other native tree species excluding bald cypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2 inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre.

  The number of permanent monitoring plots in each mitigation feature will be as follows:

  - Swamp feature BC24 = 8 plots.
  - Swamp feature BC25 = 3 plots.
  - Swamp feature BC26 = 5 plots.
  - Swamp feature BC27 = 2 plots.

- Quantitative plant data collected from permanent transects sampled using the point-centered quarter method with sampling points established at approximately 100-foot intervals along the course of each transect. Data recorded from the sampling transects will include: average density of living planted canopy species present and the species composition; average density of living planted midstory species present and the species composition; average density of all native species in the canopy stratum along with the species composition and the wetland indicator status of each species; average percent cover by all native species in the canopy stratum; average density of 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; if present, average percent cover accounted for by invasive and nuisance species present in the canopy and midstory strata (combined). In addition to these data, the following information will be recorded for native tree species in the canopy stratum: the average diameter at breast height (DBH; expressed in inches) of bald cypress trees; average DBH of all other native tree species excluding bald cypress; the average total basal area of living native trees (expressed in square feet per acre). The DBH of planted canopy species will not need to be documented until the average DBH of these trees reaches approximately 2

inches. Total basal area data will also not need to be documented until such time that the average total basal area is estimated to exceed approximately 100 square feet per acre.

The number of permanent transects and sampling points along each transect within each mitigation feature will be as follows:

- Swamp feature BC24 = 1 transect with 20 sampling points, 1 transect with 21 sampling points, and 1 transect with 28 sampling points.
- Swamp feature BC25 = 2 transects, each with 20 sampling points.
- Swamp feature BC26 = 2 transects, each with 20 sampling points.
- Swamp feature BC27 = 1 transect with 30 sampling points.

- Quantitative data concerning plants in the understory (ground cover) stratum will be gathered from sampling quadrats. These sampling quadrats will be established at each of the sampling points established along the point-centered quarter transects discussed above. Each sampling quadrat will be approximately 2 meters X 2 meters in size. Data recorded from the sampling quadrats will include: average percent cover by native ground cover species; average percent cover by invasive plant species; average percent cover by nuisance plant species; composition of ground cover species and the wetland indicator status of each species.

  The number of sampling quadrats in each mitigation feature will be as follows:

  - Swamp feature BC24 = 49 quadrats.
  - Swamp feature BC25 = 40 quadrats.
  - Swamp feature BC26 = 40 quadrats.
  - Swamp feature BC27 = 30 quadrats.

- A summary of rainfall data 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, collection and reporting of rainfall data will no longer be required.

- A summary of water table elevation data collected from piezometers coupled with staff gages installed within the mitigation site. Data (water table elevations) will be collected at least bi-weekly throughout the year. Once it is demonstrated that all applicable hydrology success criteria have been satisfied, water table monitoring will no longer be required. However, monitoring reports generated subsequent to the attainment of success criteria will include a general discussion of water levels and hydroperiod based on qualitative observations.

  The number of piezometers in each mitigation feature will be as follows:

  - Swamp feature BC24 = 8 piezometers.
  - Swamp feature BC25 = 4 piezometers.
  - Swamp feature BC26 = 4 piezometers.
  - Swamp feature BC27 = 3 piezometers.

- Various qualitative observations will be made in the mitigation features 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 ground cover strata; general estimate of the average percent cover by invasive and nuisance plant species; general estimates concerning the growth of planted canopy and midstory species; general observations concerning the colonization by volunteer native plant species; general observations regarding the growth of non-planted native species in the canopy and midstory strata. 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.

- 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.

7.1.3 Monitoring Reports Following Re-Planting Activities

Re-planting of certain areas within the mitigation features 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. It must also include a depiction of the areas re-planted, cross-referenced to a listing of the species and number of each species planted in each area.

7.1.4 Monitoring Reports Involving Timber Management Activities

In cases where timber management activities (thinning of trees and/or shrubs in the canopy and/or midstory 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 Non-Federal Sponsor'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.

7.2 DISTRICT CONSULTATION REPORTS & USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

Section 2036(a) of WRDA 2007 requires the USACE to conduct annual consultation with appropriate Federal and State agencies to assess the success of mitigation plans and to prepare annual reports summarizing the results of the consultations. To satisfy these requirements, annual consultation reports (District Consultation Reports) will be prepared and submitted to the USACE Mississippi Valley Division (MVD), or the reports will be submitted as directed by MVD. Each report will provide the following information:

- List of the types of mitigation implemented.
- Brief description of the mitigation, including acres implemented and acres remaining to be implemented (if any).
- Description of the consultation process (steps taken to consult with other Federal agencies and State agencies).
- Discussion of the status of consultation, identifying the agencies involved and the outcome. If consultation is complete, a listing of the outcome as one of the following: no action needed; no response from Federal or state agencies on consultation; on schedule with no adaptive management implemented due to consultation, or on schedule with adaptive management implemented due to consultation; behind schedule with adaptive management implemented due to consultation, or; behind schedule for reasons not related to consultation.
- Discussion of the outcome of consultation (if completed). This discussion will include: an assessment of the likelihood that the mitigation will achieve the success criteria specified in the mitigation plan (copy of plan provided); the projected timeline for achieving mitigation success, and; any recommendations for improving the likelihood of success.

In addition to the District Consultation Reports discussed above, data and information concerning the mitigation will be entered into the USACE's Civil Works Project Mitigation Database on an annual basis. The data and information required for entry into this database are specified within the database itself (website URL: https://sam-db01mob.sam.ds.usace.army.mil:4443/pls/apex/f?p=107).

7.3 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: STANDARD MONITORING AND REPORTING

Monitoring will typically take place in late summer of the year of 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. Monitoring reports will be provided to the USACE, the NFS, and the agencies comprising the IET. The various monitoring and reporting responsibilities addressed in the section are all subject to the provisions set forth in the Preface.

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.
2. Native Vegetation – A and B.
3. Invasive & Nuisance Vegetation – A, plus B until such time as monitoring responsibilities are transferred to the NFS.
4. Topography – A.

Monitoring events associated with the above will include the "time zero" (first or baseline) monitoring event plus annual monitoring events thereafter until the mitigation monitoring responsibility is transferred to the NFS. The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports after the USACE has demonstrated the mitigation success criteria listed above have been achieved.

Once monitoring responsibilities have been transferred to the NFS, the next monitoring event will take place during the year that attainment of success criterion 2.C (native vegetation criterion applicable 4 years after completion of initial plantings) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis.

If the initial survival criteria for planted canopy and midstory species are not achieved (i.e. the 1-year survival criteria specified in native vegetation success criterion 2.B), a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all survival criteria have been satisfied (i.e. that corrective actions were successful). 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 these success criteria.

If the native vegetation success criteria specified for 4 years following completion of initial plantings are not achieved (i.e. success criterion 2.C) , 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 in the mitigation features, 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).

The following table indicates the currently anticipated monitoring report schedule and the party responsible for conducting the monitoring and preparing the report.

Table 7-1. Standard mitigation monitoring report schedule and monitoring responsibility.

Year	Monitoring Report Number	Party Responsible for Monitoring and Reporting
0 (start of construction)	N/A	N/A
1 (completion of initial construction activities)	N/A	N/A
2 (completion of final earthwork/construction activities; filled areas settle to target grade)	N/A	N/A
3 (complete initial plantings early in year, completion of construction)	1 (Time Zero Report)	USACE
4 (1 year after initial plantings)	2	USACE
5 (re-planting, if necessary)	2A*	USACE*
6	2B*	USACE*
7	3	CPRA
12	4	CPRA
17	5	CPRA
22	6	CPRA
27	7	CPRA
32	8	CPRA
37	9	CPRA
42	10	CPRA
47	11	CPRA
52	12	CPRA

* Monitoring reports 2A and 2B would only be necessary if re-planting is necessary, as determined by the monitoring results documented in monitoring report #2.

It is again noted that monitoring reports 2A and 2B indicated in the preceding table will only be necessary if the second monitoring report indicates that native vegetation success criterion #2.B pertaining to the survival of planted canopy and midstory species has not been achieved, thereby requiring re-planting in Year #5. If re-planting is unnecessary, there would be no monitoring in years 5 and 6. However, it has been assumed that some re-planting will be necessary. The schedule provided in the table does not account for the need to physically adjust topography in the mitigation features once final construction activities have been completed. Should such adjustments be necessary to achieve applicable topographic success criteria, then the monitoring schedule presented would likely require adjustments.

Although the USACE will be responsible for conducting the monitoring necessary for monitoring reports 1, 2, 2A, and 2B and will be responsible for preparing these reports, the costs for these activities will be cost shared with the NFS, subject to the provisions stated in the Preface. . The costs associated with conducting the monitoring and preparing monitoring reports for all subsequent monitoring reports will be solely borne by the NFS, pursuant to the provisions stated in the Preface.

It is not feasible at this time to accurately estimate the actual calendar year when mitigation construction activities will be initiated. This explains why the years indicated in the preceding table are not actual calendar years. Should it be necessary to implement the subject mitigation project rather than the current TSMP, this mitigation plan will be revised to include a revised mitigation monitoring/reporting schedule using estimated calendar years.

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.

7.4 MITIGATION MONITORING & REPORTING SCHEDULE AND RESPONSIBILITIES: DISTRICT CONSULTATION REPORTS AND USACE CIVIL WORKS PROJECT MITIGATION DATABASE REPORTS

The USACE will be responsible for preparing and submitting all District Consultation Reports. These reports will be submitted on annual basis beginning in the year the mitigation plan is implemented (i.e. start of mitigation construction) and continuing throughout the 50-year period of analysis. The date for submittal of each report will be in accordance with guidance provided by MVD and/or HQUSACE (USACE Headquarters). Presently, MVD guidance is each annual report must be submitted at least 14 working days prior to October 1st each year; however, this guidance is subject to change.

The agencies involved in the consultation process will include, at a minimum: USACE, Mississippi Valley Division, New Orleans District (CEMVN); the Non-Federal Sponsor (i.e. CPRA); US Fish and Wildlife Service (USFWS); Louisiana Department of Natural Resources (LDNR). The USACE will be responsible for conducting the consultation until the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for conducting the consultation and for providing results of the consultation to USACE (i.e. NFS will be responsible for obtaining and providing to USACE all information necessary for preparing the District Consultation Report).

The USACE will be responsible for inputting all information required for the USACE's Civil Works Mitigation Project Database as regards this mitigation project. This information will be input by CEMVN on an annual basis beginning in the year the mitigation is implemented and continuing throughout the 50-year period of analysis. The information will be input by the deadline(s) established by HQUSACE. The USACE will be responsible for gathering the information necessary for database input until the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for gathering this information and providing it to CEMVN for input.

7.5 COST OF MITIGATION MONITORING AND REPORTING

The total cost of mitigation monitoring and reporting activities addressed herein is currently estimated to be approximately $883,000. This preliminary estimate includes all mitigation monitoring and reporting costs throughout the 50-year period of analysis. This estimate also includes the cost of conducting the additional monitoring required due to the need for one re-planting event following the initial planting event. It was assumed that one re-planting event would be necessary to meet the initial survival success criteria for planted native vegetation. If this assumption is erroneous, the estimated monitoring and reporting cost would decrease (a reduction in the Federal share of total cost). These cost estimates do not account for any further topographic alterations following completion of the final mitigation construction activities since it is not anticipated that such physical alterations will be necessary. If this assumption is violated, the estimated mitigation monitoring and reporting cost would increase due to the need for additional monitoring/reporting events. Note that this cost estimate also does not include additional monitoring and reporting costs that would be incurred should the adaptive management plan need to be implemented.

8. FINANCIAL ASSURANCES

Financial assurances are required to ensure that the compensatory mitigation project would be successful. In this case the LPV HSDRRS Project Partnership Agreement between the CPRA of Louisiana (the Non-Federal Sponsor) and the Federal Government provides the required financial assurance for this mitigation project. In the event that the Non-Federal Sponsor fails to perform, the CEMVN has the right to complete, operate, maintain, repair, rehabilitate or replace any project feature, including mitigation features, but such action would not relieve CPRA of its responsibility to meet its obligations and would not preclude the US from pursuing any remedy at law or equity to ensure CPRA's performance.

9. DEFINITION OF TERMS

Certain terms used herein shall have the meaning discussed in the following subsections.

Interagency Environmental Team (IET)
The "Interagency Environmental Team" consists of representatives from the following resource agencies; US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), US Environmental Protection Agency (EPA), State of Louisiana Office of Coastal Protection and Restoration (CPRA), Louisiana Department of Natural Resources (DNR), Louisiana Department of Wildlife and Fisheries (LDWF).

Non-Federal Sponsor (NFS)
This term refers to the Non-Federal Sponsor for the mitigation project, which is CPRA.

Invasive Plant Species
All plant species identified as invasive or as non-indigenous (exotic) in the following two sources:

> Louisiana Aquatic Invasive Species Task Force. 2005. State Management Plan for Aquatic Invasive Species in Louisiana, Appendix B. Invasive Species in Louisiana (plants). Center for Bioenvironmental Research, Tulane & Xavier Universities, New Orleans, LA.
> (Website - http://is.cbr.tulane.edu/docs_IS/LAISMP7.pdf)
>
> Barataria-Terrebonne National Estuary Program (BTNEP). 2012. Exotic Invasive Species of the Barataria-Terrebonne, Invasive Species in Louisiana. BTNEP, Thibodaux, LA. (Website - http://invasive.btnep.org/invasivesvsnatives/invasivesinla2list.aspx)

In addition, invasive plant species include; Japanese climbing fern (*Lygodium japonicum*), tall fescue (*Festuca arundinacea*), chinaberry (*Miscanthus sinensis*), Brazilian vervain (*Verbena litoralis* var. *brevibrateata*), coral ardisia (*Ardisia crenata*), Japanese ardisia (*Ardisia japonica*), cogon grass (*Imperata cylindrical*), golden bamboo (*Phyllostachys aurea),* and rescuegrass (*Bromus catharticus*).

Nuisance Plant Species
Nuisance plant species will include native species deemed detrimental due to their potential adverse competition with desirable native species. Nuisance plant species identified for the mitigation project include; dog-fennel (*Eupatorium capillifolium, Eupatorium compositifolium*), marsh thoroughwort (*Eupatorium leptophyllum*), late-flowering thoroughwort (*Eupatorium serotinum*), common ragweed (*Ambrosia artemisiifolia*), giant ragweed (*Ambrosia trifida*), cattail (*Typha* spp.), grapevine (*Vitis* spp.), wild balsam apple (*Momordica charantia*), climbing hempvine (*Mikania scandens, M. micrantha*), pepper vine (*Ampelopsis arborea*), common reed (*Phragmites australis*), catbrier (*Smilax* spp.), blackberry (*Rubus* spp.), blue vervane (*Verbena hastata*), white vervane (*Verbena urticifolia*), wingstem (*Vervesina alternifolia*), frostweed (*Verbesina virginica*), tall ironweed (*Vernonia gigantea*), black willow (*Salix nigra*), and box elder (*Acer negundo*). Following completion of the initial mitigation activities (e.g. placement of fill, initial plantings), the preceding list may be expanded to include other nuisance plant species. Any such addition to the list would be based on the results of the standard monitoring reports. The determination of whether a particular new plant species should be considered as a nuisance species and therefore eradicated or controlled would be determined by the USACE in coordination with the NFS and IET.

Native Plant Species
This category includes all plant species that are not classified as invasive plant species and are not considered to be nuisance plant species.

USACE Hydrophytic Vegetation Criteria
Reference to satisfaction of USACE hydrophytic vegetation criteria (i.e. plant community is dominated by hydrophytic vegetation) shall mean that sampling of the plant community demonstrates that one or more of the hydrophytic vegetation indicators set forth in the following reference is achieved:

USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0); ERDC/EL TR-10-20. USACE Engineer Research and Development Center, Vicksburg, MS.

Wetland Indicator Status of Plant Species

The wetland indicator status of plants is a means of classifying the estimated probability of a species occurring in wetlands versus non-wetlands. Indicator categories include; obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and obligate upland (UPL). The wetland indicator status of a particular plant species shall be as it is set forth in the following reference (the "2012 National Wetland Plant List") using the Region 2 listing contained therein. However, if the USACE approves and adopts a new list in the future, then the currently approved list will apply.

Lichvar, Robert W. and J.T. Kartesz. 2009. North American Digital Flora: National Wetland Plant List, version 2.4.0 (https://wetland_plants.usace.army.mil). USACE, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH and BONAP, Chapel Hill, NC.

Growing Season

As used herein, the growing season is considered to be the period from April through October of any given year, although some deviation from this typical range is allowed.

Planting Season

This is generally considered to be the period from approximately December 15 through March 15, although some deviation from this typical range is allowed.

Point-Centered Quarter Method

A plot-less method of forest sampling. Use of this method will be in general compliance with the applicable methodology described in the following reference:

Cottam, Grant and J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology, 37(3):451-460.

Piezometer

Typically a small-diameter observation well employed as a means of measuring water elevations in the surficial aquifer (water table elevations). Piezometers used for monitoring purposes will be constructed in general accordance with the following reference, unless otherwise approved by CEMVN:

U. S. Army Corps of Engineers. 2005. Technical standard for water-table monitoring of potential wetland sites. ERDC TN-WRAP-05-02. Vicksburg, MS: U.S. Army Engineer Research and Development Center. (website - http://el.erdc.usace.army.mil/wrap/pdf/tnwrap05-2.pdf)

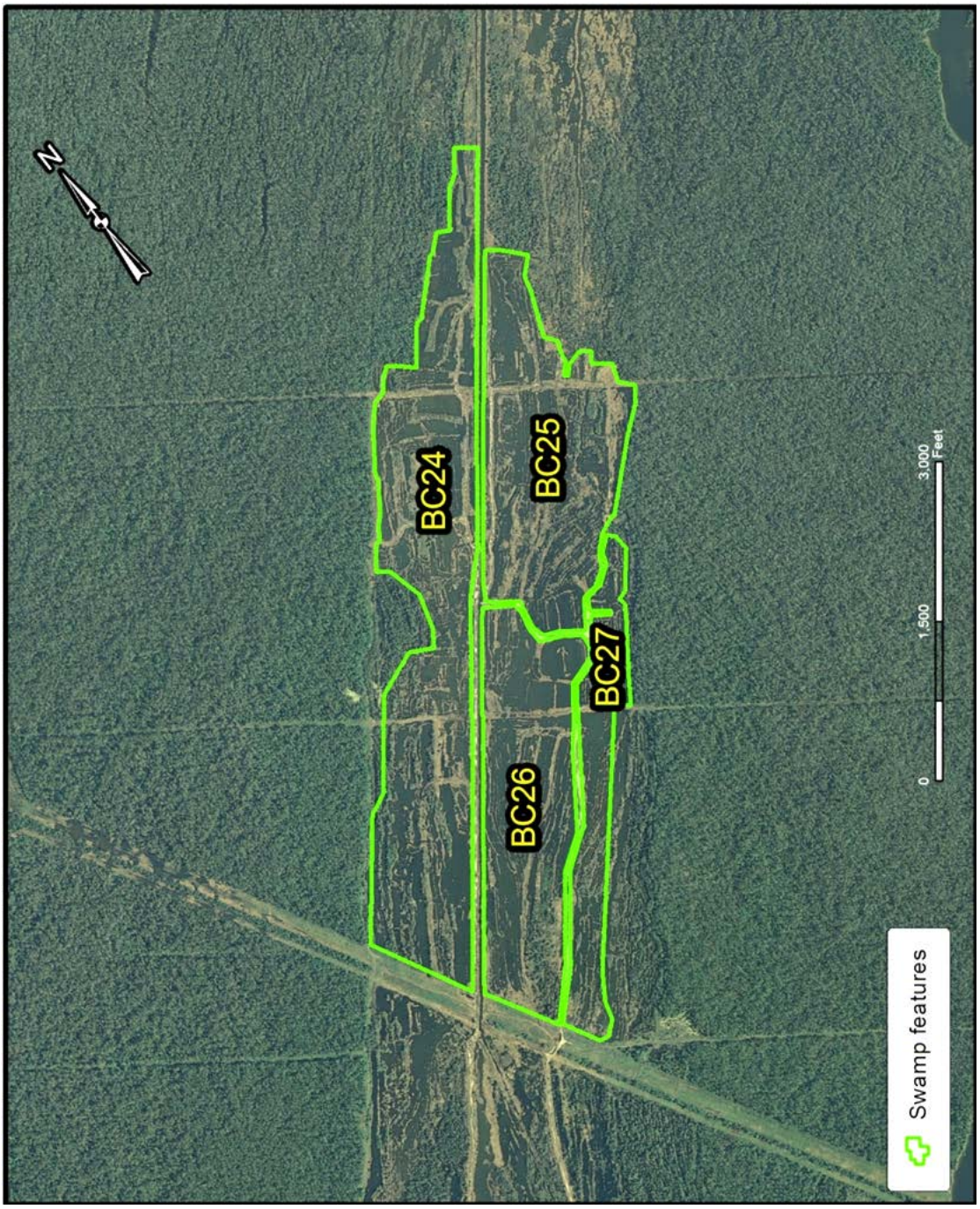

Figure L-1. Proposed swamp restoration features BC24 (127.6 ac.), BC25 (79.8 ac.), BC26 (69.2 ac.), and BC27 (33.7 ac.).

APPENDIX M

VISUAL RESOURCES IN THE LPV BASIN

- *America Bay*

The America Bay area is made up primarily of marshland and water features mixed with a few areas of forested lands. The terrain is relatively flat and characteristic of the many marshlands and wetlands present in the region. View sheds to the proposed site are offered from atop the levee system running parallel to Highway 39. Other view sheds may be obtained from access roads south of the end point for Highway 39. These access roads run parallel to the levee system, through the Bohemia Wildlife Management Area. Land uses in the area include sparse low density residential and agricultural. However, these land uses are predominantly located north of the Bohemia Wildlife Management Area, and within the Mississippi River Main Channel Corridor. The majority of land use is occupied by the Bohemia Wildlife Management Area and other natural landscape. The site has much intrinsic visual quality that adds to the scenic drive along Highway 39 and recreational opportunities throughout the area (especially atop the local levee system).

- *Amite River*

The Amite River area is made up primarily of dense forestation mixed with both manmade and natural water channels and access to Lake Maurepas. The terrain is relatively flat and characteristic of the lands present in the region. View sheds to the proposed site are offered via Highway 22, Highway 16, and Highway 1039, along with several adjoining neighborhoods and their respective local streets. Highway 22, 16 and 1039 all offer interior views to the study area, while the western border can be observed from local streets and neighborhoods located just outside the project area boundary. Land uses in the area include low and medium density residential, agricultural and natural areas, untouched by humans. At the core of this study area is a piece of the Livingston Study Area (Urban Area) which features a relatively dense land use pattern where the majority of the residential uses are found here. To the west, along the border are other densely packed urban residential areas. The site is somewhat remarkable, due to the natural component found here and the fact that so much of the area has remained untouched by humans. The land has a beautifully dramatic visual quality that adds to the scenic drives along the roads and highways traversing across this site's landscape.

- *Bayou Sauvage*

The Bayou Sauvage area is made up primarily of a broad mixture of forestation, marshland, wetland and swampland. There is a variety of permanent water features that dot the area within Bayou Sauvage National Wildlife Refuge adding to the variety of terrain and landscape found there. The terrain is relatively flat and characteristic of the lands present in the region. Primary view sheds to the proposed site are offered via Highway 90, Highway 11 and Interstate 10. The proposed site is relatively devoid of any kind of development and is primarily a natural area. View sheds along Highway 90 are very dramatic showing all forms of the landscape features and forms discussed above.

Land uses in the area include public, natural areas and what appears to be industrial along the eastern border of the study area. The site is extremely remarkable, due to the wildlife refuge. There are several sites along Highway 90 that offer excellent views into the refuge via boardwalks and piers. Parking and pavilions are available at most of these sites.

- *Biloxi Marshes Exterior*

The Biloxi Marshes Exterior area is made up primarily of marshland. The marshland here is much denser than that found in Biloxi Marshes Exterior. The terrain is flat and aquatic. There are no view sheds to the site unless from the water located within the site itself, or that of Lake Borgne (located to the west). There are no thoroughfares, nor is there any development available to offer view sheds into the study area.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Biloxi Marshes Interior*

The Biloxi Marshes Interior area is made up primarily of marshland and large, open water features. The terrain is flat and aquatic. There are no view sheds to the site unless from the water of Mississippi Sound (located to the north) or Chandeleur/ Breton Sound (located to the east). There are no thoroughfares, nor is there any development available to offer view sheds into the study area.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Blind River*

The Blind River area is made up primarily of dense forestation mixed with only a few natural water channels.. The terrain is relatively flat and characteristic of the lands present in the region. View sheds to the proposed site are offered via Highway 61, Interstate 10 and LA 3125, along with several adjoining residential and agricultural developments and their respective local streets. Highway 61, and Interstate 10 offer interior views to the study area, while the southern and western borders can be observed from LA 3125 and local streets and neighborhoods located just outside the project area boundary. Land uses in the area include low and medium density residential, industrial, agricultural and natural areas, untouched by humans. Along and across the southern and western borders, agricultural appears to be the primary use though. The site is somewhat remarkable, due to the natural component found here and the fact that so much of the area has remained untouched by humans. The land has a beautifully dramatic visual quality that adds to the scenic drives along the roads and highways traversing across this site's landscape.

- *Bonnet Carre*

The Bonnet Carre area is made up primarily of a dense, relatively natural environment with areas of thick forestation and a variety of water features, both natural and manmade. The terrain is relatively flat, but does contain a few minor changes in elevation adding to visual character of the landscape. Primary view sheds to the proposed site are offered via Highway 61 and Interstate 55. The Spillway itself serves a functional purpose, but also provides an excellent recreational opportunity. Trails within the Spillway offer intimate view sheds into natural and native areas filled with abundant wildlife and scenery. Land uses in the area include a natural area (for the Spillway itself), as well as residential and industrial areas along the border to the southeast and agricultural uses along the western border. The site is extremely remarkable, due to Bonnet Carre Spillway and its recreation areas as primary natural features.

- *Caernarvon North*

The Caernarvon North area is made up primarily of marshland and wetland mixed with small water bodies, canals and of course, Lake Lery as the predominant large water feature in the area. The terrain is predominantly flat with the occasional small ridge, though they are few and far between.

The site is located in an area that is extremely remote with access via watercraft. View sheds into the study area are few and far between. The nearest major thoroughfare is LA 300, which does offer dramatic views into the marshland, Lake Lery and the other water features in and around the study area. The next closest thoroughfare is Highway 39, and at its closest, is more than five miles away. The nearest developed area (be it residential, commercial, or industrial) is located along Highway 39 at the same distance.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Caernarvon South*

The Caernarvon South area is made up primarily of marshland and wetland mixed with a variety of water bodies, and open water leading to Chandeleur/ Breton Sound. Caernarvon South is much more aquatic than its counterpart to the north. The terrain is predominantly flat and characteristic of the other aquatic habitat found in the region.

The site is located in an area that is extremely remote with access via watercraft. View sheds into the study area are few and far between. There are no nearby major thoroughfares other than Highway 39, though it is located five miles to the southwest. There are no developed areas and the primary land use is that of a natural area, untouched by humans.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Central Wetlands*

The Central Wetlands' landscape is made up primarily of marshland, wetland and swamp mixed with a variety of water bodies and canals. The terrain is predominantly flat and open with low growing grasses, some scrub shrub and the occasional medium sized tree.

The site is very accessible. The route of Interstate 510 traverses near the center of the proposed study area. This route offers a variety of dramatic views into the landscape. The

best views come from the I-510 Bridge. There are a variety of land uses along the I-510 corridor including residential, commercial, and some industrial.

- *Chendeleur / Breton Sound*

Chendeleur/ Breton Sound's features are completely aquatic. View sheds are open and vast, with no obstructions. The site can be accessed only by watercraft.

- *East Manchac Land Bridge*

The East Manchac Land Bridge area is made up primarily of some marshland with dense trees and forestation. The area has little in the way of development other than that found in Manchac. The study area remains natural and scenic, especially around the Manchac Wildlife Management Area. This area is devoted to wildlife habitat and recreational opportunities such as fishing and nature observation. The north side of the project site contains Pass Manchac that connects Lake Pontchartrain and Lake Maurepas. The community of Manchac resides along this waterway near its intersection with Interstate 55. Interstate 55, which traverses north and south along the land bridge between Lake Pontchartrain and Lake Maurepas is the nearest major, public thoroughfare. This thoroughfare offers fantastic view sheds across the study area in 360 degree panoramas. Other view sheds are offered via watercraft, from Lake Pontchartrain.

- *East Orleans Land Bridge*

The East Orleans Land Bridge area is made up primarily of marshland with a slight introduction of trees and forestation (within the limits of the Bayou Sauvage National Wildlife Refuge). There is a variety of permanent water features, both natural and man-made, that dot the landscape within the study area. The terrain is relatively flat and characteristic of the lands present in the region. Primary view sheds to the proposed site are

offered via Highway 90 and watercraft. The proposed site is made up of single-family residential land uses. Attached to many of these residential uses are somewhat light-industrial/ commercial uses related to the fishing that takes place here. One final land use is public/ natural, pertaining to the Bayou Sauvage National Wildlife Refuge. View sheds along Highway 90 are very dramatic showing all forms of the landscape features and forms discussed above.

The site is extremely remarkable, due to the wildlife refuge. There are several sites along Highway 90 that offer excellent views into the refuge.

The nature of this study area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area. Other forms of potential could include some hiking and biking, though it will most likely be limited to the Highway 90 corridor only.

- *Eloi Bay*

The Eloi Bay area is made up primarily of marshland and large, open water features. The terrain is flat and aquatic. There are no view sheds to the site unless from the water of Eloi Bay itself (located to the southeast). There are no thoroughfares, nor is there any development available to offer view sheds into the study area. Access is strictly offered only by watercraft.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Florissant*

The Florissant area is made up primarily of marshland and wetland mixed with some forestation and small water bodies. The terrain is predominantly flat with the occasional small ridge, though the study area appears to be characteristic of similar sites found in the region.

The site is located in an area that is very remote. View sheds into the study area are few and far between. The nearest major thoroughfare is Highway 46, which does offer some views into the marshland. The best views can be found along the stretch of highway on the western most side of the study area. View sheds along the southeastern border of the study

area are obscured by dense forestation. However, the dense forestation and other natural features along the highway make for a quality scenic drive going into Hopedale.

The remote nature of the area presents an outdoor recreator's dream with fishing, hunting and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Hope Canal*

The Hope Canal area is made up primarily of dense forestation mixed with natural and man-made water channels.. The terrain is relatively flat and characteristic of the lands present in the region. View sheds to the proposed site are offered via Highway 61, Interstate 55 and Interstate 10, along with several adjoining residential and agricultural developments and their respective local streets. Interstate 10 offers interior views to the study area, while the southern border can be observed from Highway 61, and the local streets and neighborhoods located just outside the project area boundary. Interstate 55 offers views from the eastern border of the study area. Land uses in the area and surrounding vicinity include low and medium density residential, industrial, agricultural and natural areas untouched by humans. The site is somewhat remarkable, due to the natural component found here and the fact that so much of the area has remained untouched by humans. The land has a beautifully dramatic visual quality that adds to the scenic drives along the roads and highways traversing across this site's landscape.

- *Hopedale*

The Hopedale area is made up primarily of marshland mixed with some forestation and small water bodies. The terrain is predominantly flat and is characteristic of similar sites found in the region. The site is located in an area that is very remote. The nearest major thoroughfare is LA 624, which offers excellent views into the surrounding marshland and water features.

The remote nature of the area presents an outdoor recreator's dream with fishing, hunting and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *IHNC/ GIWW*

The IHNC/ GIWW area is made up primarily of a dense, industrialized, urban environment with some small natural areas along the banks of the waterways. There are many crossing thoroughfares traversing the proposed study area. All of these thoroughfares offer small and simple views into the study area. Vegetation is minimal within the proposed site, offering little in the way of screening and buffering, much less natural areas or other areas of interest. As a somewhat redeeming feature, views from the water channels themselves may offer better views of natural, relatively undisturbed sites along the MRGO.

- *Jean Louis Robin*

The Jean Louis Robin area is made up primarily of marshland, wetland and swamp mixed with a variety of water bodies and canals leading out to Chandeleur/ Breton Sound to the

southeast. The terrain is predominantly flat and characteristic of other aquatic terrains and landscapes in the region.

The site is located in an area that is extremely remote. Access to the site is offered via LA 300 and 624, both of which offer a variety of dramatic views into the marshland and natural areas in the vicinity The nearest developed areas (which includes residential, commercial, and some industrial) is located along LA 300 and 624. This development is just inside and adjacent to the study area boundary.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *La Branche Wetlands*

The La Branche Wetlands' landscape is made up primarily of marshland, wetland and swamp mixed with a variety of water bodies, canals and some forestation. The terrain is predominantly flat and open with low growing grasses, some scrub shrub and the occasional medium sized tree along the Interstate 10 corridor and denser forestation along Highway 61. These two routes offer dramatic views into an ever changing set of scenery that is of high visual quality containing all of the great design features of form, line color and texture.

Land uses are minimal throughout the study area and are primarily concentrated along the Highway 61 corridor and the southern and eastern boundaries. These uses span the full range of defined use patterns.

- *Lake Borgne*

The Lake Borgne area's features are completely aquatic but surrounded on "roughly" three sides by land or land like features. Access to the site is granted through some local roads. Primary access takes place from other connecting waterways, such as the marshlands and canals landside, and the Mississippi Sound to the northeast. View sheds are open and vast, with no obstructions. The Lake itself can be accessed only by watercraft.

- *Lake Lery*

The Lake Lery areae is made up primarily of marshland, wetland and swamp mixed with a variety of water bodies, canals and of course, Lake Lery as the predominant large water

feature in the area. The terrain is predominantly flat with the occasional small ridge, though they are few and far between.

The site is located in an area that is extremely remote. The nearest major thoroughfare is LA 300, which does offer a variety of dramatic views into the marshland, Lake Lery and the other water features in and around the study area. The nearest developed area (which includes residential, commercial, and some industrial) is located along Highway 46 to the north. This development is adjacent to, yet also outside the study area boundary.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Lake Maurepas*

The Lake Maurepas area's features are completely aquatic but surrounded on all sides by land or land like features. Access to the site is granted through some local roads. Primary access takes place from other connecting waterways, such as the marshlands and canals landside, and Pass Manchac. View sheds are open and vast, with no obstructions. The Lake itself can be accessed only by watercraft.

- *Lake Pontchartrain*

The Lake Pontchartrain area's features are completely aquatic but surrounded completely by land or land like features. Access to the site is granted through a variety of major thoroughfares, secondary arterials, and local roads on all sides of the lake. The best view sheds to the site are offered via the Causeway Bridge with a 360 degree panorama and no obstructions (other than the bridge railings and other man made features on the bridge itself). This view shed is open and vast. The Lake itself can be accessed only by watercraft.

- *MRGO Spoil Bank*

The MRGO Spoil Bank area is made up primarily of marshlands mixed with some forestation, water features and the levee system. The terrain varies due to the local levee system, but appears to be relatively flat and open with low growing grasses, some scrub shrub and the occasional medium sized tree. The site is very remote with access via the MRGO and watercraft or from atop the levee system. There is no development located in this study area. It remains natural, scenic and relatively untouched.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation.

- *North Shore Marshes*

The North Shore Marshes landscape is made up primarily of marshland with dense trees and forestation and a variety of water features leading out to Lake Pontchartrain. The primary developed areas are located at the northwestern corner of the study area (within the study area boundaries). This developed area is dense with land uses ranging from commercial to residential in nature. The rest of the study area remains natural and scenic, especially around the Big Branch Marsh. Highway 190, LA 1089 and LA 1087 are the major thoroughfares in the area and do offer view sheds into the site. Highway 190 and LA1087 offer views focused more to the denser urban environment, while LA 1089 offers views into the more natural areas of the site. Other view sheds are offered via watercraft, from Lake Pontchartrain.

- *Pearl River Mouth – LA*

The Pearl River Mouth (LA) area landscape is made up primarily of marshland with dense trees and forestation and a variety of water bodies and channels leading out to the channel between Lake Pontchartrain and Lake Borgne. The primary developed areas are located along the northern and southwestern borders of the study area (within the study area boundaries). This developed area is relatively compact with land uses focusing on single-family residential. The rest of the study area remains natural and scenic, especially around the Pearl River Wildlife Management Area, which, more or less, forms the eastern boundary of this particular study area. Highway 90 and LA 433 are the major thoroughfares in the area and offer fantastic view sheds into the site. Both highways offer views into the more natural areas of the site. Other view sheds are offered via watercraft, from the waterways and channels connecting Lake Pontchartrain and Lake Borgne.

- *River aux Chenes*

The River aux Chenes landscape is made up primarily of marshland and wetland mixed with small water bodies and canals. The terrain is predominantly flat with the occasional small ridge, though they are few and far between. The site is located in an area that is extremely remote with access via watercraft. View sheds into the study area are few and far between, but can be attained from atop the levee system traversing parallel to Highway 39. From this vantage point view sheds are near limitless and reveal a landscape filled with a variety of shapes, colors and textures.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation.

- *River Delta*

The River Delta area is made up primarily of marshland and water features mixed with a few small areas of forested lands. The terrain is relatively flat and aquatic and characteristic of the many marshlands and wetlands present in the region. View sheds to the proposed site are offered from water only and access to the site is achieved primarily through the use of

watercraft. Other view sheds may be obtained from Highway 23, though there will most likely be many obstructions due to shear distance between this thoroughfare and the actual study area. Land uses in the area include sparse low density residential and industrial. However, these land uses are located just outside and adjacent to the study area, along the main channel of the Mississippi River. Delta National Wildlife Refuge is located within the boundaries of the study area and Pass A Loutre Wildlife Management Area is located just south of the boundary. Both are sources of great natural scenery and high visual quality.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation.

- *South Lake Borgne*

The South Lake Borgne area is made up primarily of marshland and open water features leading out to Lake Borgne. The terrain is flat and aquatic. There are no view sheds to the site unless from the water of the MRGO or Lake Borgne. There are no thoroughfares, nor is there any development available to offer view sheds into the study area.

The remote nature of the area presents an outdoor recreator's dream with fishing and nature observation as the most predominant potential forms of outdoor recreation in and around the study area.

- *Tangipahoa River Mouth*

The Tangipahoa River Mouth area is made up primarily of some marshland with dense trees and forestation. The study area remains natural and scenic, especially around the Joyce Wildlife Management Area. The north side of the project site contains the only developed lands with emphasis on residential development (though these developments are adjacent to and out of the immediate study area boundary). Interstate 55, which traverses north and south along the land bridge between Lake Pontchartrain and Lake Maurepas is the nearest major, public thoroughfare. This thoroughfare offers fantastic view sheds across the study area in 360 degree panoramas. Other view sheds are offered via watercraft, from Lake Pontchartrain, and from any residential areas adjacent to the border of the study area.

- *Tchefuncte River Mouth*

The Tchefuncte River Mouth area is made up primarily of marshland with dense trees and forestation. The study area is natural and scenic, and relatively untouched by humans. The north side of the project site contains the only developed lands with emphasis on residential development (though these developments are adjacent to and out of the immediate study area boundary). Highway 22, which traverses the northern border of the study area offers some view sheds into the site. These view sheds are limited because the thoroughfare traverses the site for only a few miles of the total length of the borders. This thoroughfare does offer fantastic view sheds across the study area in 360 degree panoramas where it crosses within the boundaries. Other view sheds are offered via watercraft, from Lake Pontchartrain, and from any residential areas adjacent to the border of the study area.

- *Tickfaw River Mouth*

The Tickfaw River Mouth is made up primarily of some marshland with dense trees and forestation and a variety of natural water channels. The study area remains natural and scenic, relatively untouched by humans. The north and west sides of the project site contain the only developed lands with emphasis on residential development (though these developments are adjacent to and out of the immediate study area boundary). Interstate 55, which traverses the eastern edge of the study area along the land bridge between Lake Pontchartrain and Lake Maurepas, is the nearest major, public thoroughfare. This thoroughfare offers fantastic view sheds across the study area in 360 degree panoramas. Other view sheds are offered via watercraft, from Lake Maurepas, and from any residential areas adjacent to the border of the study area.

- *West Manchac Land Bridge*

The West Manchac Land Bridge area's landscape is made up primarily of some marshland with dense trees and forestation. The area has little in the way of development. Interstate 55, which traverses north and south along the land bridge between Lake Pontchartrain and Lake Maurepas is the nearest major, public thoroughfare. This thoroughfare offers fantastic view sheds across the study area in 360 degree panoramas. Other view sheds are offered via watercraft, from Lake Maurepas.

- *Western Mississippi Sound*

The features of the West Mississippi Sound are almost completely aquatic. The northern border of the proposed site offers view sheds from the beaches along the gulf coast of Mississippi and Cat Island (located in the southeastern corner of the proposed site) offers views in a 360 degree panorama. View sheds are open and vast, with no obstructions. While Cat Island can be accessed only by watercraft, the gulf coast beaches can be accessed from any number of local streets and thoroughfares.

The landscape of Cat Island is made up of sand dunes, low growing foliage plants and what appears to be marshland. The terrain is relatively flat with some slight variations in elevation along the areas with denser foliage and along the dunes of the beaches.

- *Livingston Area*

The Livingston area is similar to its neighbor, Amite River area. It is made up primarily of dense forestation mixed with both manmade and natural water channels. The terrain is relatively flat and characteristic of the lands present in the region. View sheds to the proposed site are offered via Highways 42, 63, 447 and Highway 1033, along with several adjoining neighborhoods and their respective local streets. Other view sheds can be had from Interstate 12, on the northern border of the study area. Land uses in the area include low and medium density residential, agricultural and natural areas, untouched by humans. This area is somewhat more rural than its neighbors. To the west, along the border are other densely packed urban residential areas. The land has a dramatic visual quality that adds to the scenic drives along the roads and highways traversing across this site's landscape.

- *Tangipahoa Area*

The Tangipahoa area is similar to the Tangipahoa River Mouth Area. It is made up primarily of some marshland with dense trees and forestation, but has a much more significant urban component. The study area remains natural and scenic, especially when viewed from Interstate 55 and Highway 51B. Emphasis appears to be on residential development with a few minor commercial centers.

- *St. Tammany Area*

The Tammany area is similar to the Tangipahoa River Mouth, Tangipahoa, and North Shore Marshes Areas. It is made up primarily of some marshland with dense trees and forestation, but has a much more significant urban component along major thoroughfares and in the many town centers that dot the landscape. Even with this development, the study area remains relatively natural and scenic, especially when viewed from Interstate 12, Highway 190, and several smaller, local highways and city streets.

- *Ascension East Area*

This area borders the Mississippi River and is heavily developed with industrial, residential and agricultural uses. Much of the natural scenery has been lost, but there are still a few pockets where it comes through; especially along historic River Road. The landscape is very flat, except those areas adjacent to the river where the natural levee rises into the steep man-made levees of the Mississippi River Levee System.

- *St. James East Area*

This area is similar to that found in Ascension East. River Road and Highway 3125 offer the best scenic drives throughout the length of the study area. One major difference is that the St. James East Area features two higher density urban residential areas on its eastern side.

- *St. John the Baptist East Area*

This area is similar to that found in Ascension East and St. James East. As with St. James East, the development is much more densely urbanized with higher density residential areas and large, spreading industrial centers specializing in petroleum products. Development has completely taken over the natural scenary, but what views are available can be had from historic River Road and Highway 61, both of which traverse the length of the study area. La Place is the key urban center in this area, catering to the surrounding, smaller communities and industrial centers in St. John Parish and adjacent parishes.

- *St. Charles East Area*

This area is similar to that found in St. John the Baptist East in almost every way. This area is completely built out. Development, urbanization, and industrialization dominate the landscape. Norco is the primary urban center with several smaller communities dotting the landscape along River Road.

- *Jefferson East and Orleans Central Areas*

These two study areas combined make up the urban center for the New Orleans Metropolitan Area. Every facet of land use can be found here along with every street and road type, and transportation type. The New Orleans area is densely developed with little to no room for future growth due to its location amidst swamps, marsh, wetlands and open water on all sides of the city perimeter. In the past, attempts at expanding the city limits and developing into outlying areas have proven disastrous. Swamp and wetland infill, conversion of open water to land, and development in low lying, flood prone areas has yielded unsustainable, unreliable and insufficient growth. This was proven after Hurricane Katrina in 2005.

But still, even with some of these negative development qualities, the city is a beacon for culture, the arts, parks and recreation, landscape and architectural design, engineering marvels, and a handful of well preserved, scenic wonders. The city is broken up into very distinguishable and close knit districts or neighborhoods including Uptown, Irish Channel, the Garden District, the Lower Ninth Ward, Lake View (in Orleans Central) and Elmwood, Bucktown, Kenner, Bridgedale (in Jefferson East), just to name a few. Each of these neighborhoods have their own identity, cultural and scenic treasures, and history that makes them unique and unlike any other place in the world.

- *St. Bernard Area*

This area borders the Mississippi River and is very similar St. John the Baptist East Area. Development is extremely dense in the western portion of the study area, with several small communities adjoining each other. These communities include Chalmette, Meraux, Violet and Arabi. Development includes heavy and light industrial, residential and agricultural uses, and a few commercial centers located along the major thoroughfares. There is still some natural scenery and a few very aesthetically pleasing stretches of road especially along Highways 46, 39 and 300. The eastern portion of this study area features a very rural setting with open fields and residential development.

- *Plaquemines Area*

This is similar to that found in the St. Bernard Area. Development here is significantly less dense and includes heavy and light industrial, residential and agricultural uses, with a few small commercial centers located along the major thoroughfare. Much of the study area is filled with fantastic view sheds of natural scenery and a few very aesthetically pleasing stretches of road especially along Highway 39. Much of this study area is like that found in the eastern portion of the St. Bernard Study area.

- *Area Southeast of Baton Rouge*

This area borders the Mississippi River and is very similar to that found in Ascension East, St. James East, Amite River, and the Livingston Areas. Development is extremely dense in the northwestern portion of the study area, along all of the approaches to Baton Rouge. Development covers the full spectrum of land uses available with emphasis on commercial, residential and agricultural uses. There is still some natural scenery and a few very aesthetically pleasing stretches of road especially along Highway 61 and Interstate 10.

Local roads and highways offer both the best and most intimate view sheds displaying a relatively rural countryside with a few rolling landscape features, verdant stands of forest, and some minimal topography.

The eastern portion of the study area is much less dense than its western counterpart. The approach to Baton Rouge features significant residential development, but the densities are still relatively low with lots ranging in size from 10,000 square feet to 1 acre in size. There is still a major agricultural component to this portion of the study area bringing greenery and rolling vistas stretching for miles.

Perhaps the most significant difference between this study area and others found adjacent to the river is that the river banks are much less congested with development. River Road is a scenic wonder stretching from Ascension East to the Louisiana State University Campus where a wide variety of culture and history can be observed in a half a day's drive.

APPENDIX N

ADAPTIVE MANAGEMENT PLAN

1.0 Introduction to Adaptive Management

Adaptive Management (AM) is an iterative and structured process which reduces ecological and other uncertainties that could prevent successful project implementation and performance. Adaptive Management establishes a framework for decision making which utilizes monitoring results and other information, as it becomes available, as a feedback mechanism used to update project knowledge and adjust management/mitigation actions to better achieve project goals and objectives. Hence, early implementation of AM and monitoring better enables a project to succeed under a wide range of conditions which can be adjusted as necessary. Furthermore, careful monitoring of project outcomes not only helps to adjust project management operations to changing conditions, but also advances scientific understanding as part of an iterative learning process.

All restoration and mitigation projects are required to consider AM; however, there may be some projects for which AM is not applicable. Adaptive Management is warranted when there are consequential decisions to be made, there are high uncertainties, when there is an opportunity to apply learning, when the value of reducing uncertainty is high, and when a monitoring system can be put in place to reduce uncertainty. In cases where AM is not warranted, the project would still develop an AM Plan but the plan would clearly describe the rationale as to why AM actions would not be warranted. A project where AM is not warranted would still contain a Monitoring Plan to measure project success.

This AM Plan for the Lake Pontchartrain and Vicinity (LPV) mitigation projects describes the organizational structure for the AM process, identifies key project uncertainties, explains how these uncertainties and risks were minimized through the Alternatives Evaluation Process (AEP), evaluates all of the Lake Pontchartrain and Vicinity (LPV) Tentatively Selected Plan (TSP) mitigation projects (Figure 1) as candidates for AM actions, and also describes the monitoring design developed to evaluate progress towards meeting identified mitigation success criteria.

1.1 Authorization

The Water Resources Development Act (WRDA) of 2007, Section 2036 (a) and USACE implementation guidance for Section 2036 (a) (CECW-PC 31 August 2009 Memorandum: "*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 AM and monitoring be included in mitigation plans for fish and wildlife and wetland losses.

2.0 Project Adaptive Management Planning

Adaptive Management planning was conducted for the entire TSP and the first tier of implementable projects as presented in programmatic IER. The AM plan will be refined as necessary for subsequent TSP projects as they are developed in future Tiered Individual Environmental Reports (TIER).

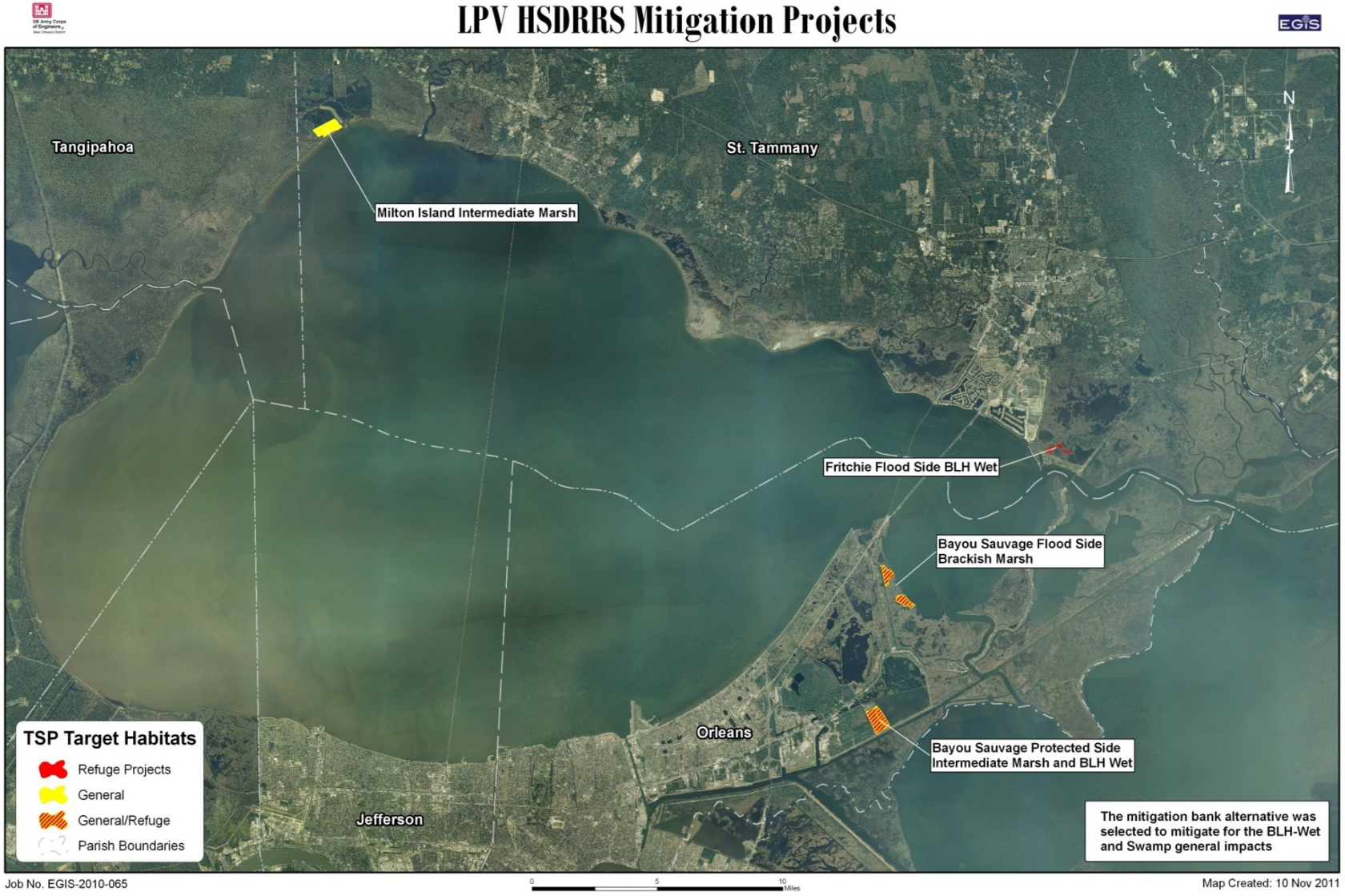

Figure1. Tentatively Selected Plan.

The level of detail in this AM Plan is based on the best currently available information developed as part of the programmatic Individual Environmental Report (IER). The IER presents the entire TSP for mitigating all the LPV Hurricane and Storm Damage Risk Reduction System (HSDRRS) impacts, but only proposes implementation of a portion of the identified projects at this time to facilitate mitigating impacts as quickly as possible.

Adaptive Management planning was conducted by using the AM program framework structure developed by the Corps New Orleans District that includes both a Set-up Phase (Figure 2) and an Implementation Phase (Figure 3). The Set-up Phase proceeded concurrently with the planning process; while the planners were evaluating and comparing alternatives and selecting a recommended plan, the Adaptive Management & Monitoring Plans were developed. The implementation phase of the Adaptive Management Framework will subsequently put the developed Adaptive Management and Monitoring Plans into action. Through the AM process projects will be designed, constructed, monitored and assessed to understand responses of the system to implementation of the project relative to stated targets, goals, objectives and project success criteria.

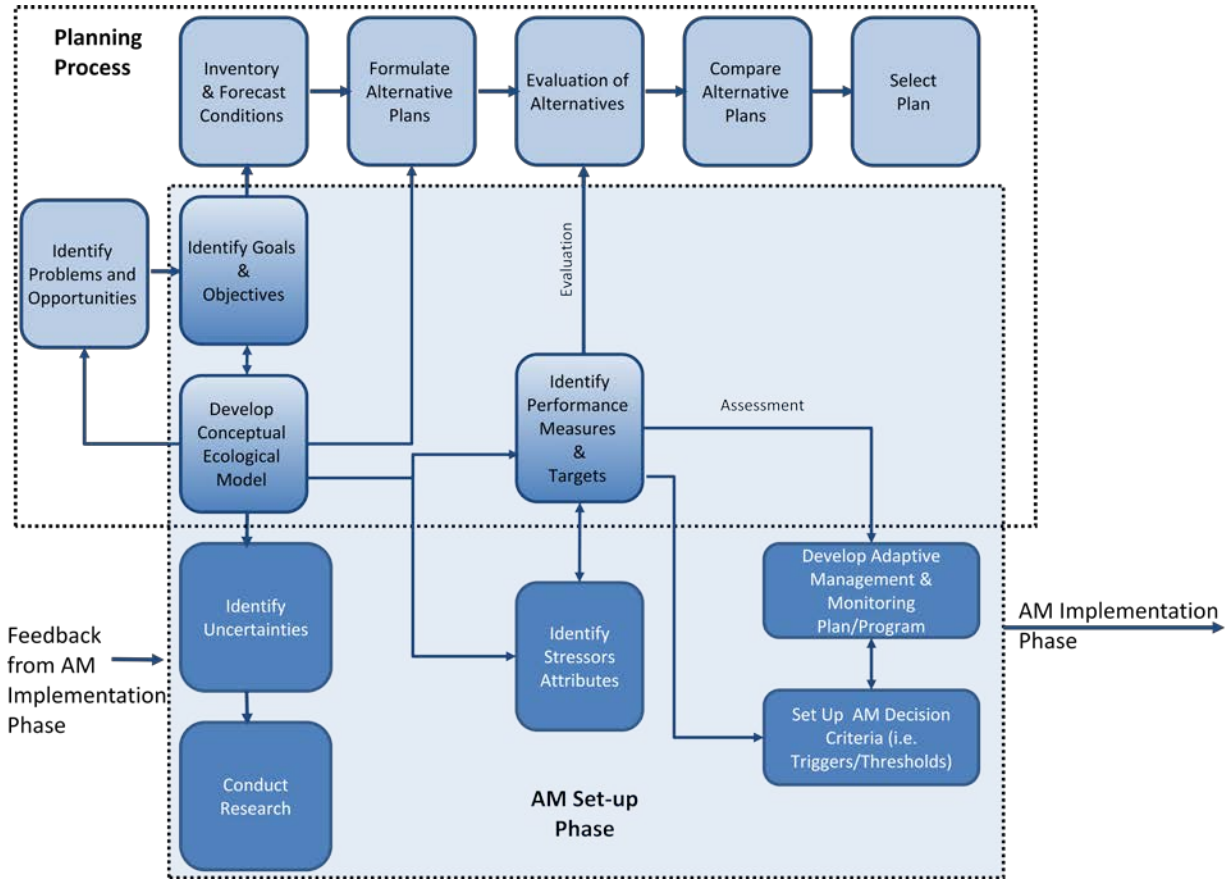

Figure 2. Set-up Phase of Adaptive Management Framework

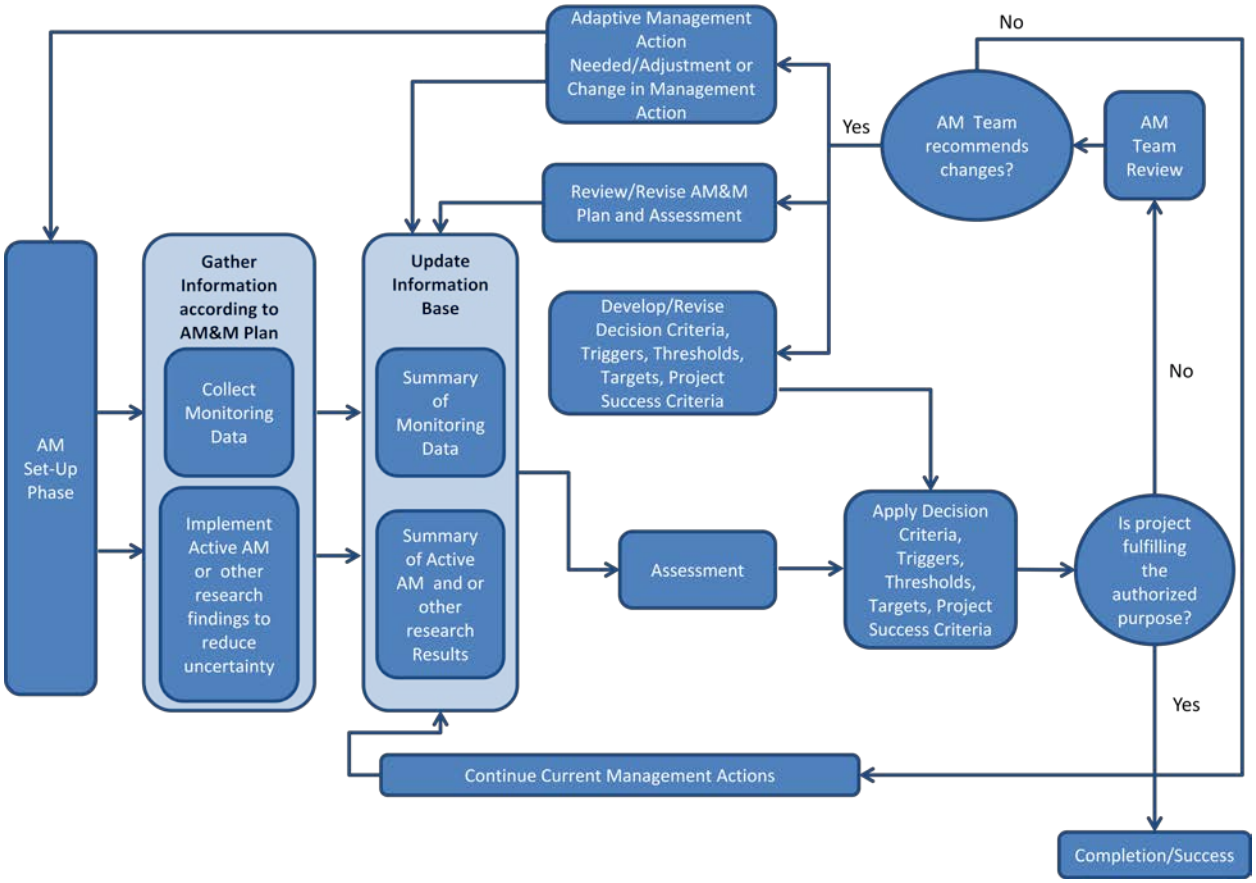

Figure 3. Implementation Phase of the Adaptive Management Framework

2.1 Conceptual Ecological Model

A conceptual ecological model (CEM) was developed to identifying the major stressors and drivers affecting each proposed mitigation type (see Table 1). The CEM does not explain all possible relationships of potential factors influencing the 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. Stressors and Drivers identified in the CEM were used during the (AEP) process to evaluate relative risks associated with each mitigation alternative.

Table 1. Conceptual Ecological Model

Alternatives/ Issues, Driver	Non-Refuge BLH Dry/BLH Wet	Non-Refuge Swamp	Non-Refuge Intermediate Marsh	Non-Refuge Brackish Marsh	Refuge PS BLH Wet	Refuge FS BLH Wet	Refuge PS Intermediate Marsh	Mitigation Banks*
Freshwater Input (Spillway/Diversion Operations)	+/-	+/-	L	+/-	+/-	+/-	L	0
Salinity	-	-	+/-	L	+/-	+/-	+/-	0
Subsidence	-	-	-	-	-	-	-	0
Sea Level Rise	-	-	-	-	-	-	L	0
Runoff	-	-	-	-	-	-	-	0
Storm induced salinity Impacts	-	-	+/-	L	-	-	+/-	0
Wave Action	-	-	-	-	L	-	-	0
Storm Surge	-	-	-	-	-	-	-	0
Vegetative Invasive Species	-	-	-	-	-	-	-	0
Herbivory	-	-	-	-	-	-	-	0
Hydrology (water table; wet/dry days; soil inundation)	+/-	+/-	+/-	+/-	+/-	+/-	+/-	0
Topography (elevation)	+/-	+/-	+/-	+/-	+/-	+/-	+/-	0

Key to Cell Codes: - = Negative Impact/Decrease + = Positive Impact/Increase +/- = Duration dependent
L = Alternative location determined to have a low risk of exposure to stressor
*Issues and drivers assumed to be addressed by Mitigation Bank sponsors; not a concern for the PDT

2.2 Sources of Uncertainty and Associated Risks

A fundamental tenet underlying AM 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 PDT identified the following uncertainties during the planning process. The alternatives considered were evaluated and ranked to select the TSP with minimal risk and uncertainty.

- Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
- Subsidence, salinity, and water level trends:
  - Subsidence rates (+/-) throughout the mitigation project life
  - Water level trends (+/-) throughout the mitigation project life
  - Variable salinities
- Uncertainty Relative to Achieving Ecological Success:
  - Water, sediment, and nutrient requirements:
  - Magnitude and duration of wet/dry cycles for bottom land hardwood (BLH) and swamp
  - Magnitude and duration of inundation for marsh
  - Annual sediment requirements
  - Nutrients required for desired productivity
  - Growth curves based on hydroperiod and nutrient application
  - Tree and marsh litter production based on nutrient and water levels
  - Tree propagation in relation to management/regulation of hydroperiod
- Uncertainty Relative to Implementability
- Reliability and Resiliency of Design
- Self-Sustainability of Project Once Ecological Success Criteria are Achieved
- Long-Term Sustainability of Project Benefits
- Adaptability

Issues such as climate change and relative sea level change (i.e., combination of eustatic sea level change and regional subsidence) are significant scientific uncertainties for all coastal Louisiana projects. These uncertainties were incorporated into the AEP. Specifically, relative sea level rise (RSLR) USACE EC-1165-2-212 provides an 18-step process for developing a "low", "intermediate", and "high" future relative sea level rise scenario and provides guidance to incorporate these potential effects into project management, planning, engineering, design, construction, operation and maintenance. The PDT, in accordance with EC-1165-65-2-212, evaluated the final array of alternatives under three potential future RSLR scenarios.

2.3 Adaptive Management Evaluation

The TSP project features were evaluated against the potential need for AM actions. However, prior to AM evaluation, the proposed alternatives were evaluated through the AEP to select a TSP with minimal risk and uncertainty. The AM Team, in coordination with the PDT, determined that uncertainties and risk elements identified for the majority of the TSP project features had been avoided during the AEP evaluation and project implementation process. To further reduce the remaining uncertainties and diminish potential future risks, a monitoring feedback loop was developed to help determine project success. This feedback loop included

contingency actions if criterions were not achieved. The items listed below have already been incorporated into the LPV Mitigation project implementation plan and OMRR&R plan to ensure the plan achieves success.

- Planting Guidelines for BLH, Swamp, and Intermediate and Brackish Marsh
- General monitoring guidelines for Project success
- Guidelines for Clearing, Grading, and other Earthwork Activities
- Specified Success Criteria (i.e., mitigation targets)
- Invasive Species Control
- Hydrologic Enhancement
- Phasing of Marsh Plantings
- Supplementary Plantings as required (contingency).
- Corrective actions to meet topographic success as required (contingency)
- Timber management activities

The need for AM actions will be reviewed and revised, as necessary, for subsequent TIER projects. If the Corps determines, based on a consideration of relevant factors, not to purchase mitigation bank credits to compensate for impacts to BLH and swamp, the Bonnet Carré swamp and BLH projects would instead become the proposed action to mitigate for BLH and swamp losses. AM contingencies, if needed for the Bonnet Carré swamp and BLH projects, would address any uncertainties and risks related to the operation of the Bonnet Carré spillway.

The Bonnet Carré Spillway was constructed as a flood control measure. When opened, the spillway diverts floodwaters from the Mississippi River to Lake Pontchartrain in order to reduce the water discharge flowing past New Orleans. In the 81 years since its construction, the Bonnet Carré spillway has been opened ten times, diverting water for between 13 and 75 days. Opening the Bonnet Carré spillway could impact the survival of mitigation plantings within the spillway depending on the timing (i.e. when in the plant lifecycle), duration (i.e. number of days spillway was open) and frequency (i.e. opening structure multiple times in a few years) of spillway openings. The AM Team recommends that two additional re-plantings be included as potential AM actions for both Bonnet Carré alternatives. The need for additional re-plantings could also trigger the need for additional mitigation monitoring. Hence, funding for four additional monitoring and reporting events should be included as potential AM actions (i.e., two additional monitoring/reporting events for each of the two re-planting events). The total cost for these additional re-plantings and monitoring/reporting AM actions is estimated to be approximately $1,750,000 for the Bonnet Carré BLH mitigation alternative, and approximately $2,215,000 for the Bonnet Carré Swamp mitigation alternative.

3.0 Monitoring for Project Success

Independent of AM, an effective monitoring program is required (WRDA 2007 Section 2036) to determine if the Project outcomes are consistent with the identified success criteria. Hence, a preliminary general Monitoring Plan was developed for each habitat type within the TSP (see Appendix C-7). The Plan identifies success criteria and targets, a general schedule for the monitoring events and the specific content for the monitoring reports that measure progress towards meeting the success criteria. A detailed monitoring plan specific to the Bonnet Carre BLH mitigation alternative has been developed (see Appendix C-8) and a detailed monitoring

plan specific to the Bonnet Carré Swamp mitigation alternative has also been developed (see Appendix C-9). Detailed monitoring plans will be developed for the remaining Corps-constructed mitigation TSP projects in conjunction with the local Sponsor following completion of the design of these TSP projects. These detailed plans will be provided in one or more of the future TIERs.

The USACE will be responsible for conducting the baseline monitoring (Time Zero) and subsequent monitoring and preparing the associated monitoring reports until such time that certain mitigation success criteria are achieved (see Table 2), although the cost for conducting these activities will be cost-shared with the Sponsor. Once the specified success criteria are achieve (see Table 2), the Sponsor will be solely responsible for conducting all subsequent monitoring and preparing the associated monitoring reports.

Mitigation success criteria, mitigation monitoring and reporting requirements, and mitigation management and maintenance activities for mitigation banks are set forth in the Mitigation Banking Instrument (MBI) for each particular bank. In cases where the TSP involves purchase of credits from a mitigation bank, the bank sponsor (bank permittee) is responsible for these activities rather than the USACE and/or the local Sponsor. USACE Regulatory staff review mitigation bank monitoring reports and conduct periodic inspections of mitigation banks to ensure compliance with mitigation success criteria stated in the MBI.

Table 2 summarizes the success criteria outlined in Appendix C-7 and may be used to depict project progress towards achieving the identified success criteria. It should be noted that the success criteria summarized above may need to be modified later with the final mitigation designs and project implementation or due to factors such as sea level rise, salinity or hydroperiod. Any deviations would be approved by the USACE in coordination with the non-Federal sponsor and Interagency Team, and would supersede the above criteria once approved.

In the event monitoring results and reports reveal that any success criteria have not been met, the USACE, non-Federal sponsor, or its assigns after consultation with CEMVN and other appropriate agencies, will modify management practices in order to achieve these criteria in the future. Items included in the project and planting implementation plans and OMRR&R plan to better ensure that the success criteria include:

- Planting Guidelines for BLH, Swamp and Intermediate and Brackish Marsh
- Invasive Species Control
- Timber Management Activities
- Hydrologic Improvements/Modifications needed for success of specific habitat types
- Phasing of Marsh Plantings
- Supplementary Plantings as required
- Corrective Actions to meet topographic success as required

The costs associated with implementing the Monitoring Program was estimated based on currently available data and information. The current estimate for set-up and implementing the Monitoring Program for the Bonnet Carré BLH mitigation alternative is $566,000, while the current estimate for the Monitoring Program for the Bonnet Carré Swamp mitigation alternative is $689,000. These costs include data collection, data assessment, data management, and development of required reports.

Table 2: Summary of Mitigation Success Criteria for Corps-Constructed Mitigation Projects - Report Card.

Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH	**Swamp**	**Marsh**
Mitigation Construction	Criteria 1A: Complete necessary initial earthwork and construction activities. Criteria 1B: Complete final construction activities (for mitigation in open water areas).	Criteria 1A: Complete necessary initial earthwork and construction activities. Criteria 1B: Complete final construction activities (for mitigation in open water areas).	Criteria 1A: Complete initial construction activities. Criteria 1B: Complete final construction activities.
Native Vegetation	Criteria 2A: Complete initial plantings. Criteria 2B: 1 year after initial plantings achieve: • Survival of ≥50% canopy species. • Survival of ≥85% midstory species. Criteria 2C: 4 years after initial plantings achieve: • ≥300 living native canopy species per acre. • 120-150 hard mast trees per acre • ≥85 midstory species per acre. For BLH-wet must meet hydrophytic vegetation criteria.	Criteria 2A: Complete initial plantings. Criteria 2B: 1 year after initial plantings achieve: • Survival of ≥50% canopy species. • Survival of ≥85% midstory species. Criteria 2C: 4 years after initial plantings achieve: • ≥250 native canopy species per acre. • ≥125 living bald cypress trees per acre. • ≥ 85 native midstory species per acre. • Vegetation meets hydrophytic vegetation	Criteria 3A. Complete initial plantings for intermediate and brackish marsh. Criteria 3B: For fresh marsh, 1 year after final construction completed, achieve: • ≥50% cover of native fresh marsh species. • meets hydrophytic vegetation criteria. Criteria 3C: For intermediate and brackish marsh , 1 year after initial plantings, achieve: • ≥80% survival of planted species OR ≥25% cover by native herbaceous species • meets hydrophytic vegetation criteria.

Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH	**Swamp**	**Marsh**
	Criteria 2D: Within 10 years after initial plantings, achieve: ≥80% coverage by native canopy species. Criteria 2E: 15 years after initial plantings, achieve: ≥75 mid-story native canopy trees per acre. Criteria 2F: 25 years after initial plantings, achieve: • 20-50% cover by native midstory species. 30-60% cover by native understory vegetation.	criteria. Criteria 2D. Within 15 years after initial plantings, achieve: • (1) ≥50% native canopy cover & >33% native midstory cover & >33% ground cover. OR (2): ≥75% native canopy cover AND: >33% native midstory cover; OR >33% native ground cover Criteria 2E: Within 45 years after initial plantings, achieve: • DBH of living bald cypress >10 inches. • DBH of other living native trees >12 inches. Total basal area of all living native trees exceeds 161 square feet per acre. Criteria 2F: 45 years after initial plantings, achieve: • ≥160 living native trees per acre. • Maintain Criteria 2D (1) or Criteria 2D(2).	Criteria 3D: For fresh marsh 3 years after final construction completion, achieve: ≥85% cover by native herbaceous species. Criteria 3E: For intermediate & brackish marsh 3 years after initial plantings, achieve: ≥75% cover by native herbaceous species. Criteria 3F: For all marshes, 5 through 20 yrs after final construction completion, achieve: ≥80% cover by native herbaceous species.
Invasive and Nuisance Vegetation	Criteria 3A. Complete initial Eradication of INV.	Criteria 3A. Complete initial Eradication of INV.	Criteria 4A. Complete initial Eradication of INV.

Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH	**Swamp**	**Marsh**
(INV)	Criteria 3B. Maintain <5% cover by INV.	Criteria 3B. Maintain <5% cover by INV.	Criteria 4B. Maintain <5% cover by INV.
Topography	Criteria 4A: After completion of construction, ≥ 80% of total graded area must be within 0.5 ft of target elevation (for mitigation other than in open water areas). Criteria 4B: For open water areas in the year after construction completion, ≥85 % of total graded area must be within 0.5 ft of target elevation.	Criteria 4A: After completion of construction, ≥ 80% of total graded area must be within 0.5 ft of target elevation (for mitigation other than in open water areas). Criteria 4B: For open water areas in the year after construction completion, ≥85 % of total graded area must be within 0.5 ft of target elevation.	Criteria 2A: Upon completion of construction, ≥ 80% of total area must be within 0.5 ft of target elevation. Criteria 2B: 1 year after completion of construction, ≥ 80% of total area must be within 0.5 ft of target elevation. Criteria 2C: 3 year after completion of construction, ≥ 90% of mitigation site must be within functional marsh elevation range.
Thinning of Native Vegetation	Criteria 5: TBD; at 15 to 20 years following initial plantings PDT will determine if thinning of canopy and midstory strata is warranted.	Criteria 5: TBD after the average total basal area of canopy species >170 square feet/acre.	Not applicable.
Hydrology	Criteria 6A: Demonstrate water table is ≤ 12 inches above soil surface for 14 consecutive days in a normal rainfall year (for BLH-Wet only). Criteria 6B: demonstrate soils are inundated or saturated between 7-13% of growing season (for BLH-Wet only).	Criteria 6A: Demonstrate compliance with the following in a normal rainfall year: • 200-300 consecutive days of inundation. • 60-90 consecutive days of non-inundation. • Average peak water table elevation 1.0-2.0 ft above soil surface. Criteria 6B. In a normal rainfall	Not applicable.

Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH	**Swamp**	**Marsh**
		year, for Swamp areas without hydrologic enhancement the water table must be ≤ 12 inches above soil surface for 14 consecutive days.	

APPENDIX O

INTERAGENCY ENVIRONMENTAL TEAM

Stephanie Zumo	Coastal Protection and Restoration Authority Board
Barry Bleichner	Coastal Protection and Restoration Authority Board
Elizabeth Davoli	Coastal Protection and Restoration Authority Board
Jeffrey Harris	Louisiana Department of Natural Resources
Frank Cole	Louisiana Department of Natural Resources
Tim Killeen	Louisiana Department of Natural Resources
Kyle Balkum	Louisiana Department of Wildlife & Fisheries
Heather Finley	Louisiana Department of Wildlife & Fisheries
Clifford Melius	Louisiana Office of State Parks
Patrick Williams	National Marine Fisheries Service
Richard Hartman	National Marine Fisheries Service
David Walther	U.S. Fish & Wildlife Service
Angela Trahan	U.S. Fish & Wildlife Service
David Castellanos	U.S. Fish & Wildlife Service
Catherine Breaux	U.S. Fish & Wildlife Service
Barbara Keeler	U.S. Environmental Protection Agency
John Ettinger	U.S. Environmental Protection Agency
Guy Hughes	U.S. National Park Service
Dusty Haigler	U.S. National Park Service

APPENDIX P

ABBREVIATIONS

AAHU	Average Annual Habitat Units
AM	Adaptive Management
BLH-Dry	Bottomland Hardwood Dry
BLH-Wet	Bottomland Hardwood Wet
BMP	Best Management Practice
BSS	Beaufort sea state
CAA	Clean Air Act
CAR	Coordination Act Report
CEMVN	U.S Army Corps of Engineers Mississippi Valley Division, U.S. Army Corps of Engineers New Orleans District
CEQ	Council on Environmental Quality
CF	Contractor Furnished
CFR	Code of Federal Regulations
CNWB	Colonial Nesting Wading Birds
CRMS	Coastwide Reference Monitoring System
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
dB	Decibel
dBA	Weighted Decibel
DNL	Day-Night Average Sound Level
DOI	Department of Interior
DR	Decision Record
EA	Environmental Assessment
ECO-PCX	National Ecosystem Restoration Planning Center of Expertise
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Endangered Species Act
°F	Fahrenheit
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
FONSI	Finding of No Significant Impact
FS	Flood Side
FWP	Future with Project
FWOP	Future without Project
GIWW	Gulf Intracoastal Waterway
GSMFC	Gulf States Marine Fisheries Commission
HPS	Hurricane Protection System
HSDRRS	Hurricane and Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic, or Radioactive Waste
IER	Individual Environmental Report
IERS	Supplemental Individual Environmental Report
IHNC	Inner Harbor Navigation Canal

LA	Louisiana
LaCPR	Louisiana Coastal Protection and Restoration
LCRP	Louisiana Coastal Resources Program
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LDEQ	Louisiana Department of Environmental Quality
LIDAR	Laser Identification Detection and Ranging
LPV	Lake Pontchartrain and Vicinity
LWCF	Land and Water Conservation Fund
MBI	Mitigation Banking Instrument
MRGO	Mississippi River Gulf Outlet
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NWR	National Wildlife Refuge
PDT	Project Delivery Team
PED	Preconstruction Engineering & Design
PIER	Programmatic Individual Environmental Report
PL	Public Law
ppm	Parts per Million
ppt	Parts per Thousand
PM	Particulate Matter
PS	Protected Side
REC	Recognized Environmental Conditions
RFI	Request for Information
RFQ/RFP	Request for Qualifications/Request for Proposal
ROD	Record of Decision
RSLR	Relative Sea Level Rise
SAV	Submerged Aquatic Vegetation
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SHPO	State Historic Preservation Office
SHS	State Historic Site
SWBNO	Sewerage and Water Board of New Orleans
TIER	Tiered Individual Environmental Report
TSMP	Tentatively Selected Mitigation Project
TSMPA	Tentatively Selected Mitigation Plan Alternative
USACE	U.S Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment
ZIP	Zone Improvement Plan