Appendix B

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Table B-1. Previously Constructed Wetland or Ecosystem Restoration Projects in Barataria Basin

Program	Parish	Year Constructed	Description	Direct Overlap	Extended Boundary Overlap
CIAP BA-15x-2 (EB): EB-Lake Salvador Shoreline Protection Phase III	St Charles	2009	A shoreline protection located near Bayou des Allemands along the northwestern Lake Salvador shoreline tying into the western BA-15 CWPPRA shoreline protection feature and extending approximately 3 miles east. *+#	No	No
CIAP BA-59: Waterline Booster Pump Station, West Bank	St. James	2010	Constructed in 2010, the project includes the installation of a waterline booster pump station in Welcome, Louisiana along Louisiana Highway 18 on the west bank of the Mississippi River in St. James Parish.*+#	No	No
CIAP BA-61: West Bank Wetland Conservation and Protection	St. James	2010	Acquisition and preservation of approximately 235 acres of existing wetlands along Louisiana Highway 20 in St. James Parish near the communities of South Vacherie and Chackbay to protect the natural habitat from future development. The purchase was completed in 2010. *+#	No	No
CWPPRA BA-03c: Naomi Outfall Management	Jefferson, Plaquemines	2002	The management of freshwater, sediment and nutrients diverted from the Mississippi River via the Naomi Siphon (BA-03) into the project area located between the communities of Naomi/La Reusitte and Lafitte in Jefferson Parish, Louisiana including The Pen. The project goal is to decrease salinities and reduce marsh loss.*	No	No

CWPPRA BA-02: GIWW (Gulf Intracoastal Waterway) to Clovelly Hydrologic Restoration	Lafourche	2000	Inhibit salinity increases within the project area by the use of hydrologic restoration features such as plugs and weirs to prevent salt water intrusion and decrease marsh loss. Shoreline protection features along the Bay L'Ours were also constructed to prevent wave induced erosion and reduce marsh loss. The project is located east of the communities of Larose and Cutoff in Lafourche Parish, Louisiana and adjacent to Little Lake. *	No	No
CWPPRA BA-15: Lake Salvador Shore Protection Demonstration	St Charles	1998	The project was constructed in two Phases. The first phase included the construction of shoreline protection features along the northern shoreline of Lake Salvador east of Baie du Cabanage to investigate the performance of various structural shoreline protection designs in unstable soil conditions and high wave energy environments. Phase II of the project included a continuous rock structure approximately 8,000 feet in length along the western section of the lake near the entrance of Bayou des Allemands. The objective of this project was to maintain the shoreline integrity and prevent interior marsh loss. *	No	No
CWPPRA BA-39: Mississippi River Sediment Delivery System - Bayou Dupont	Jefferson, Plaquemines	2010	Dredged material from the Mississippi River near La Reussite, Louisiana was pumped into confined open water areas south of Cheniere Traverse Bayou and adjacent to the West Plaquemines non-federal levee using a pipeline conveyance system to create and restore marsh. Additional grant funded received by the State of Louisiana from The American Recovery and Reinvestment Act of 2009 (ARRA) was added to this project to create approximately 100 additional acres of marsh. *	No	No

National Park Service/USACE: Lake Salvador Shoreline Protection 1997 Shoreline Protection	Jefferson	1997	A shoreline protection barrier was built by the USACE under the authority of the National Parks and Recreation Act of November 10, 1978 (PL 95-625) to protect the Jean Lafitte National Historical Park and Preserve lands from wave induced erosion in an area of the central eastern Lake Salvador shoreline where potential breaching was possible between the Lake Salvador shoreline and the Bayou Segnette Waterway. The wave break is approximately 8,000 feet long (USACE, 1995).	Yes	No
National Park Service/USACE: Lake Salvador Shoreline Protection 2005	Jefferson	2004-2005	Shoreline protection features were constructed by the USACE within the Jean Lafitte National Historical Park and Preserve along the northeastern Lake Salvador shoreline from the entrance of Bayou Bardeaux southeast along the Lake Salvador shoreline until it meets the National Park Service breakwater constructed in 1997. The goal of this project is to protect the JLNHPP lands and archaeological sites from wave induced erosion (USACE, 2004b).	No	No
National Park Service: 2002 Jean Lafitte National Historical Park & Preserve Canal Partial Back Fillings	Jefferson	2002	Jean Lafitte National Historical Park & Preserve canals backfilled in 2002 to restore marsh integrity (Haigler, 2011).	No	Yes
National Park Service: 2010 Jean Lafitte National Historical Park & Preserve Canal Partial Back Fillings	Jefferson	2010	Jean Lafitte National Historical Park & Preserve canals partially backfilled in 2010 to restore marsh integrity (Haigler, 2011).	No	Yes

National Park Service/USACE: Jean Lafitte National Historical Park & Preserve Beneficial Use Site	Jefferson	2011	The beneficial use of dredged material from Bayou Segnette Waterway and additional material from Algiers Canal associated with the construction of the West Closure Complex/HSDRSS were placed in the site bounded by the 1997 NPS wave break features on the west, existing marsh lands to the north and south, and the 1994 State of Louisiana BA-16 rock dike to the east. The project will provide improved shoreline stability (Minton, 2011).	Yes	No
National Park Service/USACE: Lake Salvador Shoreline Protection 2011	Jefferson	2011	Construction consisted of placement of rock on the floodside of the geocrib area and repairing existing rock dike on the Jean Lafitte National Historical Park and Preserve -along the eastern Lake Salvador shoreline adjacent to the geocrib constructed in 1997. The feature is owned by NPS (O'Cain, 2012).	Yes	No
State of Louisiana BA-03: Naomi Siphon Diversion	Jefferson, Plaquemines	1992	The Naomi Siphon diversion is located on the west bank of the Mississippi River near the communities of Naomi and LaReussitte, Louisiana. The maximum flow capacity of the diversion is 2,100 cfs and is designed to divert freshwater, nutrients and sediment from the Mississippi River into the adjacent wetlands near Naomi, Louisiana. *	No	No
State of Louisiana BA05c: Baie de Chactas	St Charles	1990	Construction of a rock shoreline protection feature between the northwest shoreline of Lake Salvador and Baie du Cabanage in order to reduce erosion, stabilize the shoreline, and prevent shoreline breaching. *	No	No

State of Louisiana BA-15x1: Lake Salvador Shoreline Protection Extension Project	St Charles	2005	The shoreline protection project included the construction of a rock dike along the northeastern shoreline of Lake Salvador tying into the BA-15 Phase II CWPPRA project and extending approximately 10,000 feet northeast. The project is designed to maintain the shoreline integrity and reduce interior marsh loss. *	No	No
State of Louisiana BA-16: Bayou Segnette	Jefferson	1994; 1998	A shoreline protection feature along a narrow strip of spoil bank and marsh which separates the Bayou Segnette Waterway from Lake Salvador and a barrier across an abandoned canal that connects the two water bodies was constructed in 1994 to reduce wave induced erosion of marsh habitats within the JLNHPP. Maintenance of the structure occurred in 1998-1999. *	Yes	Overlap was taken into considerati on in USGS analysis
State of Louisiana LA-01a: Dedicated Dredging Program - Lake Salvador	St Charles	1999	A Dedicated Dredging Program project which included the placement of dredged material in open water areas of Baie du Cabanage within the Salvador Wildlife Management Area where narrow marsh strips exists between Lake Salvador and the bay. The project goal is the restoration of marsh habitat and the reduction of shoreline breaching into the adjacent open water bodies. *	No	No
Texaco Oil Spill Mitigation: Texaco Oil Discharge Mitigation 1991 (Netherlands Area)	St Charles	1991	Mitigation for the 1991 Texaco oil well discharge into southwestern portion of Lake Salvador. The mitigation feature was constructed in the Netherlands area and consists of a timber pile/tire breakwater approximately 835 feet in length separating the Netherlands area from Lake Cataouatche. The objective of the project is to reduce erosion and enhance submerged aquatic vegetation habitat. The breakwater is anticipated to maintain existing conditions for 50 years (USDOI, 1991).	No	No

US Army Corps of Engineers: Davis Pond Freshwater Diversion Structure and Guide Levees	St Charles	2002	The Davis Pond Freshwater Diversion Structure is located on the west bank of the Mississippi River near Luling, Louisiana in St Charles Parish. Approximately 19 miles of guide levees were also constructed to control the diverted freshwater, nutrients and sediments from the Mississippi River through the diversion structure into the Barataria Basin for the enhancement of the wetland habitat. The maximum flow capacity of the diversion is 10,650 cfs (USACE, 2000).	No	No
WRDA BA-01: Davis Pond Freshwater Diversion and Forced Drainage Area	Jefferson, Lafourche, Plaquemines, St Charles	2002	The management of the diverted freshwater, nutrients and sediment from the Mississippi River through the Davis Pond freshwater diversion structure into the surrounding marsh areas to maintain and enhance the ecosystem of the Barataria Basin. *	Yes	Yes

Table B-2: Reasonably Foreseeable Future Wetland or Ecosystem Restoration Projects in Barataria Basin

Program	Parish	Description	Direct Overlap	Extended Boundary Overlap
CIAP BA-43 (EB): EB-Long Distance Mississippi River Sediment Pipeline	Jefferson, Lafourche, Plaquemines	The deposition of dredged material from the Mississippi River by long distance pipeline from the Mississippi River to locations within central Barataria Basin for marsh creation and restoration. Project is currently under construction and is expected to be completed by December 2015.*[+ #]	No	No
CIAP BA-62: West Bank Wastewater Assimilation Plant	St. James	Construction of a wetland assimilation treatment plant in Vacherie, Louisiana for disbursement of treated sewerage effluent into a predominantly cypress/tupelo forested wetland area in St James Parish to increase wetland vegetation health. Grant application is anticipated in the near future with construction scheduled to begin in June 2014 and anticipated construction completed in June 2015.*[+#]	No	No
CIAP PO-90: West Lac Des Allemands Shoreline Protection	St John the Baptist	Shoreline protection is to be constructed along the western shore of Lac des Allemands from “Pleasure Bend” westward to Pointe Aux Herbes in St John the Baptist Parish, Louisiana. The goal of the project is reduce shoreline erosion. Construction began in January 2013 and is anticipated of completion in August 2014.*[+#]	No	No
CWPPRA LA-16 Non-rock Alternatives to Shoreline Protection Demonstration	Jefferson	Project goals are to demonstrate different alternatives to rock shoreline protection methods by testing several different products along highly erosive shorelines in areas that are not conducive to construction with rock (CPRA, 2013b)	No	No

Pre-Katrina WBV Mitigation: Land Acquisition and BLH Mitigation	St Charles	Mitigation for Pre-Katrina West Bank and Vicinity Hurricane Protection project impacts by land acquisition, preservation, and management of lands along the St Charles Parish ridge and adjacent to Bayou Segnette State Park. Anticipated Bayou Segnette land acquisition completed by July 2014 and anticipated construction complete by Winter 2016. Anticipated St Charles land acquisition completed by March 2015 and anticipated completion date prior to Winter 2016. (USACE, 2012b).	No	No

Table B-3: Additional Authorized Projects in Barataria Basin

Program	Parish	Description	Direct Overlap	Extended Boundary Overlap
Louisiana DOTD/FHWA: Future I-49 South, Raceland to the Westbank Expressway (700-92-0011)	St. Charles; Lafourche	Proposed construction of an elevated extension to US Interstate 49 South along the US 90 corridor from the Louisiana Highway 1 interchange in Raceland, Louisiana to the Westbank Expressway near Ames Boulevard in Marrero, Louisiana. The project also includes the connection of the southern terminus of US Interstate 310 with US Interstate 49. The Record of Decision for the project was signed in January 2008 (USDOT, 2008).	No	Yes
US Department of Justice: St Charles Levee Conservation Easement	St. Charles	St Charles Levee Conservation Easement was authorized and created in 1999 by the U.S. Department of Justice as a conservation area resulting from a federal settlement with Rathborne Land Company to resolve allegations of unpermitted development of wetlands (Scallan, 2010).	No	No

(*Data source is CPRA, 2012a; +Data source is CPRA, 2010)

Table B-4: Plant Species Referenced in PIER 37, Tier 1

Common Name	Scientific Name
American elm	*Ulmus americana*
American sycamore	*Platanus occidentalis*
Bald cypress	*Taxodium distichum var. distichum*
Black willow	*Salix nigra*
Boxelder	*Acer negundo*
Bulltongue	*Sagittaria lancifolia*
Buttonbush	*Cephalanthus occidentalis*
California bullwhip	*Scirpus californicus*
Cattail	*Typha latifolia*
Cedar elm	*Ulmus crassifolia*
cutgrass	*Zizaniopsis miliaceae*
Common persimmon	*Diospyros virginiana*
duckweed	*Lemna sp.*
Eastern cottonwood	*Populus deltoides*
floating antler-fern	*Ceratopteris pteridoides*
giant salvinia	*Salvinia molesta*
Green ash	*fraxinus pennsylvanica*
Honey locust	*Gleditsia triacanthos*
Iris	*Iris L.*
Johnson grass	*Sorghum halapense*
Nuttall oak	*Quercus nuttallii*
Pignut hickory	*Carya glabra*
Planertree	*Planera aquatica*
Red maple	*Acer rubrum*
Red mulberry	*Morus rubra*
Sugarberry	*Celtis laevigata*
swamp tupelo	*Nyssa aquatica*
Sweetgum	*Liquidambar styraciflua*
Water lily	*Nymphaea odorata*
Water Oak	*Quercus nigra*
Water tupelo/tupelogum	*Nyssa aquatica*
Wild rice	*Zizania aquatica*

Table B-5: Common Wildlife Species Found in the WBV 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*
Black rat	*Rattus rattus*
Blue-winged teal	*Anas discors*
Boat-tailed grackle	*Quiscalus major*
Bobcat	*Lynx rufus*
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*
Domestic cat	*Felis catus*
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*
Greenhouse frog	*Eleutherodactylus planirostris*
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*
Piping plover	*Charadrius melodus*
Prothonotary Warbler	*Protonotaria citrea*
Rafinesque's big-eared bat	*Plecotus rafinesquii*
Red bat	*Lasiurus borealis*
Red knot	*Calidris canutus rufa*

Red-eared slider	*Trachemys scripta*
Reddish Egret	*Egretta rufescens*
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*
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Snowy egret	*Egretta thula*
Southern leopard frog	*Rana sphenocephala*
Sprague's pipit	*Anthus spragueii*
Squirrel treefrogs	*Hyla squirella*
Stinkpot	*Sternotherus odoratus*
Swallow-tailed Kite	*Elanoides forficatus*
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-6: Threatened and Endangered Species in the WBV Basin

Species	Parish	Critical Habitat	Status	Jurisdiction	
				USFWS	NFMS
Animal					
Louisiana Black Bear (*Ursus americanus luteolus*)	St. C, St. J, O, Pl	X	T	X	
*West Indian Manatee (*Trichechus manatus*)	Asc, J, L, O, Pl, St. C, St. J, St. JB,		E	X	
*Pallid sturgeon (*Scaphirhynchus albus*)	Asc, J, O, Pl, St. J, St. C, St. JB,		E	X	
Piping plover (*Charadrius melodus)*	J, L, O, Pl	X	T	X	
Red knot *(Calidris canutus)*	J, L, Pl		T	X	
Green Sea Turtle (*Chelonia mydas*)	J, L, Pl		T	X	X
Hawksbill Sea Turtle (*Eretomchelys imbricata*)	J, L, Pl		E	X	X
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	J, L, Pl		E	X	X
Leatherback Sea Turtle (*Dermochelys coriacea*)	J, L, Pl		E	X	X
Loggerhead Sea Turtle (*Caretta caretta*)	J, L, Pl		T	X	X

Table B-7: Fish and Aquatic Species Found in the WBV Basin

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*
buffalo	*Ictiobus bubalus*
channel catfish	*Ictalurus punctatus*
common carp	*Cyprinus carpio*
crawfish	*Procambarus sp.*
freshwater drum	*Aplodinotus grunniens*
Gizzard shad	*Dorosoma cepedianum*
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*
mosquitofish	*Gambusia affinis*
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 gar	*Lepisosteus oculatus*
spotted sea trout	*Cynoscion nebulosus*
striped mullet	*Mugil cephalus*

warmouth	*Lepomis gulosus*
white shrimp	*Litopenaeus setiferus*
Yellow bass	*Morone mississippiensis*
yellow bullhead	*Ameiurus natalis*
Zebra mussel	*Dreissena polymorpha*

Table B-8. Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 ft., U. S. Dept. of Trans. study 1979	Average Noise Level (dBA) 50 ft., CA/T Project study 1994	Typical Noise Level (dBA) 50 ft., U. S. Dept. of Trans. study 1995	Lmax Noise (dBA) 50 ft., CA/T Project Spec. 721.560
Air Compressor		85	81	80
Backhoe	84	83	80	80
Chain Saw				85
Compactor	82		82	80
Compressor	90	85		80
Concrete Truck		81		85
Concrete Mixer			85	85
Concrete Pump			82	82
Concrete Vibrator			76	80
Crane, Derrick	86	87	88	85
Crane, Mobile		87	83	85
Dozer	88	84	85	85
Drill Rig		88		85
Dump Truck		84		84
Excavator				85
Generator	84	78	81	82
Gradall		86		85
Grader	83		85	85
Hoe Ram		85		90
Impact Wrench			85	85
Jackhammer*		89	88	85

Loader	87	86	85	80
Paver	80		89	85
Pile Driver, Impact		101	101	95
Pile Driver, Sonic			96	95
Pump	80		85	77
Rock Drill			98	85
Roller			74	80
Scraper	89		89	85
Slurry Machine		91		82
Slurry Plant				78
Truck	89	85	88	84
Vacuum Excavator				85

* There are 82 dBA @ 7 meter rated jackhammers (90 lb. class) available. This would be equivalent to 74 dBA @ 50 ft. These are silenced with molded intricate muffler tools.

Table B-9. Prime Farmland Soils in the WBV Basin

Parish	Acreage*	% of All Soils*
Ascension	8,499.6	83.7
Assumption	30,431.9	55.3
Jefferson	28,231.3	30.8
Lafourche	60,877.7	20.2
Orleans	7,036.5	52.7
Plaquemines	8,467.9	23.2
St Bernard	0.0	0
St Charles	31,360.9	17.3
St James	37,011.4	41.9
St John the Baptist	15,324.5	25.9
TOTAL	227,241.7	27.1

*Acreages and percentages are based on the portions of the parish that fall within the WBV mitigation basin boundary.

Table 10: **2012 Fishing, Hunting Licenses & 2011 Boating Licenses Sold by Parish and in the WBV Basin**

Parish	Resident Salt *	NR Salt*	Resident Fresh*	NR Fresh*	Residential Hunting*	NR Hunting *	Boat
Assumption	1,833	13	2,971	3	1,186	0	3,607
St. James	2,027	1	2,456	1	763	0	2,135
St. John the Baptist	3,609	7	3,973	7	861	0	2,269
La Fourche	14,628	33	15,556	33	4,464	2	11,878
St. Charles	5,519	17	5,930	19	1,477	0	4,343
Jefferson	30,860	171	31,707	184	4,935	5	18,627
Orleans	11,544	98	12,059	122	1,466	6	4,649
Plaquemines	3,400	15	3,464	16	1,100	1	3,937
Total WBV Basin	**73,420**	**355**	**78,116**	**385**	**16,252**	**14**	**51,445**

Information is provided by the Louisiana Dep artment of Wildlife and Fisheries (www.wlf.louisiana.gov)
* Numbers are for one license per year per individual; Salt= salt water fishing; Fresh =fresh water fishing; NR =Non-resident; Boat= boat licenses

Table B-11: Migratory Birds Found in on JELA		
Common Name	**Scientific Name**	**Occurance**
American oystercatcher	*Haematopus palliatus*	Year-round
American bittern	*Botaurus lentiginosus*	Wintering
Bald eagle	*Haliaeetus leucocephalus*	Year-round
Black skimmer	*Rynchops niger*	Year-round
Brown-headed nuthatch	*Sitta pusilla*	Year-round
Chuck-will's-widow	*Caprimulgus carolinensis*	Wintering
Gull-billed tern	*Sterna nilotica*	Year-round
Henslow's sparrow	*Ammodramus henslowii*	Wintering
Le Conte's sparrow	*Ammodramus leconteii*	Wintering
Least bittern	*Ixobrychus exilis*	Breeding
Least tern	*Sterna antillarum*	Breeding
Lesser yellowlegs	*Tringa flavipes*	Wintering
Loggerhead shrike	*Lanius ludovicianus*	Year-round
Marbled godwit	*Limosa fedoa*	Wintering
Mississippi kite	*Ictinia mississippiensis*	Breeding
Nelson's sparrow	*Ammodramus nelsoni*	Wintering
Orchard oriole	*Icterus spurius*	Breeding
Painted bunting	*Passerina ciris*	Breeding
Peregrine falcon	*Falco peregrinus*	Wintering
Prothonotary warbler	*Protonotaria citrea*	Breeding
Red knot	*Calidris canutus rufa*	Wintering
Red-headed woodpecker	*Larus delawarensis*	Wintering
Reddish Egret	*Egretta rufescens*	Year-round
Rusty Blackbird	*Euphagus carolinus*	Wintering
Seaside sparrow	*Ammodramus maritimus*	Year-round
Sedge Wren	*Cistothorus platensis*	Wintering
Short-billed dowitcher	*Limnodromus griseus*	Wintering
Snowy plover	*Charadrius alexandrinus*	Wintering
Swainson's warbler	*Limnothlypis swainsonii*	Breeding
Whimbrel	*Numenius phaeopus*	Wintering
Wilson's Plover	*Charadrius wilsonia*	Breeding
Worm eating warbler	*Helmitheros vermivorum*	Migrating
Yellow crowned night heron	*Nyctanassa violacea*	Year-round
Yellow rail	*Coturnicops noveboracensis*	Wintering

Table B-12: Fish Species Found on JELA

Common Name	Scientific Name
Alligator gar	*Atractosteus spatula*
American eel	*Anguilla rostrata*
Atlantic croaker	*Micropogonias undulatus*
Atlantic needlefish	*Strongylura marina*
Atlantic stingray	*Dasyatis sabina*
banded pigmy sunfish	*Elassoma zonatum*
bantam sunfish	*Lepomis symmetricus*
bay anchovy	*Anchoa mitchilli*
bayou killifish	*Fundulus pulvereus*
bay whiff	*Citharichthys spilopterus*
black crappie	*Pomoxis nigromaculatus*
black drum	*Pogonias cromis*
blue catfish	*Ictalurus furcatus*
bluegill	*Lepomis macrochirus*
bowfin	*Amia calva*
brook silverside	*Labidesthes sicculus*
brown bullhead	*Ameiurus nebulosus*
channel catfish	*Ictalurus punctatus*
common carp	*Cyprinus carpio*
darter goby	*Gobionellus boleosoma*
fat sleeper	*Dormitator maculatus*
flathead catfish	*Pylodictis olivaris*
freshwater drum	*Aplodinotus grunniens*
freshwater goby	*Gobionellus shufeldti*
Gizzard shad	*Dorosoma cepedianum*
golden topminnow	*Fundulus chrysotus*
golden shiner	*Noteuryhaline marineigonus crysoleucas*
green sunfish	*Lepomis cyanellus*
Gulf killifish	*Fundulus grandis*
Gulf menhaden	*Brevoortia patronus*
Gulf pipefish	*Syngnathus scovelli*
highfin goby	*Gobionellus oceanicus*
hogchoker	*Trinectes maculates*
inland silverside	*Menidia beryllina*
ladyfish	*Elops saurus*
lake chubsucker	*Erimyzon sucetta*
largemouth bass	*Micropterus salmoides*
least killifish	*Heterandria formosa*
mosquitofish	*Gambusia affinis*
naked goby	*Gobiosoma bosc*
rainwater killifish	*Lucania parva*
redear sunfish	*Lepomis microlophus*

redfish/ red drum	*Sciaenops ocellatus*
rough silverside	*Membras martinica*
sand sea trout	*Cynoscion arenarius*
sailfin molly	*Poecilia latipinna*
sheepshead	*Archosargus probatocephalus*
sheepshead minnow	*Cyprinodon variegatus*
southern flounder	*Paralichthys lethostigma*
spotted sea trout	*Cynoscion nebulosus*
spotted sunfish	*Lepomis miniatus*
striped mullet	*Mugil cephalus*
threadfin shad	*Dorosoma petenense*
Warmouth sunfish	*Lepomis gulosus*
Yellow bass	*Morone mississippiensis*
yellow bullhead	*Ameiurus natalis*

Table B-13: Cumulative Impacts of Past Present and Reasonably Foreseeable Projects in the WBV 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 BA-43 (EB): EB-Long Distance Mississippi River Sediment Pipeline	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
CWPPRA BA-39: Mississippi River Sediment Delivery System - Bayou Dupont	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
State of Louisiana BA-03: Naomi Siphon Diversion	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
WRDA BA-01: Davis Pond Freshwater Diversion and Forced Drainage Area	Diversion	+	+/-	o	+/-	+/-	o	+/-	o	o	o	o	o
CIAP BA-62: West Bank Wastewater Assimilation Plant	Habitat Enhancement	+	+	o	o	+/-	o	+/-	o	o	o	o	o
CIAP (PO-90) WLDS-SP: West Lac Des Allemands Shoreline Protection	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
CIAP BA-61: West Bank Wetland Conservation and Protection	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
CWPPRA LA-16 Non-rock Alternatives to Shoreline Protection Demonstration	Habitat Preservation	+	+	o	+/-	+/-	o	o	+	o	o	o	o
National Park Service: Jean Lafitte National Historic Park Beneficial Use Site	Habitat Preservation	+	+	o	-	-	o	o	o	o	o	o	o
National Park Service: Lake Salvador Shoreline Protection 2011	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
Pre-Katrina WBV Mitigation: Land Acquisition and BLH Mitigation	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
State of Louisiana BA05c: Baie de Chactas	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
State of Louisiana BA-15x1: Lake Salvador Shoreline Protection Extension Project	Habitat Preservation	+	+	o	+/-	+/-	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 BA-16: Bayou Segnette	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
Surplus Funds 2007 BA-75-1: Jean Lafitte Tidal Protection/Fishers basin	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
Texaco Oil Spill Mitigation: Texaco Oil Discharge Mitigation 1991 (Netherlands Area)	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
US Department of Justice: St Charles Levee Conservation Easement	Habitat Preservation	+	+	o	o	o	o	o	+	o	o	o	o
National Park Service: Lake Salvador Shoreline Protection 1997 shoreline protection and geocrib	Habitat Preservation	+	+	o	+/-	+/-	o	o	o	o	o	o	o
National Park Service: Lake Salvador Shoreline Protection 2005	Habitat Preservation	+	+	o	+/-	+/-	+	+	o	o	o	o	o
CIAP BA-15x-2 (EB): EB-Lake Salvador Shoreline Protection Phase III	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA BA-15: Lake Salvador Shore Protection Demonstration	Habitat Restoration	+	+	o	+/-	+/-	o	+	o	o	o	o	o
CWPPRA BA-03c: Naomi Outfall Management	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
CWPPRA BA-02: GIWW (Gulf Intracoastal Waterway) to Clovelly Hydrologic Restoration	Hydrologic Restoration	+	+	o	+/-	+/-	o	o	o	o	o	o	o
National Park Service: 2002 Jean Lafitte National Historic Park Canal Partial Back Fillings	Marsh Creation	+	+	o	-	-	o	+	o	o	o	o	o
National Park Service: 2010 Jean Lafitte National Historic Park Canal Partial Back Fillings	Marsh Creation	+	+	o	-	-	o	+	o	o	o	o	o
State of Louisiana LA-01a: Dedicated Dredging Program - Lake Salvador	Marsh Creation	+	+	o	+/-	-	o	+	o	o	o	o	o
CIAP BA-59: Waterline Booster Pump Station, West Bank	Structure	+/-	+/-	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
Louisiana DOTD: Future I-49 Corridor	Structure	+/-	+/-	o	o	-	o	-	-	o	+	+	o
US Army Corps of Engineers: Davis Pond Freshwater Diversion Structure	Structure	+/-	+/-	o	o	o	o	-	-	o	o	o	o
Algiers Lock	Structure	+/-	+/-	o	-	-	o	+/-	-	o	o	-	o
Algiers Non-federal Levee (Donner Canal Levee)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Bayou Gauche Ring Levee (Sunset Levee)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Coastal Protection and Restoration Authority (CPRA) and North Lafourche Conservation, Levee and Drainage District, Valentine to Larose Levee, TE-111	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Empire Lock	Structure	+/-	+/-	o	-	-	o	+/-	-	o	o	-	o
English Turn Non-federal Levee (Donner Canal Levee)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
GIWW Navigation System	Structure	+/-	+/-	o	+/-	+/-	+/-	+/-	o	o	o	+	o
Harvey Canal Lock	Structure	+/-	+/-	o	-	-	o	+/-	-	o	o	-	o
Hurricane and Storm Damage Risk Reduction System (HSDRRS), West Bank and Vacinity	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Larose to Golden Meadow, Louisiana, Hurricane Protection Project (LGM)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Mississippi River Levees : MR&T Project	Structure	+/-	+/-	o	-	-	+/-	-	-	o	o	+	o
Mississippi River Navigation Operations and Maintenance	Structure	+/-	+/-	o	+/-	+/-	o	-	o	o	o	+	o
New Orleans to Venice (NOV) levee project, Incorporation of Non-fedeal Levees (NFL) into NOV	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
New Orleans to Venice (NOV) levee project, St. Jude to Venice	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
Oakville to La Reussite Non-federal Levee	Structure	+/-	+/-	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
St. Charles Parish Levee - West Bank Ellington Phase 3 (BA-85-3)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
St. Charles Parish Levee - West Bank Magnolida Ridge Phase 1 (BA-85-1)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
St. Charles Parish Levee - West Bank Willow Ridge Phase 2 (BA-85-2)	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
State of Louisiana - Surplus Fund 2007 project, Lafitte Tidal Protection, BA-75-3, 2007	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
State of Louisiana Surplus Fund 2007 Project - East of Harvey Canal Interim Hurricane Protection - Phase 1	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
State of Louisiana- Surplus Fund 2007 project, Jean Lafitte Tidal Protection, BA-75-1, 2007	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o
West Plaquemines Non-federal Levee	Structure	+/-	+/-	o	o	o	o	-	-	o	o	+	o

+ positive effect, - negative effect, o no effect, +/- both positive and negative effects

Appendix C

WVA Assumptions

FINAL WVA ASSUMPTIONS, CALCULATIONS, JUSTIFICATIONS, DATA, INPUTS, AND RESULTS FOR PROPOSED HSDRRS-WBV MITIGATION SITES

HSDRRS – WBV MITIGATION
Jefferson and St. Charles Parishes, Louisiana

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APRIL 2013
Revised June 2015 by USFWS
(removed eliminated alternatives)

FINAL WVA VARIABLE INPUTS

JL1B3 - Fresh Marsh Mitigation - Yankee Pond Proper (Previously M4B)

Project Acreage 84.6

Future *Without* Project (FWOP)

JL1B3 Yankee Pond Proper	Target Year[1]	V1 - % Emergent Veg.[2]	V2 - % SAV[3]	V3 - Interspersion[4] Class 1	Class 2	Class 3	Class 4	Class 5	V4 - % Water <= 1.5'[5]	V5 - Salinity[6]	V6 - Access[7]	Land Acreage[8]	Water Acreage[8]
BENEFITS	0	9.3%	10%			10%		90%	10%	0.36	1.0000	8.9	86.5
from Fresh Marsh	1	9.0%	10%			10%		90%	10%	0.36	1.0000	8.6	86.8
Restoration	45	0.0%	3%					100%	15%	0.36	1.0000	0.0	95.4
(84.6 acres)	50	0.0%	3%					100%	10%	0.36	1.0000	0.0	95.4

Future *With* Project (FWP)

JL1B3 Yankee Pond Proper	Target Year[1]	V1 - % Emergent Veg.[2]	V2 - % SAV[3]	V3 - Interspersion[4] Class 1	Class 2	Class 3	Class 4	Class 5	V4 - % Water <= 1.5'[5]	V5 - Salinity[6]	V6 - Access[7]	Land Acreage[8]	Water Acreage[8]
	0	9.3%	10%			10%		90%	10%	0.36	1.0000	8.9	86.5
BENEFITS	1	18.1%	0%					100%	100%	0.36	0.0001	17.3	2.8
from Fresh Marsh	3	53.2%	0%			100%			100%	0.36	0.0001	50.7	2.8
Restoration	5	96.9%	10%	50%		50%			100%	0.36	1.0000	92.5	2.9
(84.6 acres)	6	96.9%	25%	100%					100%	0.36	1.0000	92.4	3.0
	25	96.1%	25%	100%					100%	0.36	1.0000	91.7	3.7
	50	94.8%	5%	100%					100%	0.36	1.0000	90.5	4.9

Benefits from Marsh Creation	Impacts from Open Water and SAV Losses	NET BENEFITS
82.12	**-24.71**	**47.66**
AAHUs	**AAHUs**	**AAHUs**

JL1A1 - Fresh Marsh Mitigation - Yankee Pond Canal (Previously M4A)

Project Acreage 20.0

Future *Without* Project (FWOP)

JL1A1 Yankee Pond Canal	Target Year[1]	V1 - % Emergent Veg.[2]	V2 - % SAV[3]	V3 - Interspersion[4] Class 1	Class 2	Class 3	Class 4	Class 5	V4 - % Water <= 1.5'[5]	V5 - Salinity[6]	V6 - Access[7]	Land Acreage[8]	Water Acreage[8]
BENEFITS	0	0.0%	20%					100%	20%	0.36	1.0000	0.0	20.0
from Fresh Marsh	1	0.0%	20%					100%	20%	0.36	1.0000	0.0	20.0
Restoration	45	0.0%	6%					100%	13%	0.36	1.0000	0.0	20.0
(20.0 acres)	50	0.0%	6%					100%	9%	0.36	1.0000	0.0	20.0

Future *With* Project (FWP)

JL1A1 Yankee Pond Canal	Target Year[1]	V1 - % Emergent Veg.[2]	V2 - % SAV[3]	V3 - Interspersion[4] Class 1	Class 2	Class 3	Class 4	Class 5	V4 - % Water <= 1.5'[5]	V5 - Salinity[6]	V6 - Access[7]	Land Acreage[8]	Water Acreage[8]
	0	0.0%	20%			10%		90%	20%	0.36	1.0000	0.0	20.0
BENEFITS	1	9.9%	0%					100%	100%	0.36	0.0001	2.0	0.2
from Fresh Marsh	3	49.4%	0%			100%			100%	0.36	0.0001	9.9	0.2
Restoration	5	98.8%	20%	50%		50%			100%	0.36	1.0000	19.8	0.2
(20.0 acres)	6	98.8%	35%	100%					100%	0.36	1.0000	19.8	0.2
	25	97.9%	35%	100%					100%	0.36	1.0000	19.6	0.4
	50	96.7%	10%	100%					100%	0.36	1.0000	19.3	0.7

Benefits from Marsh Creation	Impacts from Open Water and SAV Losses	NET BENEFITS
17.94	**-6.58**	**10.03**
AAHUs	**AAHUs**	**AAHUs**

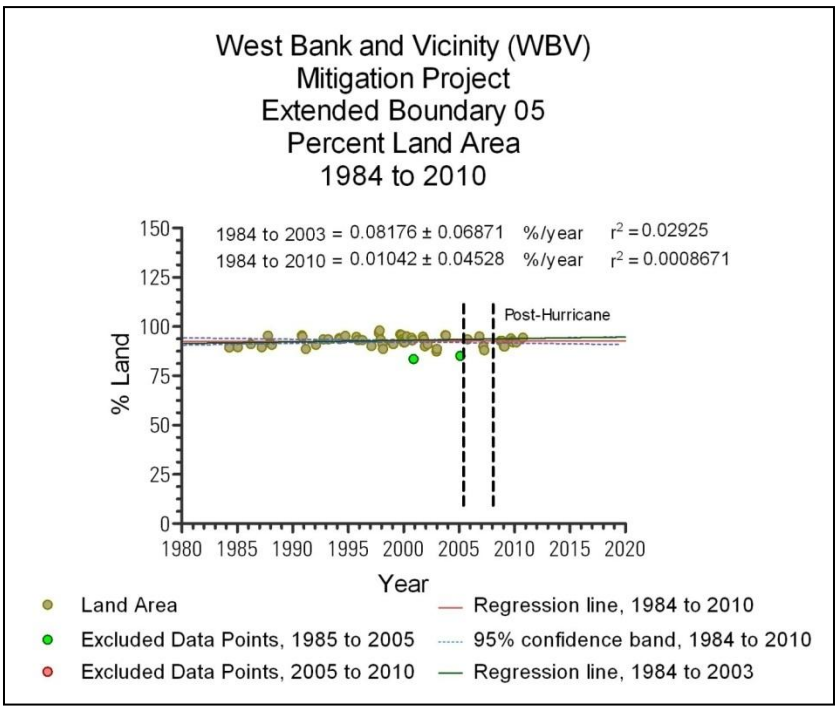
SUMMARY OF WVA MODEL ASSUMPTIONS

(Based on the Analysis/Research Below and Previously Developed Documents by the Corps and the Service)

- All currently proposed mitigation sites are open water areas that are proposed to be filled to create terrestrial wetland habitats.
- Excavation sites to acquire earthen material for mitigation purposes have not been identified.
- Where applicable, in order to maximize efficiency and consistency, variable values were taken from the previous WVAs that were developed by GSRC and BEM.
- Target years for both FWP and FWOP were taken from the previous WVAs that were developed by GSRC and BEM.

V1 – Percent of Wetland Area Covered by Emergent Vegetation

Based on multi-year aerial photography analysis by USGS, there is no documented land loss in this area.



FUTURE *WITHOUT* PROJECT (FWOP) VALUES / ASSUMPTIONS:

All of the proposed mitigation sites are currently open water (i.e., Yankee Pond, Lake Salvador, and various borrow pits). Therefore, there is no emergent marsh currently present on the proposed sites, nor would we anticipate there being emergent marsh during the 50-year project life under a "future-without-project" scenario.

FUTURE *WITH* PROJECT (FWP) VALUES / ASSUMPTIONS:

(in Areas with No Significant Land Loss over Time)

For Marsh (FWP):

(Taken from **LPV &WBV HSDRRS Mitigation: Wetland Value Assessment (WVA) Model Assumptions and Related Guidance** document, Page 16, Section 3.4 Entitled "ADDITIONAL GUIDANCE FOR MARSH RESTORATION FEATURES PROPOSED IN AREAS WHERE THERE IS NO SIGNIFICANT LAND LOSS OVER TIME")

- 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.

V2 – Percent of Open Water Covered by Submerged Aquatic Vegetation

The marsh WVA models fully account for both beneficial affects to, and habitat losses from the elimination of, submerged aquatic vegetation. Those models are designed to evaluate the percent coverage of SAV in relation to the acreage of open water habitat that supports it. In doing so, it provides two separate habitat suitability indices (HSIs) with two corresponding average annual habitat units (AAHUs); one value for land/marsh and a separate value for open water.

Because of this separation of values that includes a specific open water assessment, modifications to the WVA or additional SAV-specific WVA assessments would not be necessary to capture negative affects to SAVs. For open water areas that would be filled to create marsh platforms, the previously developed assumptions (shown below) would suffice.

EXCEPTION: OPEN WATER EXCAVATION performed to acquire earthen fill used in marsh creation platforms creation had not initially been assessed for adverse impacts to SAV and open water habitat. There have been significant discussions by the HET regarding the appropriateness of assessing SAV impacts resulting from open water excavation. The value of SAV is well documented (see discussion below) which justifies the need to provide mitigation for this habitat. Also, studies show that dredging activity not only results in the direct removal or destruction of existing grass beds, but the change in bottom depth, bottom sediment characteristics, and water clarity that accompanies dredging activities can prevent the reestablishment of SAV. Increased water depth from dredging reduces light penetration to the bottom, and dredged areas often refill with finer sediments that are easily resuspended by currents or boat wakes causing chronic elevated turbidity and reduced light penetration (Deaton et al. 2010). Although SAV water depth tolerance is variable depending on species, available research suggests that most species of SAV are generally not tolerant of water depths that exceed 8 feet (Deaton et al. 2010, Merino et al. 2009; Street et al. 2005). Dredging open water to a depth that exceeds 8 feet would presumably eliminate virtually all SAV in the project area for the full extent of a 50-year project life.

Deaton, A.S., W.S. Chappell, K. Hart, J. O'Neal, B. Boutin. 2010. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries, NC. 639 pp. (see pages 257 and 275)

Merino, J.H., J. Carter, and S.L. Merino. 2009. Mesohaline submerged aquatic vegetation survey along the U.S. Gulf of Mexico Coast, 2001 and 2002: A salinity gradient approach. Gulf of Mexico Science. pp. 9 – 20. (see page 10)

Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC. 656 pp.

FUTURE *WITHOUT* PROJECT (FWOP) VALUES / ASSUMPTIONS:

Baseline Values (TY0):

The SAV values for Yankee Pond and its vicinity (JL1B3 and JL1A1) as well as the east shoreline of Lake Salvador (JL15) were derived from actual field sampling on May 17, 2011 (see field notes below). SAV values for the other sites were estimated based on apparent vegetation signatures on aerial photography (see analysis below). Using aerial photography signatures to identify submerged aquatic vegetation is a technique currently used by some researchers, typically in conjunction with some level of field sampling validation (Ferraro et al. 2005).

Ferraro, C., D. Yeager, and T.D. Thibaut. 2005. Mapping of submerged aquatic vegetation in the coastal waters of Alabama. Proceedings of the 14th Biennial Coastal Zone Conference; New Orleans, Louisiana; July 17 to 21, 2005. 4pp. (see page 1)

Projected Values (TY1 – TY50):

Projections of future SAV coverage were taken from **LPV &WBV HSDRRS Mitigation: Wetland Value Assessment (WVA) Model Assumptions and Related Guidance** document, Page 13, Section 3.1 Entitled "FRESH MARSH MODEL – GENERAL ASSUMPTIONS – V2-Percent of Open Water Area Covered By Submerged Aquatic Vegetation").

TY	Year	Assumption
0	2013	Baseline conditions (existing conditions).
1	2014	Baseline conditions (existing conditions).
45	2016	30% of baseline cover by SAV.
50	2063	30% of baseline cover by SAV.

Reductions of SAV coverage in TYs 45 and 50 are predicted due salinity increases associated with sea level rise acceleration as well as increases in water depth and turbidity as open water areas enlarge and are subject to more severe wave action.

For Marsh Creation Sites:

Baseline Values (TY0):

Same as FWOP baseline values (see discussion above).

Projected Values (TY1 – TY50):

Projections of future SAV coverage were taken from **LPV &WBV HSDRRS Mitigation: Wetland Value Assessment (WVA) Model Assumptions and Related Guidance** document, Page 13, Section 3.1 Entitled "FRESH MARSH MODEL – GENERAL ASSUMPTIONS – V2-Percent of Open Water Area Covered By Submerged Aquatic Vegetation")

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.

Future With Project (FWP) - - - SAV Values

Mitigation Site	Target Year	Actual Year	Historic SLR	Baseline Water Depth	Intermediate SLR	Intermediate SLR Water Depth	SAV Abundance (Percent Coverage)
JL1A1 - Yankee Pond Canal	0	2013	0.04	4.34	0.05	4.35	**20%**
	1	2014	0.06	4.36	0.07	4.37	**0%**
Recorded TY -2 Water Depth	3	2016	0.11	4.41	0.13	4.43	**0%**
(Taken in 2011)	5	2018	0.15	4.45	0.18	4.48	**20%**
4.30	6	2019	0.17	4.47	0.20	4.50	**35%**
-	25	2038	0.58	4.88	0.73	5.03	**35%**
-	50	2063	1.11	5.41	1.53	5.83	**10%**
JL1B3 - Yankee Pond Proper	0	2013	0.04	2.24	0.05	2.25	**10%**
	1	2014	0.06	2.26	0.07	2.27	**0%**
Recorded TY -2 Water Depth	3	2016	0.11	2.31	0.13	2.33	**0%**
(Taken in 2011)	5	2018	0.15	2.35	0.18	2.38	**10%**
2.20	6	2019	0.17	2.37	0.20	2.40	**25%**
-	25	2038	0.58	2.78	0.73	2.93	**25%**
-	50	2063	1.11	3.31	1.53	3.73	**5%**

For Excavation Sites:

Available research suggests that most species of SAV are generally not tolerant of water depths that exceed 8 feet. Dredging to depths less than 8 feet would have incrementally less impact on SAV. We assumed that excavation to depths of less than or equal to 4 feet below the water surface would not appreciably reduce the long-term SAV coverage below baseline estimates. We also assumed that excavation to depths greater than or equal to 8 feet below the water surface would completely eliminate baseline SAV and would prevent its reestablishment for the full extent of a 50-year project life.

Excavation to Depths of ≤ 4 Feet Below the Water Surface:

Baseline Values (TY0):
Same as FWOP baseline values.

Projected Values (TY1 – TY3):
SAV = 0% for these TYs.
We assume that all SAV will be removed or otherwise destroyed during excavation and will not have sufficient time to recover.

Projected Values (TY5 – TY6):
SAV = initial/baseline values for these TYs

We assume that SAV will have had sufficient time to become reestablished.

Projected Values (TY50):
SAV = 30% of baseline SAV coverage
We assume that SAV coverage will resemble FWOP project conditions for this TY (see FWOP assumption table above).

Excavation to Depths of ≥ 8 Feet Below the Water Surface:

Baseline Values (TY0):
Same as FWOP baseline values.

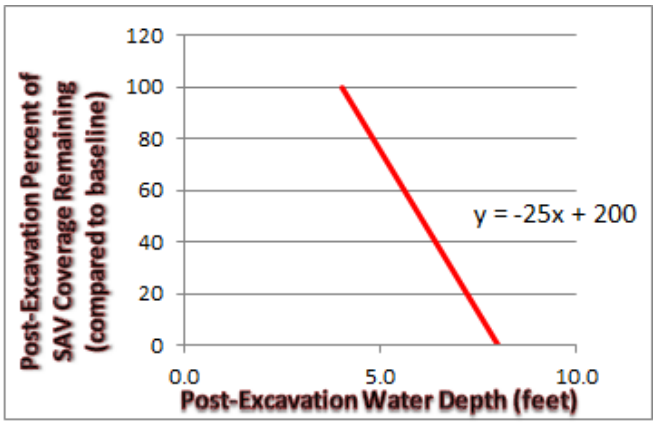
Projected Values (TY1 – TY50):
SAV = 0% for these TYs.
We assume that all SAV will be removed or otherwise destroyed during excavation and will not recover during the project life.

Excavation to Depths of Between 4 to 8 Feet (exclusive) Below the Water Surface:

Baseline Values (TY0):
Same as FWOP baseline values.

Projected Values (TY1 – TY3):
SAV = 0% for these TYs.
We assume that all SAV will be removed or otherwise destroyed during excavation and will not have sufficient time to recover.

Projected Values (TY5 – TY6):
We graphed/formulated a trend line between a 4-foot-depth value of 100% of the baseline-SAV and an 8-foot-depth value of 0% of the baseline SAV. This would assume that there is a linear relationship between the increase in water depth and the decrease in baseline SAV coverage (i.e., there is an even increment of SAV lost for each corresponding incremental increase in water depth). The regression analysis formula will be used to calculate the SAV value for these TYs:



% of Baseline SAV Coverage Remaining = (-25 X Post Excavation Water Depth [ft]) + 200

Then,

Excavation Adjusted SAV Coverage = (Baseline SAV %) X (% of Baseline SAV Coverage Remaining)

Projected Values (TY50):
SAV = 30% of TY6 SAV coverage
This is similar to the FWOP TY50 assumption. However, because of the anticipated reduction in SAV abundance due to excavation, we projected our values based on the adjusted TY6 values instead of the original TY0 values. The FWP assumptions for marsh creation were not used to derive these projected values because those values assumed an SAV increase at TY6 and TY25, instead of a decrease such as expected to result from excavation-related activities.

Currently, there are no defined excavation sites, therefore it was not possible to calculated associated SAV values.

V3 – Marsh Edge and Interspersion

Marsh edge and interspersion values were derived from ocular estimates of recent aerial photography, and were taken from estimates developed by GSRC and BEM where available.

V4 – Percent of Open Water Area < 1½ Feet Deep

There were very few areas less than 1½ feet deep that were measured during our May 17, 2011, field data collection trips to Yankee Pond and its vicinity (JL1B3 and JL1A1), and the east shoreline of Lake Salvador (JL15) (see field notes above). WVA values used for these sites were taken from estimates developed by GSRC and BEM, and the values for the remaining areas were based on the GSRC and BEM assumptions for these sites.

V5 – Mean Salinity During the Growing Season

Salinity values were derived from a combination of CRMS station data and, for certain sites, measurements taken during our May 17, 2011, field data collection trips. Sources used for each salinity estimate are shown as footnotes under the following, respective WVA input tables (shown below).

V6 – Aquatic Organism Access

(Taken from page 25, in Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), Wetland Value Assessment Methodology, Coastal Marsh Community Model. Prepared by: CWPPRA Environmental Work Group. January 2012: Version 1.1. [POC: Kevin J. Roy, USFWS, Lafayette, LA 70506].)

Marsh creation projects consist of an elevated marsh platform and typically utilize containment dikes to contain dredged material, thus impacting fisheries access. Marsh creation projects are typically designed to settle to an intertidal elevation by TY3 or TY5 and containment dikes are breached upon project completion or by TY3. Therefore, marsh creation projects are typically assigned an access value of 0.0001 (i.e., no access) at TY1 as the elevation of the marsh platform and/or presence of containment dikes do not allow fisheries access. The access value would increase to 1.0 when (typically TY3) it is estimated that the platform will settle (i.e., based on project design settlement curves, if available) to an intertidal elevation and the containment dikes are breached.

APPENDIX

CONSIDERATIONS, ASSUMPTIONS, OBSERVATIONS, AND DATA
RELATED TO THE EVALUATION OF SUBMERGED AQUATIC VEGETATION (SAV)
USING THE WETLAND VALUE ASSESSMENT (WVA)

I. Documented Value of Submerged Aquatic Vegetation

(Taken from pages 65 – 66, in Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), Wetland Value Assessment Methodology, Coastal Marsh Community Model. Prepared by: CWPPRA Environmental Work Group. January 2012: Version 1.1. [POC: Kevin J. Roy, USFWS, Lafayette, LA 70506].)

Submerged aquatic vegetation can serve as additional habitat for nekton to forage or provide cover from predation. In Louisiana, several studies point to the important role SAV plays in coastal marsh habitats for nekton species (Castellanos and Rozas 2001; Duffy and Baltz 1998; Kanouse 2003; Kanouse et al., 2006; Rozas et al., 2005; Rozas and Minello 2006), and elsewhere large densities of nekton have been associated with SAV beds in salt marshes (Glancy et al., 2003; Irlandi and Crawford 1997; Minello et al., 2003; Raposa and Oviatt 2000; Thomas et al., 1990). In a *Spartina alterniflora* marsh in North Carolina, Irlandi and Crawford (1997) found that twice as many pinfish were taken from the marsh edge when there was an adjacent seagrass bed. A similar trend was reported by Raposa and Oviatt (2000) who found higher abundances of *Gobiosoma ginsburgi*, *Apeltes quadracus*, and *Opsanus tau* in eelgrass beds that were adjacent to salt marshes. The nursery values of these habitats; however, is dependent upon the geographic

location, tidal range, salinity, and the landscape features (Minello et al., 2003). Further, in a literature review of the relative role of seagrass meadows as nurseries, Heck et al., (2003) found significantly greater survival of nekton in seagrasses than in unvegetated substrates; however, no significant difference was detected between seagrasses and other structures (e.g., oyster reefs, emergent vegetation).

In a brackish marsh, Kanouse (2003) observed higher densities of nekton in SAV habitats with the greatest densities and biomass coinciding with a peak in SAV biomass. Similarly, Kanouse et al. (2006) found significantly higher uses of *Ruppia maritima* by nekton versus non-vegetated brackish habitats in south central Louisiana. *Ruppia maritima* biomass and nekton biomass were also strongly positively correlated. An increase in SAV biomass was used as proxy for vegetative structural complexity which may provide increased refuge and food. In the Chesapeake Bay, an increase in grass shrimp, mummichogs, and banded killifish was also seen in SAV compared to non-vegetated habitat (Ruiz et al., 1993).

As in saline and brackish marsh systems, submerged aquatic vegetation is often used by some species as a refuge from predators or as a feeding ground when the marsh surface is inaccessible (McIvor and Odum 1988; Rozas and Minello 2006; Rozas and Odum 1987a; Rozas and Odum 1987b; Rozas and Odum 1988). Few studies exist on the relative roles of SAV as nekton habitat in the freshwater and intermediate marshes of Louisiana, but these studies indicate that the presence of SAV can extend the overall habitat available when found adjacent to emergent vegetation (Castellanos and Rozas 2001; Rozas et al., 2005; Rozas and Minello 2006). Rozas and Minello (2006) found up to 10 times more brown shrimp and 30 times more of white shrimp in *Vallisneria* than non-vegetated sites. Harris mud crab, Ohio shrimp, daggerblade grass shrimp, rainwater killifish, naked goby and gulf pipefish were also found in *Vallisneria* with densities at least as high as in emergent vegetation (Rozas and Minello 2006). These results are consistent with Castellanos and Rozas (2001) who found that densities of most species were similar in flooded marsh and SAV.

Castellanos, D.L. and Rozas, L.P., 2001. Nekton Use of Submerged Aquatic Vegetation, Marsh, and Shallow Unvegetated Bottom in the Atchafalaya River Delta, a Louisiana Tidal Freshwater Ecosystem. *Estuaries*, 24(2), 184-197. Chesney, E.J.; Baltz, D.M., and Thomas, R.G., 2000. Louisiana estuarine and coastal fisheries and habitats: perspectives from a fish's eye view. *Ecological Applications*, 10(2), 350-366.

Duffy, K.C. and Baltz, D.M., 1998. Comparison of fish assemblages associated with native and exotic submerged macrophytes in the Lake Pontchartrain estuary, USA. J. exptl. Marine Biol. Ecol. 223: 199–221.

Glancy, T.P.; Frazer, T.K.; Cichra, C.E., and Lindberg, W.J., 2003. Comparative patterns of occupancy by decapod crustaceans in seagrass, oyster, and marsh-edge habitats in a northeast Gulf of Mexico estuary. *Estuaries*, 26(5), 1291-1301.

Heck, K.L., Jr.; Hays, G., and Orth, R.J., 2003. Critical evaluation of the nursery role hypothesis for seagrass meadows. *Marine Ecology Progress Series*, 253, 123-136.

Irlandi, E.A. and Crawford, M.K., 1997. Habitat linkages: the effect of intertidal saltmarshes and adjacent subtidal habitats on abundance, movement, and growth of an estuarine fish. *Oecologia*, 110, 222-230.

Kanouse, S.C. 2003. Nekton use and growth in three brackish marsh pond microhabitats. MS Thesis. Louisiana State University, Baton Rouge, LA.

Kanouse, S.; La Peyre, M.K., and Nyman, J.A., 2006. Nekton use of *Ruppia maritima* and non-vegetated bottom habitat types within brackish marsh ponds. *Marine Ecology Progress Series*, 327, 61-69.

McIvor, C.C. and Odum, W.E., 1988. Food, Predation Risk, and Microhabitat Selection in a Marsh Fish Assemblage. *Ecology*, 69(5), 1341-1351.

Minello, T.J.; Able, K.W.; Weinstein, M.P., and Hays, C.G., 2003. Salt marshes as nurseries for nekton: testing hypotheses on density, growth and survival through meta-analysis. *Marine Ecology Progress Series*, 246, 39-59.

Rozas, L.P. and Minello, T.J., 2006. Nekton use of Vallisneria americana Michx. (Wild Celery) beds and adjacent habitats in Coastal Louisiana. *Estuaries and Coasts*, 29(2), 297-310.

Rozas, L.P.; Minello, T.J.; Munuera-Fernández, I.; Fry, B., and Wissel, B., 2005. Macrofaunal distributions and habitat change following winter-spring releases of freshwater into the Breton Sound estuary, Louisiana (USA). *Estuarine, Coastal and Shelf Science*, 65(1-2), 319-336.

Rozas, L.P. and Odum, W.E., 1987a. Use of Tidal Freshwater Marshes by Fishes and Macrofaunal Crustaceans along a Marsh Stream-Order Gradient. *Estuaries*, 10(1), 36-43.

Rozas, L.P. and Odum, W.E., 1987b. Fish and macrocrustacean use of submerged plant beds in tidal freshwater marsh creeks. *Estuaries*, 38, 101-108.

Rozas, L.P. and Odum, W.E., 1988. Occupation of Submerged Aquatic Vegetation by Fishes: Testing the Roles of Food and Refuge. *Oecologia*, 77(1), 101-106.

Ruiz, G.M.; Hines, A.H., and Posey, M.H., 1993. Shallow water as a refuge habitat for fish and crustaceans in non-vegetated estuaries: an example from Chesapeake Bay. *Marine Ecology Progress Series*, 99, 1-16.

II. Limitations in Accurately Estimating the Abundance of Submerged Aquatic Vegetation

(Taken from pages 18 – 19, in Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), Wetland Value Assessment Methodology, Coastal Marsh Community Model. Prepared by: CWPPRA Environmental Work Group. January 2012: Version 1.1. [POC: Kevin J. Roy, USFWS, Lafayette, LA 70506].)

The baseline (TY0) value for this variable often cannot be estimated in coastal Louisiana via visual estimates of cover because turbidity generally is great enough to obscure SAV even when SAV almost covers pond bottoms (e.g. Merino et al. 2005). SAV abundance varies so much that neither estimates of biomass (via cores) nor objective measures of percent cover (estimated from presence/absence on a garden rake touched at numerous points across a pond) are effective alone. Biomass estimates are preferred but estimating biomass is inefficient when SAV beds are small and few. At the other end of the spectrum, estimating the percent of pond bottom covered by SAV fails to provide meaningful information when SAV beds cover virtually the entire pond bottom but plant stature varies spatially. Furthermore, SAV is temporally dynamic in coastal Louisiana with great differences among years (Nyman and Chabreck 1996) and within years but lacks seasonal patterns within years (Merino et al. 2005). For these reasons, the WVA often utilizes best professional judgment along with whatever data is available to generate input data for SAV. Greater emphasis is placed on salinity and marsh type, as indicated by the observations of Chabreck (1971), with secondary emphasis placed on turbidity as indicated by the observations that terraces improve water clarity and increase SAV abundance (Bush Thom et al. 2004, O'Connel and Nyman in press).

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. The EnvWG recognized, however, that those effects were 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 SAV cover.

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.

Some low-salinity saline marshes may contain beds of widgeon-grass and open water areas behind some barrier islands may contain dense stands of seagrasses (e.g., *Halodule wrightii* and *Thalassia testudinum*). However, saline marshes typically do not contain an abundance of aquatic vegetation as often found in fresh/intermediate and brackish marshes. Open water areas in saline marshes typically contain sparse aquatic vegetation and are primarily important as nursery areas for marine organisms. Therefore, in order to reflect the importance of those open water areas to marine organisms, a saline marsh lacking aquatic vegetation is assigned a SI=0.3. It is assumed that optimal coverage of aquatic plants occurs at 100 percent.

<u>Future projections for V2 should consider changes in salinity, freshwater introduction, nutrient input, turbidity, water depth, fetch, and other factors which affect SAV growth.</u> Perhaps the two most important factors to consider under FWOP and FWP conditions are salinity and nutrient input as SAV growth is highly dependent on each of those factors. Few standard conventions have been adopted for projecting V2. <u>Future projections should be supported by monitoring data, scientific literature, examples of project success in other areas, previous WVAs, or personal knowledge of the project area.</u>

Bush Thom, C.S., M.K.G. La Peyre, and J.A. Nyman. 2004. Evaluation of nekton use and habitat characteristics of restored Louisiana marsh. Ecological Engineering 23:63-75.

Chabreck, R.H. 1971. Ponds and lakes of the Louisiana coastal marshes and their value to fish and wildlife. Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commissioners 25:206-215.

Merino, J.H., J.A. Nyman, and T. Michot. 2005. Effects of season and marsh management on submersed aquatic vegetation in coastal Louisiana brackish marsh ponds. Ecological Restoration 23:235-243.

Nyman, J.A., and R.H. Chabreck. 1996. Some effects of 30 years of weir management on coastal marsh aquatic vegetation and implications to waterfowl management. Gulf of Mexico Science 1:16-25.

O'Connell, and J.A. Nyman. in press. Marsh terraces in coastal Louisiana increase marsh edge and densities of waterbirds. Wetlands.

III. Sampling Period for Submerged Aquatic Vegetation

The Coastal Marsh Community WVA Model Manual states that ". . . SAV is temporally dynamic in coastal Louisiana with great differences among years (Nyman and Chabreck 1996) and within years but lacks seasonal patterns within years (Merino et al. 2005). Although seasonal patterns may be difficult to establish, certain studies conducted in northern Gulf of Mexico estuaries (Ferraro et al. 2005; Merino et al. 2009) suggest that the months of June and July constitute the preferred sampling period for determining the presence and maximum extent of submerged aquatic vegetation (SAV):

Ferraro, C., D. Yeager, and T.D. Thibaut. 2005. Mapping of submerged aquatic vegetation in the coastal waters of Alabama. Proceedings of the 14th Biennial Coastal Zone Conference; New Orleans, Louisiana; July 17 to 21, 2005. 4pp. (see page 1)

Merino, J.H., J.A. Nyman, and T. Michot. 2005. Effects of season and marsh management on submersed aquatic vegetation in coastal Louisiana brackish marsh ponds. Ecological Restoration 23:235-243.

Merino, J.H., J. Carter, and S.L. Merino. 2009. Mesohaline submerged aquatic vegetation survey along the U.S. Gulf of Mexico Coast, 2001 and 2002: A salinity gradient approach. Gulf of Mexico Science. pp. 9 – 20. (see page 10)

Nyman, J.A., and R.H. Chabreck. 1996. Some effects of 30 years of weir management on coastal marsh aquatic vegetation and implications to waterfowl management. Gulf of Mexico Science 1:16-25.

IV. Salinity and Water Depth in Relation to SAV Occurrence

Although various species of submerged aquatic vegetation may be found in salinity regimes ranging from 0 to 36 ppt (see tables below), according to the Coastal Marsh Community WVA Model Manual, ". . . saline marshes typically do not contain an abundance of aquatic vegetation as often found in fresh/intermediate and brackish marshes." According to the 2007 Chabreck and Linscomb Vegetative Type Map, all of the currently proposed HSDRRS-WBV mitigation sites occur within the fresh marsh boundary, suggesting that they would support a broader coverage and more diverse species assemblage of submerged aquatic vegetation relative to more saline systems.

Although SAV water depth tolerance is variable depending on species, based on the two studies below, most species of SAV are generally not tolerant of water depths that exceed 8 feet. Placing earthen fill to create a terrestrial habitat, or dredging open water to a depth that exceeds 8 feet, would presumably eliminate virtually all SAV in the project area for the full extent of a 50-year project life.

Table 4.1. Average environmental conditions at locations where submerged aquatic vegetation occurred in coastal North Carolina, 1988-1991. [Source: Ferguson and Wood 1994]

	Environmental parameter					
	Salinity (ppt)		Secchi depth m (ft)		Water depth m (ft)	
SAV species	Range	Average	Range	Average	Range	Average
HIGH SALINITY SEAGRASS						
Eel Grass	10 - >36	26	0.3 - 2.0 (1.0 - 6.6)	1.0 (3.3)	0.4 - 1.7 (1.3 - 5.6)	1.2 (3.9)
Shoal Grass	8 - >36	25	0.4 - 2.0 (1.3 - 6.6)	1.0 (3.3)	0.1 - 2.1 (0.3 - 6.9)	0.8 (2.6)
Widgeon Grass	0-36	15	0.2 - 1.8 (0.7 - 5.9)	0.7 (2.3)	0.1 - 2.5 (0.3 - 8.2)	0.8 (2.6)
LOW SALINITY SEAGRASS						
Redhead Grass	0-20	1	0.4 - 1.4 (1.3 - 4.6)	0.9 (3.0)	0.4 - 2.4 (1.3 - 7.9)	0.9 (3.0)
Wild Celery	0-10	2	0.2 - 2.0 (0.7 - 6.6)	0.6 (2.0)	0.2 - 2.3 (0.7 - 7.6)	1.0 (3.3)
Eurasian Watermilfoil	0-10	2	0.2 - 1.4 (0.7 - 4.6)	0.6 (2.0)	0.5 - 2.4 (1.6 - 7.9)	1.1 (3.6)
Bushy Pondweed	0-10	1	0.2 - 2.0 (0.7 - 6.6)	0.7 (2.3)	0.5 - 1.7 (1.6 - 5.6)	1.0 (3.3)
Sago Pondweed	0-9	2	0.2 - 0.4 (0.7 - 1.3)	0.3 (1.0)	0.6 - 0.9 (2.0 - 3.0)	0.8 (2.6)

Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC. 656 pp.

TABLE 2. Mean and range of environmental variables by species along the U.S. Gulf of Mexico.

Species	Salinity (ppt) Mean (range)	Depth (cm) Mean (range)
Ruppia maritima	8.2 (0–26.7)	51.5 (10–120)
Hydrilla verticillata	4.6 (0–20.7)	85.0 (45–120)
Vallisneria americana	1.0 (0.2–4.7)	67.2 (35–100)
Najas guadalupensis	5.1 (0.9–13.6)	46.7 (15–80)
Potamogeton sp.	2.0 (0.2–5.4)	55.4 (10–100)
Heteranthera sp.	1.3 (0.2–2.3)	70.0 (60–80)
Myriophyllum spicatum	4.2 (0–20.7)	60.8 (20–120)
Ceratophyllum demersum	3.4 (0.2–7)	49.6 (10–90)
Eloecharis sp.	5.8 (0.2–23.8)	26.8 (5–80)
Sagitaria sp.	2.6 (0.5–11.6)	21.2 (5–70)
Halodule wrightii	16.2 (0.7–36)	68.7 (30–120)
Halophila engelmannii	17.6 (2.0–36)	84.6 (50–120)
Thalassia testudinum	13.3 (10.1–16.4)	115 (110–120)
Syringodium filiforme	12.4 (3.9–16.9)	80 (50–120)

Merino, J.H., J. Carter, and S.L. Merino. 2009. Mesohaline submerged aquatic vegetation survey along the U.S. Gulf of Mexico Coast, 2001 and 2002: A salinity gradient approach. Gulf of Mexico Science. pp. 9 – 20.

V. Observed Abundance of SAV in Proposed Mitigation Sites

WVA Marsh Data

Project: WBV Mitigation WVAs

Site: Jean Lafitte

Date: 5/17/2011

Point (GPS): P15

Wetland Type: open water (m2)

Notes/Existing Conditions: must 5 SP existing 4 ft x 20 ft

Water Depth:

	V1 % Marsh	V2 % SAV	V3- Interspersion	V4 Water < 1.5 ft deep	V5 Salinity	V6 Fish Access	Comments
P5	0	0	5	6'1"	0.2	1	
P6	0	yes Milfoil 50%	5	2'	0.3	1	
P7	0	yes 50%	5	1'5"	0.3	1	#674
P8	0	no 0%	5	10 in	0.3	1	#675
P9	0	0%	5	1'1"	0.3	1	
P20	0	100%	5	1'11"	0.3	1	677, 678

Notes (Target elevation recommendations, etc): deep channel for barge traffic By fill material / barge Rock directly on shoreline existing / prior fill washed away ↓ #651 3-4 ft tall 15-20 ft wide

Photographs: P15 667, 668, 669

Little to no SAV. very small amount of Eurasian milfoil observed

WVA Marsh Data

Project: WBV Mitigation WVAs

Site: Jean Lafitte

Date: ~~5/5/2011~~ 5/17/2011

Point (GPS): P1 – P5

Wetland Type: open water

Notes/Existing Conditions:

Water Depth: 10% total see comment

	V1 % Marsh	V2 % SAV	V3- Interspersion	V4 Water < 1.5 ft deep	V5 Salinity ppt	V6 Fish Access	Comments
P1	0	eurasian milfoil coontail yes	5	1 ft 10 in	0.3	1	
P2	0	Yes 90%	5	2'3"	0.3	1	
P3	0	NO 0%	5	2'1"	0.3	1	
P4	0	Yes coontail 20%	5	2'4"	0.3	1	
P5	0	0% no	5	2'6"	0.3	1	

Notes (Target elevation recommendations, etc): high water, SAV present likely to fill in during summer.

Photographs: 637, 638, 639 SAV: coontail & Eurasian milfoil

WVA Marsh Data

Project: WBV Mitigation WVAs

Site: Jean Lafitte

Date: ~~5/5/2011~~ 5/17/2011

Point (GPS): P6, P7, P8

Wetland Type: open water

Notes/Existing Conditions: Yankee Pond Canal

Water Depth: 20%

	V1 % Marsh	V2 % SAV	V3- Interspersion	V4 Water < 1.5 ft deep	V5 Salinity ppt	V6 Fish Access	Comments
P6	0	Yes *	5	2'7"	0.3	1	
P7	0	90% *	5	5'2"	0.3	1	
P8	0	0 *	5	5'2"	0.3	1	
							bulltongue

Notes (Target elevation recommendations, etc): * Lots of SAV in shallow zones, probably not in deeper parts of canal Appx 20% Canals →

Photographs: 640, 641, 642, 643

SAV: giant salvinia & water hyacinth present in think clumps along canal edges. Some Eurasian milfoil & coontail

VI. Effect of Sea-Level Rise on the Abundance of SAV in Proposed Mitigation Sites

Using a water level gage at Lafitte and the Intermediate NRC curve it was determined that the sea level would rise 0.8 feet over the 50-year project life. At that level, none of the sites would exceed 8 feet in depth, which appears to be a threshold for the establishment and proliferation of SAV (the threshold depth may actually be less, such as 4 to 6 feet, in more turbid waters). Also, it is uncertain exactly how the borrow sites listed below would be impacted by sea level rise because those sites are in higher-elevation forested areas. It is possible that sea level rise over the 50-year project life would not be sufficient to measurably impact those areas, but they were included in this table anyway because adding the predicted intermediate rise to current water levels did not cause them to reach the 8-foot water-depth threshold (see APPENDIX B, Section entitled "V2 – Percent of Open Water Covered by Submerged Aquatic Vegetation" for specific SAV values calculated for use in the WVA).

Sea-Level Rise Calculations Used in the Previous Table

Start year: 2011			Historic trend Low scenario	Estimated Subsidence	Estimated Subsidence in feet	Estimated Eustatic rise using NRC curve I	Total rise for Intermediate Scenario 1	Total rise for Intermediate Scenario 1
Assumed Historic Eustatic SLR rate: 1.7		Historic RSLR: 6.5 mm/yr		RSLR - Eustatic = 4.8 mm/yr		acceleration factor: 2.71E-05	Eustatic + Subsidence	Eustatic + Subsidence
	year	mm	feet	mm	feet	mm	mm	feet
	2011	0.0	0.00	0.0	0.00	0.0	0.0	0.00
	2012	6.5	0.02	4.8	0.02	2.8	7.6	0.02
	2013	13.0	0.04	9.6	0.03	5.6	15.2	0.05
	2014	19.5	0.06	14.4	0.05	8.4	22.8	0.07
	2015	26.0	0.09	19.2	0.06	11.4	30.6	0.10
	2016	32.5	0.11	24.0	0.08	14.3	38.3	0.13
	2017	39.0	0.13	28.8	0.09	17.4	46.2	0.15
	2018	45.5	0.15	33.6	0.11	20.4	54.0	0.18
	2019	52.0	0.17	38.4	0.13	23.6	62.0	0.20
	2020	58.5	0.19	43.2	0.14	26.8	70.0	0.23
	2021	65.0	0.21	48.0	0.16	30.0	78.0	0.26
	2022	71.5	0.23	52.8	0.17	33.3	86.1	0.28
	2023	78.0	0.26	57.6	0.19	36.7	94.3	0.31
	2024	84.5	0.28	62.4	0.20	40.1	102.5	0.34
	2025	91.0	0.30	67.2	0.22	43.5	110.7	0.36
	2026	97.5	0.32	72.0	0.24	47.0	119.0	0.39
	2027	104.0	0.34	76.8	0.25	50.6	127.4	0.42
	2028	110.5	0.36	81.6	0.27	54.2	135.8	0.45
	2029	117.0	0.38	86.4	0.28	57.9	144.3	0.47
	2030	123.5	0.41	91.2	0.30	61.6	152.8	0.50
	2031	130.0	0.43	96.0	0.31	65.4	161.4	0.53
	2032	136.5	0.45	100.8	0.33	69.3	170.1	0.56
	2033	143.0	0.47	105.6	0.35	73.2	178.8	0.59
	2034	149.5	0.49	110.4	0.36	77.1	187.5	0.62
	2035	156.0	0.51	115.2	0.38	81.1	196.3	0.64
	2036	162.5	0.53	120.0	0.39	85.2	205.2	0.67
	2037	169.0	0.55	124.8	0.41	89.3	214.1	0.70
	2038	175.5	0.58	129.6	0.43	93.5	223.1	0.73
	2039	182.0	0.60	134.4	0.44	97.7	232.1	0.76
	2040	188.5	0.62	139.2	0.46	102.0	241.2	0.79
	2041	195.0	0.64	144.0	0.47	106.3	250.3	0.82
	2042	201.5	0.66	148.8	0.49	110.7	259.5	0.85
	2043	208.0	0.68	153.6	0.50	115.1	268.7	0.88
	2044	214.5	0.70	158.4	0.52	119.6	278.0	0.91
	2045	221.0	0.73	163.2	0.54	124.1	287.3	0.94
	2046	227.5	0.75	168.0	0.55	128.7	296.7	0.97
	2047	234.0	0.77	172.8	0.57	133.4	306.2	1.00
	2048	240.5	0.79	177.6	0.58	138.1	315.7	1.04
	2049	247.0	0.81	182.4	0.60	142.9	325.3	1.07
	2050	253.5	0.83	187.2	0.61	147.7	334.9	1.10
	2051	260.0	0.85	192.0	0.63	152.6	344.6	1.13
	2052	266.5	0.87	196.8	0.65	157.5	354.3	1.16
	2053	273.0	0.90	201.6	0.66	162.5	364.1	1.19
	2054	279.5	0.92	206.4	0.68	167.5	373.9	1.23
	2055	286.0	0.94	211.2	0.69	172.6	383.8	1.26
	2056	292.5	0.96	216.0	0.71	177.7	393.7	1.29
	2057	299.0	0.98	220.8	0.72	182.9	403.7	1.32
	2058	305.5	1.00	225.6	0.74	188.2	413.8	1.36
	2059	312.0	1.02	230.4	0.76	193.5	423.9	1.39
	2060	318.5	1.04	235.2	0.77	198.8	434.0	1.42
	2061	325.0	1.07	240.0	0.79	204.2	444.2	1.46
	2062	331.5	1.09	244.8	0.80	209.7	454.5	1.49
	2063	338.0	1.11	249.6	0.82	215.2	464.8	1.53

Date: 24 April rvsd (11 March original) 2015

Prepared by: USFWS, Louisiana Field Office

File location: G:\FWS Program Files\Corps Projects\New Orleans District\HSDRRS New Orleans\WBV_Mitigation\2015_Revised_HSDRRS_projects\NPS Mitigation E of HWY 45\JL 15 NPS

JL15 NPS Mitigation (Geo-crib; Marsh)

Notes: (1) The mitigation WVA for this site was previously developed, reviewed and accepted by FWS; this WVA analyses updates values based on post-construction information (satellite photos, LiDAR, site visit, NPS fly-over photos.) (2) This WVA analysis did not include the original (i.e., total) area of the proposed mitigation plan because during the site visit areas of willow were noted and it was thought that it would be better to allow them to remain or encourage cypress on this spoil bank to help resist future erosion and avoid impacts to the marsh. Approximately 3 acres to be degraded in the existing plan will remain spoil bank. (3) To reflect observed field conditions the Service used LiDAR data (2013) for the project area and adjacent marsh site and water elevations to determine blh areas, i.e., those that are elevated too high to function as marsh without earthwork (determined to be 2.25 feet). See tables 1 and 2 and figures 1 and 2 for marsh elevations; remaining tables and figures for willow and shrub/scrub area. (4) Future without project assumed the entire area remained open water.

Benefits from JL15: 51.8 acres (1.8 acres of non-marsh elevation blh removed; total acreage 53.6) and 26.72 AAHUs

Mitigation Potential: 0.52 AAHUs/ acre

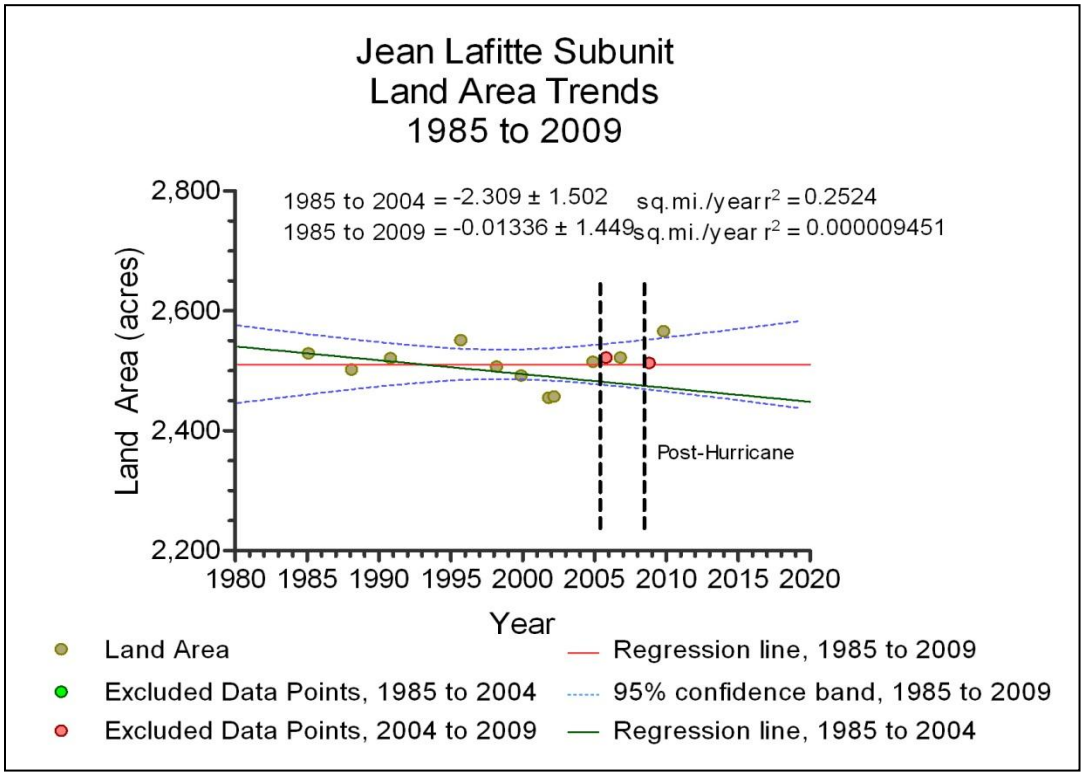
V1 - Emergent Vegetation

FWOP and TY 0 (Existing) for FWP – The project area was open water would continue to remain in that state.

FWP the area was mostly filled to a marsh height based on site visit, LiDAR, water levels and aerial photographs. While some areas of willow and shrub-scrub exist they do not constitute a significant portion of the area and with additional settling of the pumped material may convert to marsh. This opinion is based on the fact that the 2013 satellite photograph and LiDAR were taken1 year post-construction, thus settlement of disposed material was not complete; typically the majority of settlement occurs within the first three years. Increased water depths due to additional compaction and RSLR may result in the drowning within 3 to 5 years of shrub/scrub (s/s) and willow habitat at the lower elevations, those experiencing = o r > than 75 % inundation (total of about 2 acres). The willows and s/s that are at the 50% inundation frequency elevation are likely to persist for many years into the future such that some eradication may be necessary to achieve marsh mitigation benefits (additional 4.5 acres). Their persistence is dependent on future compaction and RSLR rates. The lowest areas may have some willow and s/s persist but

overall the area should be easily characterized as marsh. Those areas higher than 2.5 feet (< 1% inundation) in elevation are most likely to persist as a willow forest.

Land Loss Data



USGS land loss analysis of the Jean Lafitte area (see above figure) indicates that the area is relatively stable; thus no significant loss of marsh habitat is projected over the period of analysis. Relative SLR (intermediate rate) is expected to be approximately 1.5 feet by TY 50. However most marshes within the Park are flotant; conversion of this area to a similar marsh type could be expected to occur with the gradual rise in water levels, thus the acreage is estimated to be remain relatively unchanged. Loss rates (0.075 acres/year) proposed in the May 27, 2011 Revised Assumption document for Variable 1, 3, and 4 for areas where there is not significant marsh loss would have resulted in half the marsh acreage being lost by TY 11 and only 1.1 acres of marsh by TY 50. This did not appear to be reasonable considering the proximity to the Davis Pond Freshwater Diversion and historical loss rates. It was assumed that the marsh would remain stable and the flotant characteristics would allow openwater area but these would possibly be ephemeral and equivalent to the existing openwater acreage in adjacent wetlands, approximately 1 acre.

V2 – Submerged Aquatic Vegetation

The FWOP project area was primarily open water during a May 17, 2011, HSDRRS WVA field trip it was estimated that approximately 55% of the open water had SAV cover. It is assumed that this value will decrease over the 50 year project life as open water areas continue to deepen and wave energy increases. FWP the area would likely remain almost entirely marsh.

V3 – Interspersion

The marsh creation cell has approximately 4% existing marsh (33/804 acres). For the HSDRRS Mitigation alternatives analysis it is assumed that marsh creation would occur within the entire cell and, therefore, no marsh nourishment would be credited. Therefore, the site will be classified as Class 5 for FWOP.

FWOP
TY 0 - 50 100% Class 5

FWP
Classes were based on existing conditions, surrounding marsh conditions and percent loss rates for V1.

TY0 100% Class 5
TY1 100% Class 5
TY3 100% Class 3 ("carpet marsh")
TY8 100 % Class 1
TY50 100 % Class 1; based upon loss rates (TY50 = 93% marsh) and approximately equivalent to open water percentage in adjacent marshes.

V4 - Shallow Open Water Habitat

FWOP & FWP
Water depths were taken at the project site during a field investigation. All were deeper than 1.5 feet for FWOP. Post construction water depths at the site were less than 1.5 feet during recent site visit but only very minor areas of openwater existed; anticipated to remain because of possible flotant marsh forming in the area.

V5 – Salinity

Average salinity during the growing season information was calculated by GSRC during the previous WVA analysis; it is not expected that the salinity has changed nor would change with operation of the Davis Pond diversion.

FWOP & FWP
TY 0 – 50 0.73 ppt

V6 – Fish Access

FWOP
TY 0 - 50 1.0 open system; all of the study area is accessible and the access points are open and unobstructed.

FWP
TY0 1.0 open system

TY1	0.8	fish dips but not to standard spacing
TY8	1	fish dips added to approximate standard spacing
TY50	1.0	functioning fish dips present

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Emergent Marsh AAHUs =	0.12
B. Future Without Project Emergent Marsh AAHUs =	44.78
Net Change (FWP - FWOP) =	**-44.66**

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Open Water AAHUs =	11.59
B. Future Without Project Open Water AAHUs =	0.63
Net Change (FWP - FWOP) =	**10.96**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	-44.66
B. Open Water Habitat Net AAHUs =	10.96
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1 =	**-26.72**

	On JLNHPP CMRS0188			S of Lafitte & GIWW CRMS3985			N end of Bayou Perot CRMS 4245						Meters			COE Gague Lapalco Blvd & Bayou Se		
			Feet	Meters		Feet	Meters		Feet	Meters			Mean for all				feet	meters
NAVD 88		Average	1.07	0.327		1.17	0.356		1.19	0.363			0.348662			Average	1.0001	0.304831
Lidar and Gauge		Max	4.37	1.333		4.92	1.499		5.54	1.687			1.506517			Max	4.29	1.307592
		Min	-0.65	-0.198		-0.68	-0.206		-0.32	-0.096			-0.16671			Min	-0.61	-0.18593
Aug 06 - Aug 14		STD	0.54	0.166		0.54	0.165		0.48	0.145			0.158574			STD	0.51307	0.156384
LiDAR flown March 2013		"+ 1 STD	1.61	0.492		1.71	0.521		1.67	0.509			0.507235			"+ 1 STD	1.513171	0.461214
Gcrib built 2010-11		"- 1 STD	0.53	0.161		0.63	0.191		0.72	0.218			0.190088			"- 1 STD	0.48703	0.148447
		1st quartile (25%)	0.75	0.229		0.87	0.266		0.87	0.265			0.253534			1st quartile (2	0.63	0.192024
1.6 for 14 days @ 4 times		2nd (50%)	1.11	0.338		1.20	0.365		1.20	0.365			0.355769			2nd (50%)	0.97	0.295656
		3rd (75%)	1.42	0.434		1.51	0.461		1.49	0.454			0.449559			3rd (75%)	1.33	0.405384
		60 percentile	1.24	0.376		1.31	0.399		1.30	0.396			0.390533			60 percentile	1.11	0.338328
		65 percentile	1.30	0.396		1.37	0.419		1.36	0.415			0.409994			65 percentile	1.18	0.359664
		70 percentile	1.36	0.416		1.44	0.440		1.41	0.431			0.428934			70 percentile	1.26	0.384048
		80 percentile	1.49	0.455		1.58	0.483		1.56	0.475			0.470916			80 percentile	1.42	0.432816
		85 percentile	1.59	0.483		1.67	0.508		1.66	0.505			0.498646			85 percentile	1.52	0.463296
		90 percentile	1.69	0.514		1.80	0.547		1.76	0.538			0.533041			90 percentile	1.64	0.499872
		95 percentile	1.85	0.564		1.95	0.595		1.95	0.595			0.584992			95 percentile	1.84	0.560832
		99 percentile	2.25	0.687		2.42	0.736		2.31	0.705			0.709486			99 percentile	2.2909	0.698266
2		# of readings	2874.00			2139.00			2145.00							# of readings	2490	
		2006 to 2014														2006 to 2014		
		"+ 2 STD	2.16		"+ 2 STD	2.25		"+ 2 STD	2.15							"+ 2 STD	2.026241	
		"+ 3 STD	2.70		"+ 3 STD	2.79		"+ 3 STD	2.62							"+ 3 STD	2.539312	

Table 1. Water elevations and percent inundation for gauges in the project vicinity

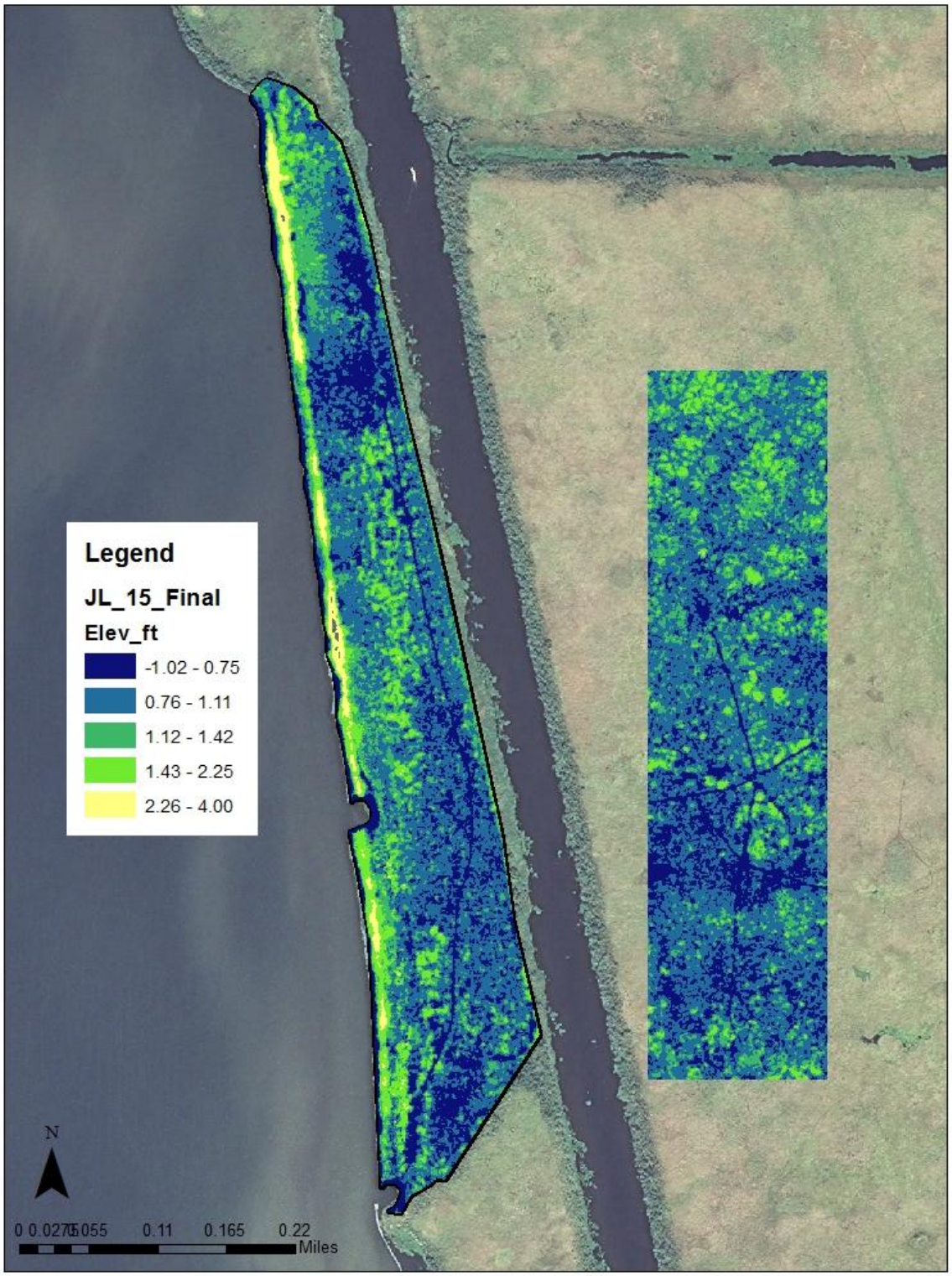


Figure 1: Elevations of Geocrib and adjacent marsh

Note: All maps have been enlarged so scale is no longer correct.

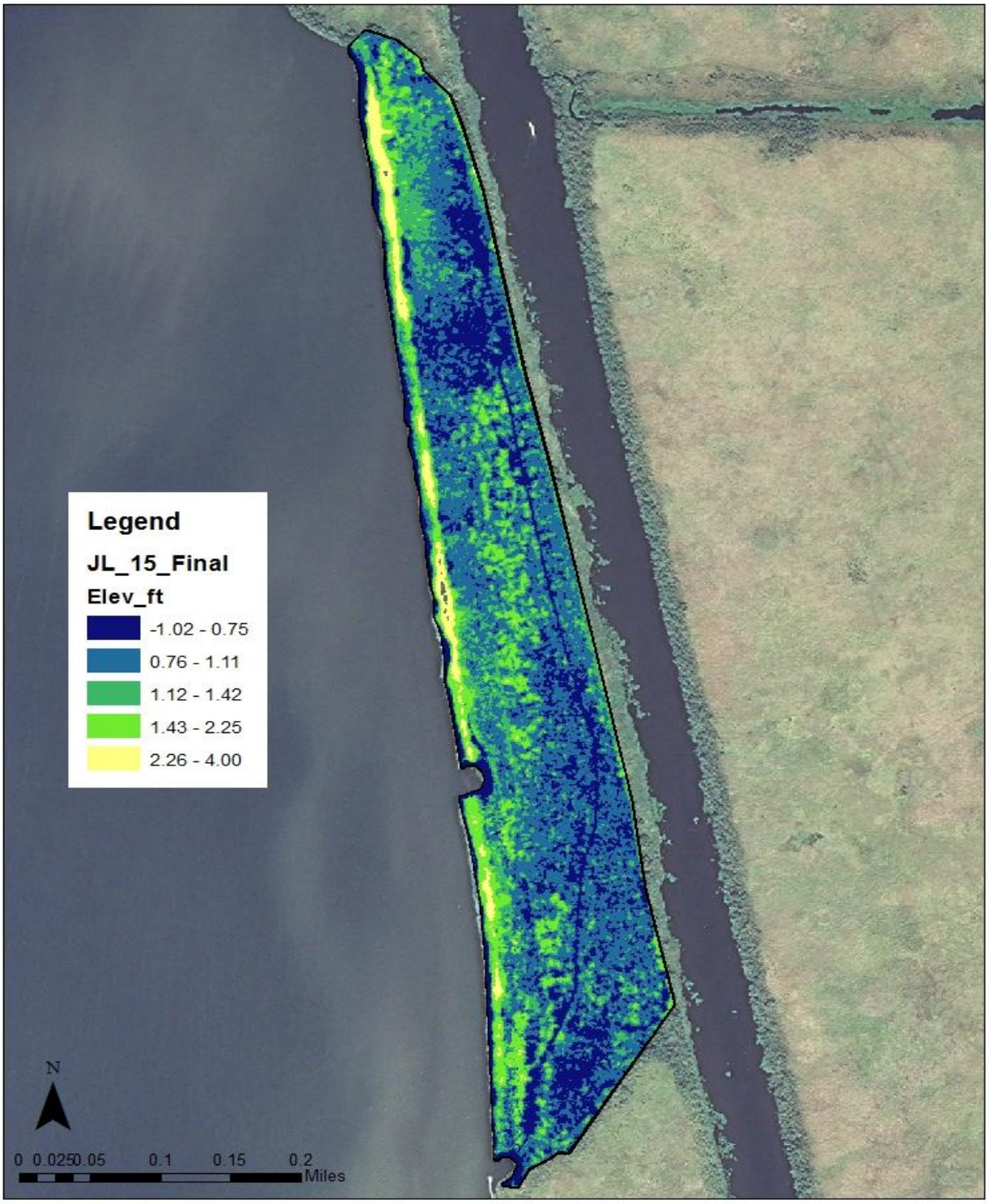


Figure 2. Elevations in geocrib

				JL15	53.6	acres		Adjacent Marsh		52	acres		
% inundation		elevation	Map colors	acres	precent of area	Cumulative acres	Map colors	acres	precent of area	Cumulative acres			
75		0.75		11.6	21.6	11.6		10.4	20	10.4			
50		1.11		23.8	44.4	35.4		28.8	55.4	39.2			
25		1.42		10.7	20.0	46.1		10.1	19.4	49.3			
1		2.25		5.8	10.8	51.9		2.7	5.2	52			
<1		>2.25		1.8	3.4	53.7		insignificant	insignificant				
			total	53.7	100.2			52	100.0				
				acres	precent of area			acres	precent of area				
Shrub-scrub				3.3	6.2			0.4	0.8				
				JL15	Elevation			Acres	Acres of higher elevation			% inundation	
mean elevation of adjacent marsh:					0.99			29.6	22.4			59	
mean elevation of adjacent marsh plus:				1 SD (0.25)	1.24			41.1	10.9			40	
mean elevation of adjacent marsh plus:				2 SD (0.5)	1.49			47.1	4.9			20	
mean elevation of adjacent marsh plus:				3 SD (0.75)	1.74			49.5	2.5			8	

Table 2. Inundation and elevation of geocrib and adjacent marsh

Figure 3. Areas equal to or less than mean marsh elevation

Figure 4. Areas that experience 1% or greater inundation

WILLOW AREA

			JL15	12.6	acres	
% inundation		elevation	Map colors	acres	precent of area	Cumulative acres
75		0.75		1.9	15.1	1.9
50		1.11		3.1	24.6	5
25		1.42		2.6	20.6	7.6
1	(1% chance)	2.25		3.2	25.4	10.8
<1		>2.25		1.8	14.3	12.6
			total	12.6	100.0	

			JL15	12.6	acres	
% inundation		elevation		acres	precent of area	Cumulative acres
58		< = 1		4	31.7	4
20		>1 & <=1.5		3.9	31.0	7.9
3		>1.5 & <=2		2.2	17.5	10.1
		>2 & <=2.5		1.2	9.5	11.3
		>2.5		1.2	9.5	12.5
			total	12.5	99.2	

Shrub-scrub Area

			JL15	3.3	acres	
% inundation		elevation	Map colors	acres	precent of area	Cumulative acres
75		0.75		0.1	0.8	0.1
50		1.11		1.4	11.1	1.5
25		1.42		1.4	11.1	2.9
1	(1% chance)	2.25		0.3	2.4	3.2
<1		>2.25		0.01	0.1	3.21
			total	3.21	25.5	

			JL15	3.3	acres	
% inundation		elevation		acres	precent of area	Cumulative acres
58		< = 1		0.9	7.1	0.9
20		>1 & <=1.5		2.1	16.7	3
3		>1.5 & <=2		0.2	1.6	3.2
		>2 & <=2.5		0.002	0.0	3.202
		>2.5		0.001	0.0	3.203
			total	3.203	25.4	

WILLOW & SS AREA

			JL15	15.9	acres	
% inundation		elevation	Map colors	acres	precent of area	Cumulative acres
75		0.75		2	12.6	2
50		1.11		4.5	28.3	6.5
25		1.42		4	25.2	10.5
1	(1% chance)	2.25		3.5	22.0	14
<1		>2.25		1.81	11.4	15.81
			total	15.81	99.4	

			JL15	15.9	acres	
% inundation		elevation		acres	precent of area	Cumulative acres
58		< = 1		4.9	30.8	4.9
20		>1 & <=1.5		6	37.7	10.9
3		>1.5 & <=2		2.4	15.1	13.3
		>2 & <=2.5		1.202	7.6	14.502
		>2.5		1.201	7.6	15.703
			total	15.703	98.8	

Table 3. Inundation, elevation, and acreage of willow and shrub/scrub area

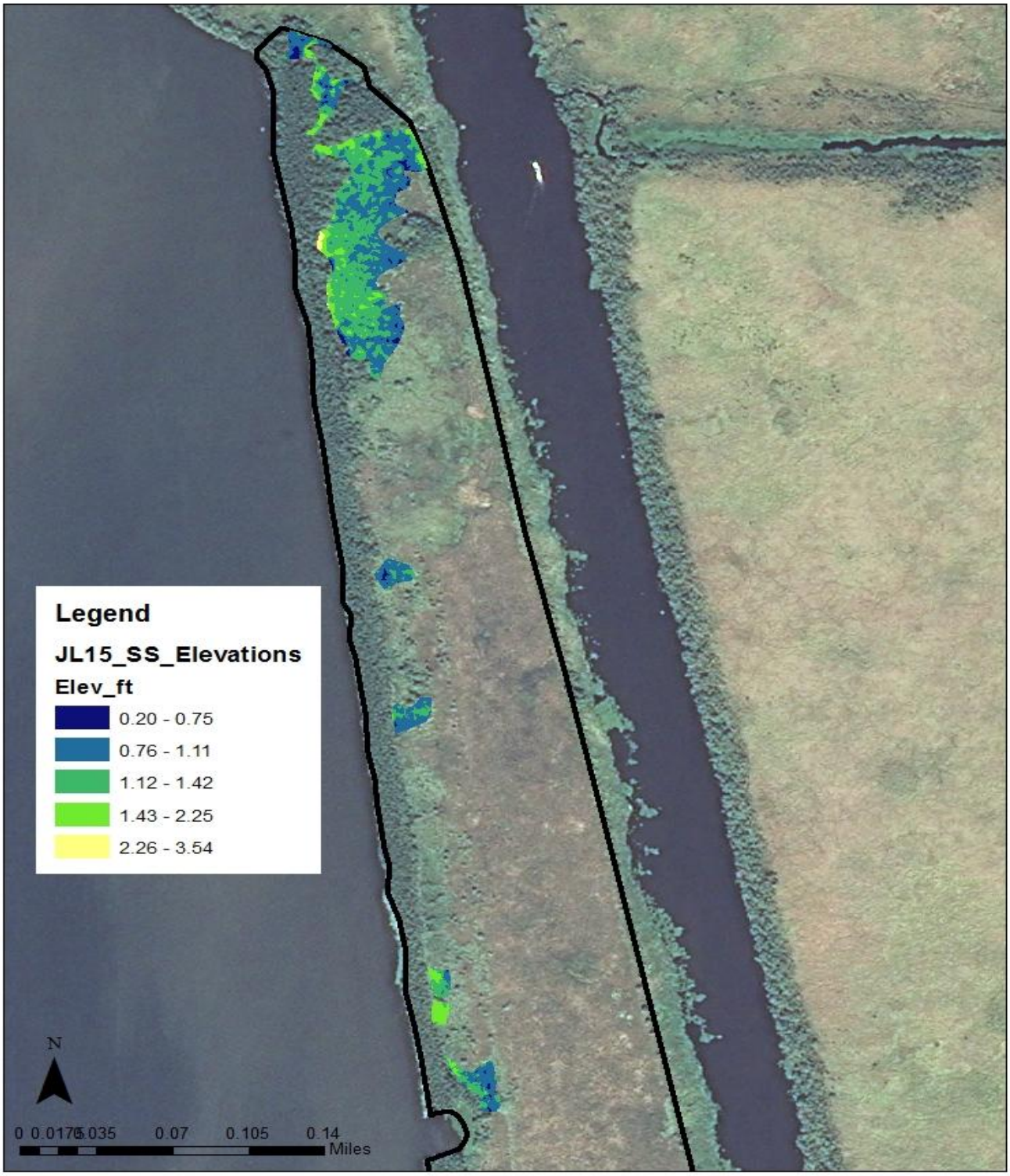


Figure 5. Areas and elevation of shrub - scrub

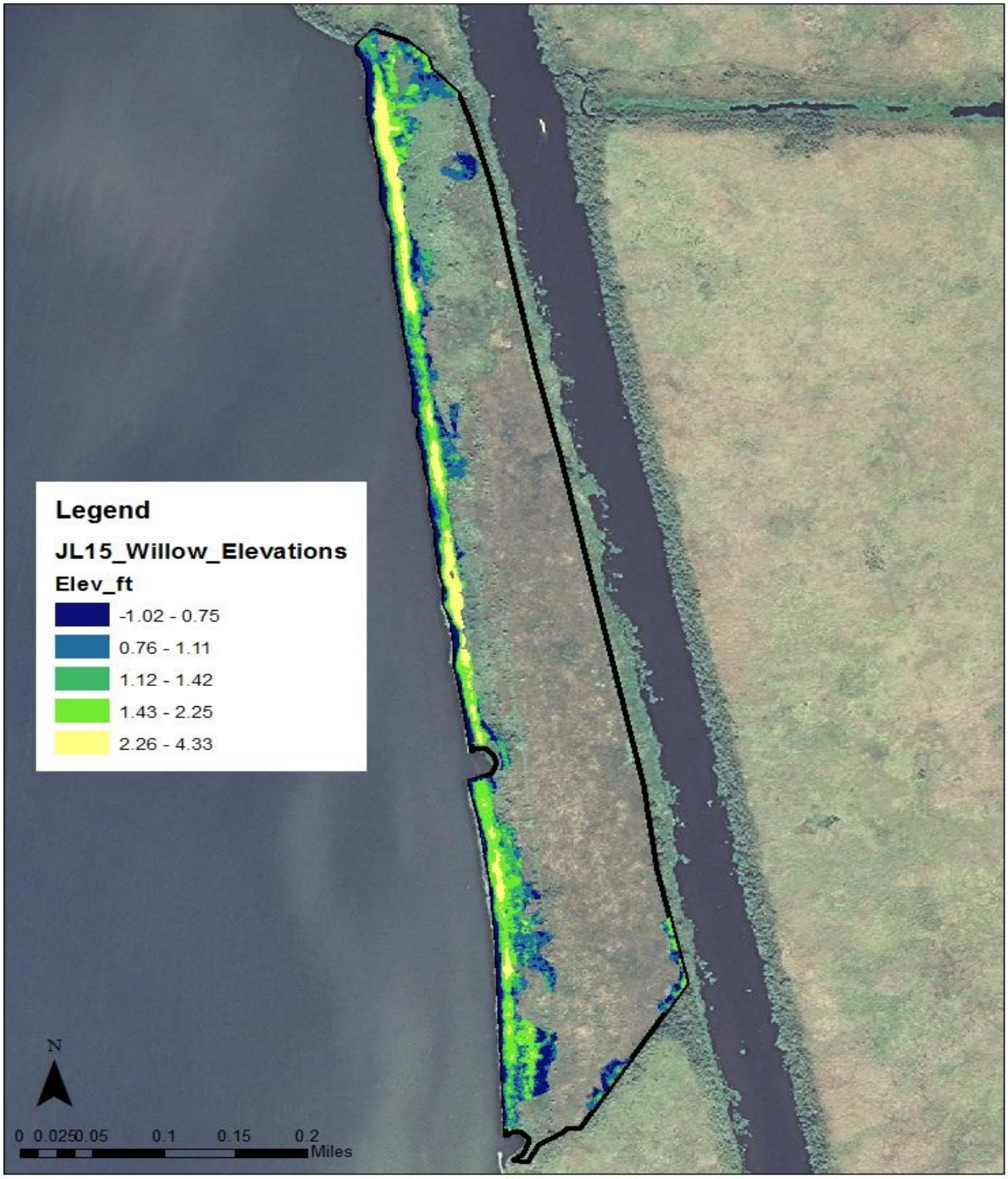


Figure 6. Areas and elevation of willow Figure

Date: 26 Feb. 2015

Prepared by: USFWS, Lafayette Field Office and USACE, New Orleans District

File location:

JL7 Millaudon Canal Swamp (NPS)

Notes: (1) This WVA used data from the Millaudon Canal area because no field data was obtained because the Millaudon site was entirely cypress and resembled this site that data was used. (2) To determine the benefit area (area of improved hydrology) information was taken from the modeling done for the BAC augmentation features.

Benefits from JL17: 63 acres and 6.11 AAHUs

Mitigation Potential: 6.11/63=0.1 AAHUs/ac

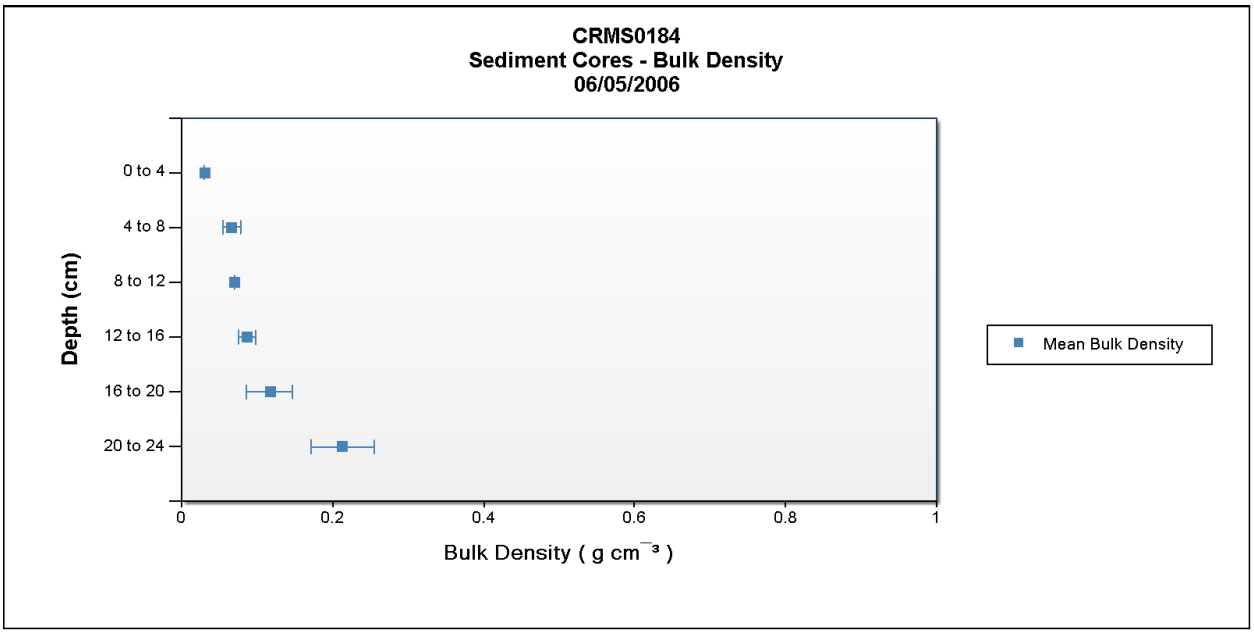
Determination of Benefit Area:

As part of the 404 augmentation study 2 hydrology improvement alternatives were modeled. The first had the canals being reconnected to the GIWW and while the second included gapping of the spoil banks and refilling the canal. The first scenario resulted in benefit acreage of 11 acres during incoming tides. Outgoing tides resulted in a greater benefitted area that is assumed to be 27.5 acres (increase in acreage divided evenly between JL 8 and 9). The second scenario resulted in 70 acres being benefitted during an ebb tide and an estimated 85 acres during flood tide (increase in acreage divided evenly between JL 8 and 9). It was decided to use the maximum acreage because this does represent the total area being benefitted. As a result of concerns about boat wake induced erosion the opening at the GIWW was sized to approximately 25 feet (bottom width); the modeled opening was approximately 100 feet (width of the canal) so the maximum benefit area was reduced proportionally (i.e., 25%) resulting in an estimated 21 acres being benefitted. The dimensions of the connection with the Millaudon Canal control the amount of tidal exchange, thus those dimensions are the major limiting factor of the benefit area. For this project the 3 gaps were anticipated to collectively influence 63 acres.

Future without project:

Site visit to the area did not reveal any typical characteristics of a swamp beginning to decline; such as reduced crown cover (as well as loss of limbs), decreasing basal area, and trees showing signs of decadence. Within the Barataria Basin some areas have begun to exhibit such signs of decline. Examination of soil bulk density (see following table) from a CRMS site (http://lacoast.gov/crms_viewer2/Default.aspx#) in the 404c area shows very low bulk densities; bulk densities in this range have been associated with swamps that have started declining and converting to fresh marsh. In contrast, the two lowest bulk densities in Atchafalaya River swamps, still connected to Mississippi River flows, were 0.38 and 0.59. The remaining 17 samples were all greater than 0.88 (Hupp et al. 2008). Isolation from riverine

flows by closure of Bayou des Families and levee construction have undoubtedly impacted this area and its future condition.



V1 – Stand Structure

FWOP: It is anticipated that over time the canopy will begin to thin but the understory and midstory may not significantly increase because of the already open canopy. A decrease in one class is expected.

FWP: Restored hydrology was assumed to maintain current stand structure.

V2 – Stand Maturity

FWOP: Average dbhs were used for TY1 and 0. Stagnant water conditions are expected to decrease growth rate. Decreased growth rates developed for the Lake Maurepas restoration were used (Wood 2010 personal communication); specifically the growth rate reflecting increased inundation and stress but survival till the period of analysis was used.

FWP: Average dbhs were used for TY1 and 0. Growth rates are expected to improve to match those of a swamp experiencing improved water flows and periodic dewatering, i.e., typical growth rates.

V3 – Water Regime

The water regime utilized GSRC appeared to represent existing conditions and improved hydrology with the gaps so they were used. SLR could increase flooding duration by FWP TY 50 thus increasing the flood duration class.

V4 – Salinity

Average salinity during the growing season was calculated by GSRC during the previous WVA analysis. No increase during FWP was anticipated due to the influence of planned and existing diversion projects; they should preclude any significant salinity increases in the area.

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	33.70
B. Future Without Project AAHUs =	27.59
Net Change (FWP - FWOP) =	**6.11**

Hupp, C. C. Demas, D. Kroes, R. Day, and T. Doyle. 2008. Recent sedimentation patterns within the central Atchafalaya Basin, Louisiana. Wetlands, Vol. 20 (1). Pp.125-140.

Bern Wood (Southeastern Louisiana University - SELU; working with Dr. Gary Shaffer) during a February 2010 verbal communication with the USFWS (Angela Trahan) - data was collected from Maurepas Swamp study sites.

Putnam, J., G. Furnival, and J. McKnight. 1960. Management and inventory of southern hardwoods. Forest Service, Agriculture Handbook No. 181. Pp. 102

Date: 27 March 2015

Prepared by: USFWS, Lafayette Field Office and USACE, New Orleans District

File location:

JL7 Horseshoe Bayou Swamp (NPS)

Notes: (1) To determine the benefit area (area of improved hydrology) information was taken from the modeling done for the BAC augmentation features.

Benefits from JL17: 43 acres and 2.31 AAHUs

Mitigation Potential: 2.31/43=0.5 AAHUs/ac

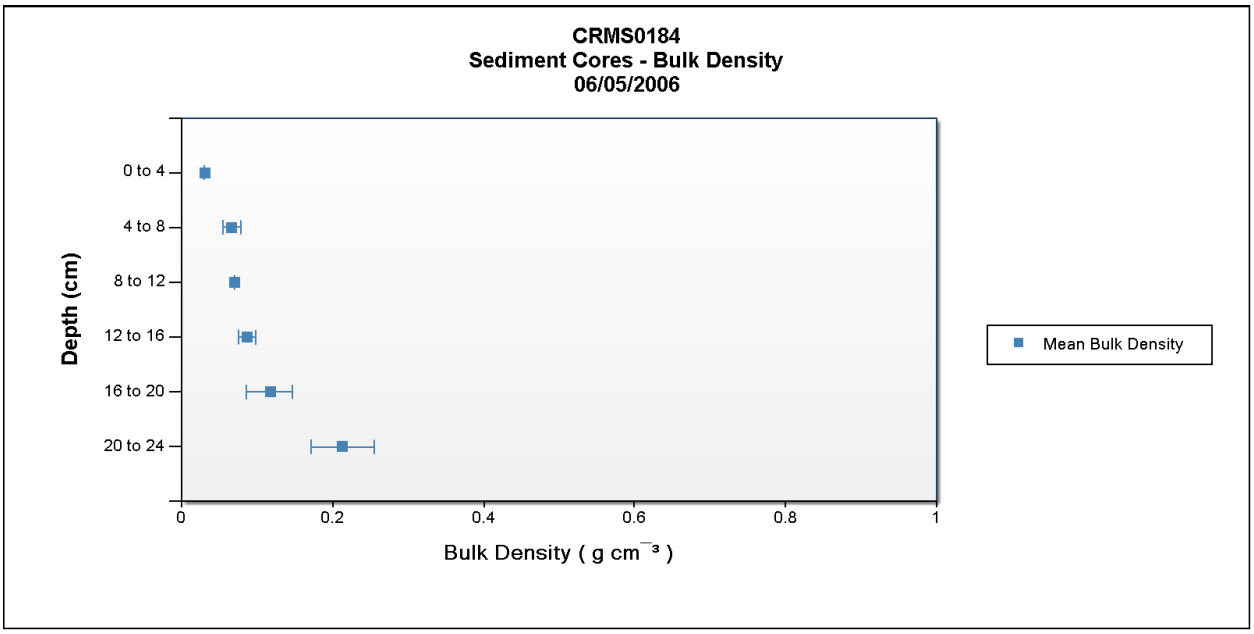
Determination of Benefit Area:

As part of the 404 augmentation study 2 hydrology improvement alternatives were modeled. The first had the canals being reconnected to the GIWW and while the second included gapping of the spoil banks and refilling the canal. The first scenario resulted in benefit acreage of 11 acres during incoming tides. Outgoing tides resulted in a greater benefitted area that is assumed to be 27.5 acres (increase in acreage divided evenly between JL 8 and 9). The second scenario resulted in 70 acres being benefitted during an ebb tide and an estimated 85 acres during flood tide (increase in acreage divided evenly between JL 8 and 9). It was decided to use the maximum acreage because this does represent the total area being benefitted. As a result of concerns about boat wake induced erosion the opening at the GIWW was sized to approximately 25 feet (bottom width); the modeled opening was approximately 100 feet (width of the canal) so the maximum benefit area was reduced proportionally (i.e., 25%) resulting in an estimated 21 acres being benefitted. The dimensions of the connection with the Horseshoe Bayou control the amount of tidal exchange, thus those dimensions are the major limiting factor of the benefit area as well as the fact that the northern portion of the area is influenced by gaps along the Millaudon Canal; thus the acreage was reduced based on approximate difference between these areas. For this project the 3 gaps were anticipated to collectively influence 43 acres.

Future without project:

Site visit to the area did not reveal any typical characteristics of a swamp beginning to decline; such as reduced crown cover (as well as loss of limbs), decreasing basal area, and trees showing signs of decadence. Within the Barataria Basin some areas have begun to exhibit such signs of decline. Examination of soil bulk density (see following table) from a CRMS site (http://lacoast.gov/crms_viewer2/Default.aspx#) in the 404c area shows very low bulk densities; bulk densities in this range have been associated with swamps that have started declining and converting to fresh marsh. In contrast, the two lowest bulk densities in Atchafalaya River swamps, still connected to Mississippi River flows, were 0.38 and 0.59. The remaining 17 samples were all greater than 0.88 (Hupp et al. 2008). Isolation from riverine

flows by closure of Bayou des Families and levee construction have undoubtedly impacted this area and its future condition.



V1 – Stand Structure

FWOP: It is anticipated that over time the canopy will begin to thin but the understory and midstory may not significantly increase because of the already open canopy. A decrease in one class is expected.

FWP: Restored hydrology was assumed to maintain current stand structure.

V2 – Stand Maturity

FWOP: Average dbhs were used for TY1 and 0. Stagnant water conditions are expected to decrease growth rate. Decreased growth rates developed for the Lake Maurepas restoration were used (Wood 2010 personal communication); specifically the growth rate reflecting increased inundation and stress but survival till the period of analysis was used.

FWP: Average dbhs were used for TY1 and 0. Growth rates are expected to improve to match those of a swamp experiencing improved water flows and periodic dewatering, i.e., typical growth rates.

V3 – Water Regime

The water regime utilized GSRC appeared to represent existing conditions and improved hydrology with the gaps so they were used. SLR could increase flooding duration by FWP TY 50 thus increasing the flood duration class.

V4 – Salinity

Average salinity during the growing season was calculated by GSRC during the previous WVA analysis. No increase during FWP was anticipated due to the influence of planned and existing diversion projects; they should preclude any significant salinity increases in the area.

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project AAHUs =	22.73
B. Future Without Project AAHUs =	20.43
Net Change (FWP - FWOP) =	**2.31**

Hupp, C. C. Demas, D. Kroes, R. Day, and T. Doyle. 2008. Recent sedimentation patterns within the central Atchafalaya Basin, Louisiana. Wetlands, Vol. 20 (1). Pp.125-140.

Bern Wood (Southeastern Louisiana University - SELU; working with Dr. Gary Shaffer) during a February 2010 verbal communication with the USFWS (Angela Trahan) - data was collected from Maurepas Swamp study sites.

Putnam, J., G. Furnival, and J. McKnight. 1960. Management and inventory of southern hardwoods. Forest Service, Agriculture Handbook No. 181. Pp. 102

Wetland Value Assessment (WVA) Project Information Sheet

August 2011

Prepared for:
United States Army Corps of Engineers
New Orleans District

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Project Name: West Bank and Vicinity (WBV) Hurricane Storm Damage and Risk Reduction System (HSDRRS) Mitigation-Jean Lafitte National Historic Park & Preserve (JLNHPP) Wet Bottomland Hardwood (BLH-Wet) Restoration

Project Type: There are two alternative designs for the JLNHPP BLH-Wet Restoration features: Alternative Design #1 and Alternative Design #2.

Project Area:

The proposed BLH-Wet restoration features (Table 1) for Alternative Design #1 are located within the right-of-way of the West Bank HSDRRS Levee, immediately adjacent to JLNHPP on the flood side of the levee in Jefferson Parish, Louisiana (Attachment A, Figure 1). The proposed features BLH-Wet Restoration for Alternative Design #2 (Table 1) are located in the southern and central portions of JLNHPP (Attachment A, Figure 1). Feature B1 (JL15) is located along Lake Salvador, B2 (JL16) is at the southern tip of JLNHPP that borders Bayou Villars and Bayou Barataria, B3 (JL17) is located in the central portion of JLNHPP between Barataria Boulevard and the Shell pipeline canal, and Feature JL18 is located along the Shell pipeline canal (Attachment A, Figure 1).

Table 1. JLNHPP BLH-Wet Restoration Features

Feature ID	Poly ID	Acres	Net Average Annual Habitat Units (AAHUs)	Mitigation Potential (AAHUs/acre)
Alternative Design #1				
B1	JL11	10.71	6.85	0.64
B2	JL12	16.83	10.56	0.63
B3	JL13	20.55	12.85	0.63
B4	JL14	16.75	10.73	0.64
TOTALS	-	**64.84**	**40.99**	-
Alternative Design #2				
B1	JL15	54.00	20.45**	0.60
B2	JL16	8.60	0.92	0.11
B3	JL17	5.40	3.45	0.64
N/A*	JL18	18.60	11.90	0.64
TOTALS	-	**86.60**	**36.72**	-

* JL 18 was added after the initial round of WVAs for Alternative Design #2.
** Net AAHUs for B1 (JL15)= FWP BLH-Wet AAHUs (32.29 AAHUs)– FWOP Impacted Existing Marsh (-11.83 AAHUs)

Objectives:

The proposed JLNHPP BLH-Wet Restoration features are needed to mitigate for HSDRRS impacts on areas within JLNHPP, and these impacts must be mitigated within JLHNPP. Presently, all four Alternative Design #1 features are borrow pits that would be filled and planted in order to restore 64.84 acres BLH-Wet habitat within JLNHPP. The Alternative Design #2 features would also be filled and planted in order to restore 86.6 acres of BLH-Wet habitat. Refer to the U.S. Army Corps of Engineers New Orleans District (CEMVN) Project Description document for more project details.

Wetland Value Assessment (WVA):

The Alternative Design #1 WVA will evaluate the restoration of 64.84 acres of BLH-Wet habitat, and Alternative Design #2 WVA will evaluate the restoration of 86.6 acres of BLH-Wet habitat. For the comparison of alternatives, the area within the Alternative Design #1 features analyzed by U.S. Geological Survey (USGS) is assumed to be 100 percent (%) open water, and BLH-Wet restoration would occur throughout the entirety of each Alternative Design #1 feature.

Presently, CEMVN and the interagency team determined that models will not be used for Future Without Project (FWOP) scenarios in situations where proposed BLH-wet restoration features are being built in existing open water habitats (i.e., 0 AAHUs for FWOP conditions at B1 [JL11], B2 [JL12], B3 [JL13], and B4 [JL14]). As mitigation site evaluations continue, the interagency team will determine if, and how, WVA models will be used to assess open water habitat values. Under Alternative Design #1, no FWOP conditions for B1 (JL11), B2 (JL12), B3 (JL13), and B4 (JL14) will be discussed further within this project information sheet.

Alternative Design #2 features B3 and JL18 are in existing open water, and no FWOP conditions at B3 (JL17) or JL18 will be discussed further within this project information sheet. Alternative Design #2 feature B2 (JL16) is a heavily disturbed area with few trees and shrubs, and FWOP conditions at B2 (JL16) were analyzed using the BLH-Wet model. Feature B1 (JL15) is already filled and has 100% herbaceous vegetation cover (cattail [*Typha* spp.] and Johnson grass [*Sorghum halepense*]). Therefore, FWOP conditions at B1 (JL15) were analyzed using the interior fresh marsh model.

Project assumptions and methods were developed by CEMVN in coordination with the interagency team and the contractor. Habitat boundaries were identified by incorporating the following resources:

- Field investigations (Attachment B)
- Geographic Information System (GIS) software
- 2007 USGS vegetation data
- 2007 U.S. Fish and Wildlife (USFWS) National Wetland Inventory (NWI) data
- Natural Resources Conservation Service (NRCS) soil data
- Coastwide Reference Monitoring System (CRMS) salinity data
- Previous WVAs

WVA Variables:

Variable V_1 – Stand Structure:

<u>FWOP Conditions</u>

Alternative Design #1
Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2
Under Alternative Design #2, FWOP conditions for B1 (JL15) were analyzed using the interior fresh marsh model. Variable V_1 in the interior fresh marsh model accounts for emergent vegetation, and the interagency team selected the most current classification, fresh marsh, from the Vegetation Types in Coastal Louisiana in 2007 (Sasser et al. 2008) to determine vegetation classification. Currently, the entire B1 (JL15) feature is 100% fresh marsh. Under the FWOP conditions, it is assumed that 50% of existing marsh will settle to elevation by end of Target Year (TY) 1 and become shallow open water. It is also assumed that shoreline erosion increases from TY 1 to TY 5 to the historic rate (8.03 feet/year), and the entire B1 (JL15) feature will become 100% open water by TY 5. Using this same assumption, the feature would remain 100% open water through TY 50.

Under the Alternative Design #2 FWOP conditions for B2 (JL16), land use is not expected to change, and the area would remain heavily disturbed with a few trees and shrubs throughout all TYs (Class 1; Table 2).

Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

Alternative 1 and Alternative 2
Alternative Design #1 and Alternative Design #2 Future With Project (FWP) assumptions were developed by CEMVN in coordination with the interagency team (Table 2 and Table 3). Table 2 describes the composition classes defined by percent cover of mast-producing tree species. FWP conditions for Alternative Design #1 and Alternative Design #2 would require land shaping and grading to restore surface grades to elevations that would support forested habitat (Table 3) and to allow for natural hydrologic patterns to occur (refer to CEMVN Project Description document for more information). TY 8 was included in the WVA analysis to capture the general assumption that planted trees will achieve a Class 5 once they reach 7 years old.

Table 2. Tree Species Composition (V_1) Descriptions in BLH Habitat Analysis

Class	Description
Class 1	Less than 25% of canopy consists of mast or other edible seed-producing trees
Class 2	25 to 50% of overstory canopy consists of mast or edible seed-producing trees, but hard mast producers are less than 10% of the canopy
Class 3	25 to 50% of overstory canopy consists of mast or edible seed-producing trees, but hard mast producers are more than 10% of the canopy
Class 4	Greater than 50% of overstory canopy consist of mast or other edible seed-producing trees, but hard mast producers are less than 20% of the canopy
Class 5	Greater than 50% of overstory canopy consist of mast or other edible seed-producing trees, but hard mast producers are less than 20% of the canopy

The entire acreage would be planted with mast-producing species suited to the soils and site-specific conditions. Mast-producing species (e.g., water oak [*Quercus nigra*], sugarberry [*Celtis laevigata*], American elm [*Ulmus americana*], nuttall oak [*Quercus nuttalli*]) would be planted on 9-foot by 9-foot centers (538 trees per acre) and mid-story species (e.g., mayhaw [*Craegus opaca*], buttonbush [*Cephalanthus occidentalis*], and persimmon [*Diospyros virginiana*]) would be planted on 20-foot by 20-foot centers (109 stems per acre) in order to quickly establish a dense canopy and to minimize the establishment and growth of Chinese tallow (*Triadica sebifera*). Hard-mast species would be 60% of the planted canopy trees and soft-mast species would be 40% of the total canopy species. It is assumed that the species composition ratios would remain static over the entire period of analysis. Chinese tallow is not considered a mast or other edible seed-producing species, but it does contribute to the percent cover.

Table 3. FWP V_1 Stand Structure Assumptions

Target Year (TY)	Alternative Design	Features	Assumption
0	1 and 2	All	Class 1 (open water)
1	1 and 2	All	Class 1
2	1 and 2	All	Class 1
8	1 and 2	All	Class 5
20	1 and 2	All	Class 5
50	1 and 2	All	Class 5

Variable V_2 – Stand Maturity:
FWOP Conditions

Alternative Design #1
Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2
Under the Alternative Design #2, FWOP conditions for B1 (JL15) were analyzed using the interior fresh marsh model. Variable V_2 in the interior fresh marsh model accounts submerged aquatic vegetation (SAV). Presently there is no (0%) SAV at B1 (JL15). During TY 1, as open shallow water develops, SAV will begin to grow (SAV at 10% of the site). As shallow open water increases at B1 (JL15), SAV would also increase, and SAV would cover 50% and 75% of the site by TY 5 and TY 50, respectively.

Currently, feature B2 (JL16) is a heavily disturbed area with a few trees and shrubs. Based on field investigations, the average diameter at breast height (DBH) of trees at B2 (JL16) is 14 inches. FWOP values and assumptions for the V_2 variable at B2 (JL16) are described below in Table 4.

Table 4. FWOP V_2 Stand Maturity Assumptions for B1 (JL15)

TY	Features	Age (years)	DBH (inches)	Assumption
0	B2 (JL16)	0.00	14.00	Based on field investigations; average DBH of existing trees was 14 inches.
1	B2 (JL16)	0.00	14.60	Young tree in-growth projection (USFWS).
50	B2 (JL16)	0.00	28.40	BLH site in-growth projection (USFWS).

Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

Alternative Design #1 and #2
For FWP analyses under Alternative Design #1 and Alternative Design #2, it was assumed that 1-year-old trees would be planted in TY 2, so the age for each TY was assumed to be 1 year less than the corresponding TY (e.g., age 1 at TY 2, age 7 at TY 8, age 19 at TY 20) at all features for the life of each project (Table 5).

Table 5. FWP V_2 Stand Maturity Assumptions

TY	Features	Age (years)	DBH (inches)
Alternative Design #1			
0	All	0.00	0.00
1	All	0.00	0.00
2	All	1.00	0.00
8	All	7.00	0.00
20	All	19.00	0.00
50	All	49.00	0.00
Alternative Design #2			
0	B1, B3, JL18	0.00	0.00
1	B1, B3, JL18	0.00	0.00
2	B1, B3, JL18	1.00	0.00
8	B1, B3, JL18	7.00	0.00
20	B1, B3, JL18	19.00	0.00
50	B1, B3, JL18	49.00	0.00
0	B2 (JL16)	0.00	14.00
1	B2 (JL16)	0.00	14.60
2	B2 (JL16)	1.00	0.00
8	B2 (JL16)	7.00	0.00
20	B2 (JL16)	19.00	0.00
50	B2 (JL16)	49.00	0.00

Variable V_3 – Understory / Mid-story:
FWOP Conditions

Alternative Design #1
Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2
Under the Alternative Design #2, FWOP conditions for B1 (JL15) were analyzed using the interior fresh marsh model. Variable V_3 in the interior fresh marsh model accounts for interspersion (Table 6).

Table 6. FWOP V_3 Interspersion General Assumptions for Feature B1 (JL15)

TY	Class 1 %	Class 2 %	Class 3 %	Class 4 %	Class 5 %
0	100.00	0.00	0.00	0.00	0.00
1	50.00	0.00	50.00	0.00	0.00
5	0.00	0.00	0.00	0.00	100.00
50	0.00	0.00	0.00	0.00	100.00

Understory (90%) and mid-story (10%) species percent cover currently exist within the Design Alternative #2 B2 (JL16) feature. It was assumed that Relative Sea Level Rise (RSLR) and competition between mid-story and adult trees at this feature will reduce the understory to 60% by TY 50. It was also assumed that the mid-story trees at B2 (JL16) will increase to 25% by TY 50, and eventually grow into the canopy.

Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

Alternative Design #1 and #2
General assumptions were developed by CEMVN in coordination with the interagency team (Table 7). It is assumed that normal flooding regimes would persist through the 50-year life of the project. Understory (90%) and mid-story (10%) species currently exist within the Design Alternative #2 B2 (JL16) feature.

Table 7. FWP Understory and Midstory Assumptions

TY	Features	Understory (%)	Midstory (%)
Alternative Design #1			
0	All	0.00	0.00
1	All	0.00	0.00
2	All	100.00	0.00
8	All	50.00	50.00
20	All	25.00	60.00
50*	All	30.00	25.00
Alternative Design #2			
0	B1, B3, JL18	0.00	0.00
1	B1, B3, JL18	0.00	0.00
2	B1, B3, JL18	100.00	0.00
8	B1, B3, JL18	50.00	50.00
20	B1, B3, JL18	25.00	60.00
50*	B1, B3, JL18	30.00	25.00
0	B2 (JL16)	90.00	10.00
1	B2 (JL16)	0.00	0.00
2	B2 (JL16)	100.00	0.00
8	B2 (JL16)	50.00	50.00
20	B2 (JL16)	25.00	60.00
50*	B2 (JL16)	30.00	25.00

***** Site specific conditions: Assume RSLR would adversely impact understory and mid-story growth and survival due to increased depth of inundation and flooding duration.

Variable V_4 – Hydrology:
FWOP Conditions

Alternative Design #1
Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2
Under the Alternative Design #2, FWOP conditions for B1 (JL15) were analyzed using the interior fresh marsh model. Variable V_4 in the interior fresh marsh model accounts for the % of shallow open water at the site (less than or equal to 1.5 feet). B1 (JL 15) is presently filled and has 100% herbaceous vegetation cover with no open water ($V_4 = 0$ for TY 0). Under FWOP conditions at B1 (JL15), 100% of the open water will be shallow by TY 1, and depth would not increase at the site through TY 50.

The Alternative Design #2 B2 (JL16) area is currently impounded, with no apparent hydrologic exchange. It was assumed that the area is temporarily flooded during parts of the year. By TY 50, higher water levels may allow for low hydrological exchange with other water bodies in the area.

Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

Alternative Design #1 and #2
Hydrologic projections for the JLNHPP BLH-Wet Restoration features are provided in Table 8. Proposed hydrologic improvements could include various actions intended to improve the existing hydro-period such that appropriate wetland hydrology would be restored (Table 8) within the BLH-wet features (refer to CEMVN Project Description document for details). It was assumed that by TY 50, RSLR would result in the hydrologic exchange to increase by one category (e.g., moderate exchange to high exchange).

Table 8. FWP Hydrologic Projections for JLNHPP BLH-Wet

TY	Features	Duration*	Exchange**	Specific Assumption
Alternative Design #1				
0	All	Permanent	Low	Sites are open water borrow pits surrounded by levee and marsh habitat, so water exchange is low. However, site is connected by some minor canals.
1	All	Permanent	None	Retention dikes constructed.
2	All	Temporary	Moderate	Dikes are degraded or removed and would result in moderate exchange between other ecosystems since the sites are surrounded by marsh.
8	All	Temporary	Moderate	N/A
20	All	Temporary	Moderate	N/A
50	All	Temporary	High	Higher water levels as a result of RSLR would increase exchange between the restoration site and surrounding habitats.
Alternative Design #2				
0	B1 (JL15)	Permanent	High	Site immediately adjacent to Lake Salvador.
1	B1 (JL15)	Permanent	None	Retention dikes constructed.
2	B1 (JL15)	Temporary	High	Dikes are degraded or removed, resulting in high exchange with surrounding waterbodies (e.g., Bayou Segnette Waterway and Lake Salvador).
8	B1 (JL15)	Temporary	High	N/A
20	B1 (JL15)	Temporary	High	N/A
50	B1 (JL15)	Temporary	High	Higher water levels as a result of RSLR would increase exchange between the restoration site and surrounding habitats.
0	B2 (JL16)	Temporary	None	Site is currently impounded with no water exchange, but probably temporarily floods during certain times of the year due to its close proximity to other wetlands.
1	B2 (JL16)	Permanent	None	Retention dikes constructed.
2	B2 (JL16)	Temporary	Low	Dikes are degraded or removed, resulting in low exchange with surrounding waterbodies.
8	B2 (JL16)	Temporary	Low	N/A
20	B2 (JL16)	Temporary	Low	N/A
50	B2 (JL16)	Temporary	Moderate	Higher water levels as a result of RSLR would increase exchange between the restoration site and surrounding habitats.

Table 8, continued

TY	Features	Duration*	Exchange	Specific Assumptions
0	B3 (JL17) and JL18	Permanent	Moderate	Sites are permanently flooded (open water canals) and experience moderate water exchange with other canals.
1	B3 (JL17) and JL18	Permanent	None	Retention dikes constructed.
2	B3 (JL17) and JL18	Temporary	Moderate	Dikes are degraded or removed, resulting in moderate exchange with nearby canals and waterways.
8	B3 (JL17) and JL18	Temporary	Moderate	N/A
20	B3 (JL17) and JL18	Temporary	Moderate	N/A
50	B3 (JL17) and JL18	Temporary	High	Higher water levels as a result of RSLR would increase exchange between the restoration site and surrounding habitats.

*Duration assumption developed by CEMVN in coordination with the interagency team.
****** Water exchange variable determined by site-specific conditions.

Variable V_5 - Size of Contiguous Forested Area:
FWOP Conditions

Alternative Design #1
Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2
Under the Alternative Design #2, FWOP conditions for B1 (JL15) were analyzed using the interior fresh marsh model. Variable V_5 in the interior fresh marsh model accounts for average mean salinity during the growing season. CRMS 3985 monitoring station is near the proposed B1 (JL15) site. The site's average mean salinity during the growing season is 0.73 parts per thousand (ppt). While salinity spikes may occur, mean growing season salinities are not predicted to change significantly within the project life. Therefore, the salinity for FWOP is not expected to change and were assumed to be 0.73 ppt throughout all FWOP TYs.

Under the Alternative Design #2, the FWOP size of the contiguous forested area adjacent to B2 (JL16) is 59 acres (Class 3), and it is assumed that this acreage will not change through TY 50.

Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

Alternative Design #1 and #2
The size of the adjacent forests correlates to a specific class and was calculated using GIS software (Table 9). General assumptions developed by CEMVN in coordination with the interagency team include:

- A non-forested corridor (e.g., road, canal) less than 75 feet wide does not constitute a break.
- The mitigation polygon is not classified as "forested" until TY 20.
- At TY 20 and all TYs thereafter, the mitigation polygon is included in the calculation of forested acreages.

Table 9. Size of Contiguous Forested Area

Features	Size of Contiguous Forested Area TY 0 to TY 8 (acres)	Size of Contiguous Forested Area TY 20 to TY 50 (acres)	TY 0 to TY 8 Class	TY 20 to TY 50 Class
Alternative Design #1				
B1 (JL11)	326.00	336.71	Class 4	Class 4
B2 (JL12)	236.00	252.83	Class 4	Class 4
B3 (JL13)	121.00	141.55	Class 4	Class 4
B4 (JL14)	351.00	367.75	Class 4	Class 4
Alternative Design #2				
B1 (JL15)	0.00	54.00	Class 1	Class 3
B2 (JL16)	59.00	67.6	Class 3	Class 3
B3 (JL17)	605.00	610.4	Class 5	Class 5
JL18	605.00	623.6	Class 5	Class 5

Variable V_6 – Suitability and Traversability of Surrounding Land Uses:
FWOP Conditions

Alternative Design #1
Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2

Under the Alternative Design #2, FWOP conditions for B1 (JL15) were analyzed using the interior fresh marsh model. Variable V_6 in the interior fresh marsh model accounts for fish access. For FWOP TY 0 through TY 5, fish access to the site is assumed to be very limited (V_6 = 0.0001). During FWOP TY 5, it is assumed that fish access will improve (V_6 = 1.000) as rock dikes degrade, and fish access would remain unchanged from TY 5 through TY 50.

For Alternative Design #2 FWOP analyses of B2 (JL16), the suitability and traversability of the surrounding land use was calculated using GIS software to create a 0.5-mile buffer around the feature (Table 10; Attachment A, Figure 3).

Table 10. FWOP V_6 Suitability and Traversability of Surrounding Land Uses Assumptions

TY	Features	Forest/Marsh (%)	Abandoned Agriculture (%)	Pasture/Hay (%)	Active Agriculture (%)*	Development (%)
0	B2 (JL16)	44.05	0.00	0.00	33.70	22.25
1	B2 (JL16)	44.05	0.00	0.00	33.70	22.25
50	B2 (JL16)	44.05	0.00	0.00	33.70	22.25

Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

Alternative Design #1 and Design #2
For FWP analyses, the suitability and traversability of the surrounding land use was calculated using GIS software to create a 0.5-mile buffer around each feature (Table 11; Attachment A, Figure 3). The percentages in parenthesis within Table 11 indicate the percent change in land use based on the

restoration area becoming forested in TY 20. Land use did not change for FWP TY 20 through TY 50. Alternative 2 B1 (JL15) did not experience any land use change because marsh habitat would be converted into BLH habitat, and Alternative B2 (JL16) did not experience any land use change since a low-quality forested area would be replaced by a BLH habitat.

Table 11. FWP Suitability and Traversability of Surrounding Land Uses

Feature	TY	Forest/Marsh	Abandoned Agriculture	Pasture/Hay	Active Agriculture*	Development
Alternative Design #1						
B1 (JL11)	0	66.52	0.00	0.00	7.93	25.55
	1	66.52	0.00	0.00	7.93	25.55
	2	66.52	0.00	0.00	7.93	25.55
	8	66.52	0.00	0.00	7.93	25.55
	20	68.02 (+1.5%)	0.00	0.00	6.43 (-1.5%)	25.55
	50	68.02	0.00	0.00	6.43	25.55
B2 (JL12)	0	44.47	0.00	0.00	9.30	46.23
	1	44.47	0.00	0.00	9.30	46.23
	2	44.47	0.00	0.00	9.30	46.23
	8	44.47	0.00	0.00	9.30	46.23
	20	46.47 (+2%)	0.00	0.00	7.30 (-2%)	46.23
	50	46.47	0.00	0.00	7.30	46.23
B3 (JL13)	0	41.91	0.00	0.00	10.12	47.97
	1	41.91	0.00	0.00	10.12	47.97
	2	41.91	0.00	0.00	10.12	47.97
	8	41.91	0.00	0.00	10.12	47.97
	20	43.91 (+2%)	0.00	0.00	8.12 (-2%)	47.97
	50	43.91	0.00	0.00	8.12	47.97
B4 (JL14)	0	62.26	0.00	0.00	7.32	30.42
	1	62.26	0.00	0.00	7.32	30.42
	2	62.26	0.00	0.00	7.32	30.42
	8	62.26	0.00	0.00	7.32	30.42
	20	64.26 (+2%)	0.00	0.00	5.32 (-2%)	30.42
	50	64.26	0.00	0.00	5.32	30.42
Alternative Design #2						
B1 (JL15)	0	48.29	0.00	0.00	51.71	0.00
	1	48.29	0.00	0.00	51.71	0.00
	2	48.29	0.00	0.00	51.71	0.00
	8	48.29	0.00	0.00	51.71	0.00
	20	48.29	0.00	0.00	51.71	0.00
	50	48.29	0.00	0.00	51.71	0.00
B2 (JL16)	0	44.05	0.00	0.00	33.70	22.25
	1	44.05	0.00	0.00	33.70	22.25
	2	44.05	0.00	0.00	33.70	22.25
	8	44.05	0.00	0.00	33.70	22.25
	20	44.05	0.00	0.00	33.70	22.25
	50	44.05	0.00	0.00	33.70	22.25
B3 (JL17)	0	86.78	0.00	0.00	7.14	6.08
	1	86.78	0.00	0.00	7.14	6.08
	2	86.78	0.00	0.00	7.14	6.08
	8	86.78	0.00	0.00	7.14	6.08
	20	87.38 (+0.6%)	0.00	0.00	6.54 (-0.6%)	6.08
	50	87.38	0.00	0.00	6.54	6.08

Table 11, continued

Feature	TY	Forest/Marsh	Abandoned Agriculture	Pasture/Hay	Active Agriculture*	Development
JL18	0	87.58	0.00	0.00	11.74	0.68
	1	87.58	0.00	0.00	11.74	0.68
	2	87.58	0.00	0.00	11.74	0.68
	8	87.58	0.00	0.00	11.74	0.68
	20	88.88 (+1.3%)	0.00	0.00	10.44 (-1.3%)	0.68
	50	88.88	0.00	0.00	10.44	0.68

*Includes open water

Variable V_7 – Disturbance:

Table 12 describes the distance and type classes applicable for Variable V_7 for FWOP and FWP conditions. General assumptions were developed by CEMVN in coordination with the interagency team and include:

- Baseline conditions will not change over time; existing conditions present in TY 0 will remain unchanged over the life of the mitigation project.
- All distances should be measured from the perimeter of the BLH mitigation polygon.

Table 12. Distance and Type Classes for V_7

Distance Class	Description	Type Class	Description
1	0 to 50 feet away	1	Constant/major disturbance (e.g., highways, industrial)
2	50.1 to 500 feet away	2	Frequent/moderate disturbance (e.g., residential, moderately used waterways and roadways)
3	>500 feet away	3	Seasonal/intermittent disturbance (e.g., agriculture)
		4	Insignificant disturbance (e.g., individual homes, lightly used roads and waterways)

FWOP Conditions

Alternative Design #1

Because all of the BLH features for Alternative Design #1 are currently open water, FWOP conditions were not analyzed for this variable.

Alternative Design #2

Distance class and type class for B2 (JL17) were determined by averaging the major disturbance factors within a 0.5-mile buffer of the site (V_7 distance = 2 and V_7 type = 2). For FWOP analyses of B2 (JL17), it was assumed that the distance class and type class would remain unchanged throughout TY 50. Because all of the B3 (JL17) and JL18 are currently open water, FWOP conditions were not analyzed for this variable.

FWP Conditions

For FWP analyses, distance class and type class were determined for each feature by averaging the major disturbance factors within a 0.5-mile buffer (Table 11). It was assumed that the distance class and type class would remain unchanged throughout the life of the project at all features.

Table 13. Distance Class and Type Class

Feature	Disturbance	Type	Class
B1 (JL11)	Residences	2	3
	Canals	4	3
	Highway 45	1	3
	AVERAGE	**2**	**3**
B2 (JL12)	Residences	2	2
	Canals	4	3
	Highway 45	1	3
	AVERAGE	**2**	**3**
B3 (JL13)	Residences	2	2
	Canals	4	3
	Highway 45	1	3
	AVERAGE	**2**	**3**
B4 (JL14)	Residences	2	3
	Canals	4	3
	Highway 45	1	3
	AVERAGE	**2**	**3**
B1 (JL15)	Bayou Segnette Waterway	2	1
	Lake Salvador	2	1
	Residences	2	3
	AVERAGE	**2**	**2**
B2 (JL16)	Bayou Segnette Waterway	2	1
	Lake Salvador	2	3
	Highway 301	2	3
	Residences	2	2
	AVERAGE	**2**	**2**
B3 (JL17)	Highway 45	2	2
	Canals	4	1
	Residences	2	3
	AVERAGE	**3**	**2**
JL18	Residences	2	3
	Canals	4	1
	AVERAGE	**3**	**2**

General Notes:

WBV sea level rise (SLR) was calculated using projections for each gauge in feet (Attachment C). The low rate is an extrapolation of historic RSLR rate experienced at the particular gauge site; the intermediate rate is based on an estimate of local subsidence from the gauge record and NRC curve 1 eustatic SLR. The high rate is based on an estimate of local subsidence from the gauge record and NRC curve III eustatic SLR. However, for the alternatives analysis, only the intermediate SLR rate was used. The WBV gauge indicates that a 1.0-foot rise in sea level would occur by 2041 (TY 25) and a 2.0-foot rise in sea level would occur by 2070 (TY 54).

BLH-Wet restoration sites within the JLNHPP are surrounded by existing marsh and open water habitat and in close proximity to Lake Cataouatche and Lake Salvador, and RSLR and subsidence impacts would be experienced. Mid-story and understory species would experience reduced growth and survival as a result of increased flooding duration and depth of inundation. Project design would ensure that normal flooding conditions would persist for several years, but by TY 50 water exchange between the restoration site and surrounding wetlands experience a slight increase.

Appendix D

Planting Guidelines, Monitoring Plan, and Success Criteria

PLANTING GUIDELINES, MONITORING PLAN, AND SUCCESS CRITERIA

TIERED INDIVIDUAL ENVIRONMENTAL REPORT
JEAN LAFITTE NATIONAL HISTORIC PARK AND PRESERVE MITIGATION FEATURES
PIER 37, TIER 1

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INTRODUCTION

This document follows the general mitigation guidelines developed for the West Bank and Vicinity Hurricane Storm Damage and Risk Reduction System (HSDRRS) Mitigation Program. The guidelines were developed by the U.S. Army Corps of Engineers (USACE) in coordination with an Interagency Team and the non-Federal project sponsor (NFS), Louisiana Coastal Protection and Restoration Authority (LA CPRA). The original general guidelines by habitat type were included as Appendix L in the PIER 37. This appendix outlines the project specific guidelines and plans for planting, monitoring, and reporting and identifies success criteria for the mitigation sites included in PIER 37, TIER 1. The mitigation sites are fully described in PIER 37, TIER 1 and summarized in Table 1.

Table 1. Mitigation Projects included in PIER 37, TIER 1

Feature	Habitat	Action	Acres
JL14A	Park/404c Flood Side BLH-Wet	Create BLH-Wet habitat from open water in an existing borrow pit will include BLH plantings	8
JL7	Park/404c Flood Side Swamp	Hydrologic Enhancement-Gapping in existing spoil banks on Millaudon Canal and Horseshoe Canal to improve surface flow and exchange in existing swamp	106
JL1B5	General Flood Side Fresh Marsh	Construct marsh platform from open water in Yankee Pond, will include retention dikes and fish dips	91.2
JL1B4	Park/404c Flood Side Fresh Marsh	Construct marsh platform from open water in Yankee Pond, will include retention dikes and fish dips	20.4
JL15	Park/404c Flood Side Fresh Marsh	Existing marsh platform site along Lake Salvador (Geo-crib) will be refurbished to include refurbishment of rock dike, construction of fish dips and invasive species removal	55.5

The proposed mitigation actions under PIER 37, TIER 1 include construction, with the NFS responsible for operation and maintenance of functional portions of work as they are completed. On a cost shared basis, The USACE would monitor the completed mitigation to determine whether additional construction, invasive species control and/or plantings are necessary to achieve mitigation success. The USACE would 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 the USACE determines that the mitigation has achieved initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If, after meeting initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, the USACE would consult with other agencies and the NFS to determine whether operational changes would be sufficient to achieve ecological success criteria. If, instead, structural changes are deemed necessary to achieve ecological success, the USACE would implement

appropriate contingency management measures in accordance with the contingency plan and subject to cost sharing requirements, availability of funding, and current budgetary and other guidance.

All construction, maintenance, and monitoring activities will require a Special-Use Permit from the NPS prior to any entrance onto the Park. Coordination should continue until construction of the flood protection project and restoration projects are complete and prior to any subsequent maintenance or monitoring. Once the project is turned over to the NFS, the NFS will be required to coordinate with the NPS to obtain all necessary permits to conduct monitoring, operations and maintenance of the project.

The respective responsibilities for the construction, monitoring and maintenance of the PIER 37, TIER 1 mitigation projects are as follows:

1. Construction and planting (the “construction phase”) - performed by the USACE per applicable cost-sharing;

2. After construction and planting, the USACE issues Notice of Construction Complete (NCC) and provides the Operation, Maintenance, Repair, Replacement, and Rehabilitation manual to the NFS (the “O&M phase”);

3. Notwithstanding NCC, the USACE will monitor the project on a cost-shared basis until it reaches its Initial Success Criteria;

4. If, after NCC but before Initial Success Criteria are achieved, the project needs additional construction, invasive species control or planting, the USACE will perform these items subject to applicable cost-sharing and availability of funds;

5. After Initial Success Criteria are achieved, the NFS will monitor project;

6. If, after Initial Success Criteria are achieved, there is a problem that can be corrected through a change in operation, the NFS will be responsible to change its operation of the project; and

7. If, after Initial Success Criteria are achieved, there is a problem that requires structural changes, the USACE will implement contingency management according to applicable cost-sharing and subject to availability of funds.

For the NPS Restoration projects, “construction” is defined as:

1. Mobilization and de-mobilization of required construction equipment to the site.

2. Construction of temporary retention/perimeter dikes and associated spill boxes to contain dredged material for JLlB4, JL1B5 and potentially JL14A.

3. Dredging material from the bottom of Lake Cataouatche and pumping the material via hydraulic pipeline along a defined access corridor to the designated fill site to establish a marsh platform at the design elevation.

4. Delivery and placement of outside source borrow material into the JL14A feature.

5. Surveying to determine fill height during and at the end of the dredging/disposal operation.

6. Augmentation of the rock shoreline protection feature at the JL15 site.

7. Gapping of Millaudon and Horseshoe Canal spoil berms with adjacent disposal for the JL 7 feature.

8. Installation of native BLH-WET species throughout the JL14A feature.

9. Degrading the perimeter dikes and gapping dikes/shoreline protection to allow water exchange/tidal connection (for the JLlB4 and JL1B5 features, 1 year after disposal has concluded).

10. Invasive and nuisance plant species control in the marsh features (for the JLlB4 and JL1B5 features, 1 year after disposal has concluded).

11. One year after dredge material disposal, surveying to determine the fill elevation in the JLlB4 and JL1B5 marsh features.

MITIGATION PLANTING GUIDELINES

The planting plans for the Fresh marsh, BLH Wet, Swamp and habitats were originally provided in PIER 37 Appendix L. It should be noted that not all project features being implemented under this TIER will require plantings as part of the initial construction phase. Currently, only the Jean Lafitte FS BLH-Wet Restoration project (JL14A) includes plantings as part of the construction phase. Nevertheless, planting plans for the mitigation projects that do not have vegetative plantings planned as part of construction phase (Fresh Marsh JL1B5, JL15, JL1B4 and Swamp JL7) are still provided below in the event that subsequent monitoring indicates that vegetative success criteria (Table 6) are not met and planting is deemed to be required or implemented as part of an Contingency Management action (see Appendix E).

Jean Lafitte FS Fresh Marsh Restoration projects (JL1B5, JL1B4 & JL15)

As part of the construction phase planting of fresh marsh habitats is not proposed since it is anticipated that desirable fresh marsh vegetation would rapidly colonize through natural recruitment. Planting of fresh marsh could be necessary if the initial vegetative cover goal is not achieved (Table 6). If determined to be necessary, plantings should follow the guidelines below.

Stock will typically be either 4-inch container size or bare-root or liner stock, depending on the species involved. 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 February 15 through May 15. Planting should not be undertaken later than approximately May 31, 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 three different species would be utilized.

Jean Lafitte FS BLH-Wet Restoration project (JL14A)

This project includes the planting of BLH-Wet species as part of project construction phase. 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). Seedling protection devices such as plastic seedling protectors would be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Tables 2 and 3. 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 2) and approximately 40% soft mast-producing species (Table 3). 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 2 and 3. 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. Any deviations should first be approved by the USACE, the NFS, and the Interagency Team. In general, a minimum of 4 hard mast species and a minimum of 5 soft mast species should be utilized.

The midstory species installed will be selected from the species list provided in Table 4. Plantings will consist of at least 5 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. Once determined they should be documented in the monitoring reports.

Table 2. 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%
Live oak	*Quercus virginiana*	30% - 40%
Water oak	*Quercus nigra*	5%
Laurel oak	*Quercus laurifolia*	10% - 20%
Water hickory	*Carya aquatica*	15% - 20%

Table 3. 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%
Pumpkin ash*	*Fraxinus profunda*	15% - 25%
Bald cypress	*Taxodium distichum*	5% - 15%
Common persimmon	*Diospyros virginiana*	10% - 20%

*If available. If not available, substitute with green ash.

Table 4. Planting List for Wet Bottomland Hardwood Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Roughleaf dogwood	*Cornus drummondii*	10% - 20%
Green hawthorn	*Crataegus viridis*	10% - 20%
Possumhaw	*Ilex decidua*	10% - 20%
Dahoon holly	*Ilex cassine*	5% - 10%
Wax myrtle	*Myrica cerifera*	5% - 10%

Jean Lafitte FS Swamp Enhancement project (JL7)

The swamp enhancement project includes topographic alterations to improve surface flow and hydrologic exchange within an existing swamp forest. Plantings are not planned as part of the project construction phase however, plantings may be required if the project

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does not meet the specified vegetative success criteria as identified in Table 6 and is implemented as part of Contingency Management (See Appendix E). Plantings if determined to be necessary should follow the guidelines below.

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). Seedling protection devices such as plastic seedling protectors would be installed around each planted seedling.

The canopy species installed will be in general accordance with the species lists provided in Table 5. 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. Any deviations should first be approved by the USACE, the NFS, and the Interagency Team. 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 6. 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. Once determined they should be documented in the monitoring reports.

Table 5. 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 6. Preliminary Planting List for Swamp Habitat, Midstory Species

Common Name	Scientific name	Percent Composition
Buttonbush	*Cephalanthus occidentalis*	30 -40%
Roughleaf dogwood	*Cornus drummondii*	5 – 10%
Swamp privet	*Forestiera acuminata*	15 – 25%
Possumhaw	*Ilex decidua*	10 – 20%
Virginia willow	*Itea virginica*	10 – 20%
Wax myrtle	*Myrica cerifera*	15 – 25%
Swamp rose	*Rosa palustris*	15 – 25%
American snowbell	*Styrax americanus*	10 – 20%

GUIDELINES FOR THE ERADICATION AND CONTROL OF INVASIVE PLANT SPECIES

The eradication of invasive plant species may incorporate a variety of eradication methods including 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, invasive trees would be killed and allowed to remain standing or in place.

The USACE will be responsible for the initial eradication of invasive plants as well as for any subsequent eradication efforts until such time that the mitigation monitoring responsibilities are transferred to the NFS. Thereafter, the NFS will be responsible for the successful control and eradication of invasive plant species, subject to the cited provisions. The management objectives for Fresh marsh and BLH restoration projects (JL1B5, JL1B4, JL15, JL14A) will be to maintain the mitigation site such that it is essentially free from invasive plant species immediately following a given maintenance event and such that the total average vegetative cover accounted for by invasive species each constitute less than 5% of the total average plant cover during periods between maintenance events. The management objectives for Swamp Enhancement (JL7) are included as Contingency Management contingency actions (Appendix E) which include invasive species control to ensure survival of native species and meet required success criteria. The USACE, in cooperation with the Interagency Team, may determine that removal of invasive species is warranted to maintain or enhance the ecological value of the site, if monitoring reports document increased invasive species coverage as compared to the baseline conditions and invasive species are negatively impacting the success of native species.

HYDROLOGY GUIDELINES

Bottomland Hardwood Wet Hydrology Guidelines

The following hydrologic guidelines are applicable to Jean Lafitte FS BLH-Wet Restoration project (JL14A).

As outlined in the Appendix L of PIER 37, the optimal hydrologic regime for wet 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.

The following provides some general hydrologic guidelines for mitigation projects involving BLH-Wet habitat restoration. These are simply guidelines and the attainment of one or more of these guidelines may not be possible in some situations. Hydrologic Success Criteria for BLH-Wet are summarized in Table 2.

- 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

Table 7 summarizes the success criteria for the BLH Wet, Swamp and Fresh marsh project features provided in the PIER Appendix L are incorporated by reference and summarized below and will be used to assess project progress towards achieving the identified success criteria.

Table 7. Summary of Success Criteria for BLH-Wet, Swamp and Fresh Marsh *(see PIER 37 Appendix L for the full narrative of the success criteria)*

Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH-Wet Restoration (JL14A)	**Swamp Enhancement (JL7)**	**Fresh Marsh Restoration (JL1B5, JL1B4, JL15)**
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 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 ≥80% midstory species. Criteria 2C: 4 years after initial plantings achieve: • ≥269 living native canopy species per acre. • Average 60% hard mast, 40% soft mast trees per acre • ≥75 midstory species per acre.	Criteria 2A: 1 year after final construction completion: • Maintain the number of naturally recruited bald cypress and tupelo saplings per acre as compared to baseline conditions* • Maintain the number of living bald cypress trees per acre as compared to baseline conditions* • Maintain native midstory species per acre compared to baseline conditions*. • Vegetation meets	Criteria 2A: 1 year after final construction completed, achieve: • ≥50% cover of native species • meets hydrophytic vegetation criteria. Criteria 2B: 3 years after final construction completion, achieve: • ≥75% cover by native herbaceous species. Criteria 2C: 5 through 20 yrs after final construction completion, achieve: • ≥80% cover by native

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Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH-Wet Restoration (JL14A)	**Swamp Enhancement (JL7)**	**Fresh Marsh Restoration (JL1B5, JL1B4, JL15)**
	• meets hydrophytic vegetation criteria. Criteria 2D: Within 10 years after initial plantings, achieve: ≥80% coverage by native canopy species, 60% hard mast, 40% soft mast trees. Criteria 2E: 15 years after initial plantings, achieve: Average cover in the mid-story stratum >20%.	hydrophytic vegetation criteria. Criteria 2B: 4 years after final construction completion and throughout the project life: • Maintain native canopy species per acre. • Maintain living bald cypress trees per acre. • Maintain native midstory species per acre. • Vegetation meets hydrophytic vegetation criteria. Interagency Team	herbaceous species.
Invasive Vegetation (INV)	Criteria 3A. Complete initial Eradication of INV. Criteria 3B. Maintain <5% cover by INV throughout the duration of the overall 50 year monitoring period.	Not applicable. *(Invasive species control is included as a Contingency Management action not a success criteria.)*	Criteria 3A. Complete initial eradication of INV. Criteria 3B. Maintain <5% cover by INV throughout the duration of the overall 50 year monitoring period.
Topography	Criteria 4A: In the year after construction	Criteria 4A: After completion of construction, ≥ 80% of	Criteria 4A: Upon completion of construction, ≥ 80%

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Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH-Wet Restoration (JL14A)	**Swamp Enhancement (JL7)**	**Fresh Marsh Restoration (JL1B5, JL1B4, JL15)**
	completion, ≥80 % of total graded area must be within 0.5 ft of target elevation.	the constructed gaps must be within 0.25 ft of target elevation/design grade of the gaps and 95% of the design cross-section.	of total area must be within 0.5 ft of target elevation. Criteria 4B: 1 year after completion of construction, ≥ 80% of total area must be within 0.5 ft of target elevation. Criteria 4C: 3 years after completion of construction, ≥ 90% of mitigation site must be within functional marsh elevation range.
Thinning of Native Vegetation	Criteria 5A: TBD; at 15 to 20 years following initial plantings PDT will determine if thinning of canopy and midstory strata is warranted.	Not applicable.	Not applicable.
Hydrology	Criteria 6A: Demonstrate ground surface elevations conducive to establishment and support of hydrophytic vegetation, and establishment & maintenance of hydric soil characteristics. Criteria 6B: 2 years following attainment of the 1-year survivorship criteria, water level information should	Criteria 6A: Demonstrate increased hydrologic connectivity within the project area by gap construction and maintain 80% of design cross section through gaps (i.e. clear any obstructions). Use or installation of water level recorders hydrologically connected to the canals adjacent to the gaps and within the swamp for 1 year. If	Not applicable.

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Performance Categories	Mitigation Success Criteria by Habitat Type		
	BLH-Wet Restoration (JL14A)	**Swamp Enhancement (JL7)**	**Fresh Marsh Restoration (JL1B5, JL1B4, JL15)**
	indicate the sites hydrology will be restored such that the Property meets the wetland criterion as described in the 1987 Manual as well as the November 2010 Regional Supplement to the Corps of Engineers wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0 (USACE 1987, 2010). *Once hydrologic success criteria have been satisfied monitoring will no longer be required (see BLH monitoring guidelines in the subsequent sections).*	readings demonstrate connectivity (e.g., similar water level response) then success criteria has been achieved. *Once hydrologic success criteria have been satisfied monitoring will no longer be required (see swamp monitoring guidelines in the subsequent sections).*	

MITIGATION MONITORING GUIDELINES

A monitoring plan consistent with WRDA 2007 Section 2036 has been developed and is described in subsequent sections. The monitoring plan measures the parameters necessary to evaluate success criteria identified in Table 7, and includes schedules for the monitoring events and the specific content for the monitoring reports required to document performance over the 50 year period of analysis.

Additionally, as required in the 2009 "Modification to the 1985 Clean Water Act Section 404(c) Final Determination for Bayou aux Carpes" aerial imagery will be obtained for the long term monitoring plan for the augmentation features and mitigation projects. Since the long term monitoring plan for the mitigation projects is just the first element of this overall plan, the specifics on what type of aerial imagery, how often, and in what season this imagery would be obtained would be presented in the forthcoming overall long term monitoring plan. Once this imagery is obtained it would be utilized in all subsequent

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monitoring reports for the augmentation features and mitigation projects to document vegetative trends.

Jean Lafitte Flood side Fresh Marsh Restoration projects (JL1B5, JL1B4 & JL15)

Baseline Monitoring Report

The mitigation sites will be monitored and a baseline monitoring report prepared for each marsh site (Yankee Pond and Geocrib). It should be noted that, since the Yankee pond features (JL1B5 & JL1B4) will be constructed concurrently, only one monitoring report for the Yankee Pond site is needed however separate sections must be included to portion out the results for the Park 404c area (JL1B4) from the rest of the Yankee Pond site (JL1B5).

Shortly after completion of all initial mitigation activities (e.g. initial eradication of invasive plants, completion of initial earthwork, grading, surface water management system alterations/construction, etc.), the mitigation sites will be monitored and a baseline or monitoring report will be prepared for each site (Yankee Pond and Geocrib). See Tables 8 and 9 respectively. Monitoring and reporting requirements for the baseline reports include the following items:

A. A detailed discussion of all mitigation activities completed.

B. 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. Potential locations/areas of interest for the monitoring plots, transects, quadrats, photo station locations, and staff gage locations are shown in Figures 1 & 2. The exact locations will be determined and documented and coordinated with the USACE during the initial site visit and the baseline monitoring event. If available aerial imagery of the mitigation site will also be included.

C. 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.

D. 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 and will be finalized during the baseline monitoring event. Figures 1 and 2 illustrate potential locations and areas of interest for the photo stations and should represent the minimal number of stations.

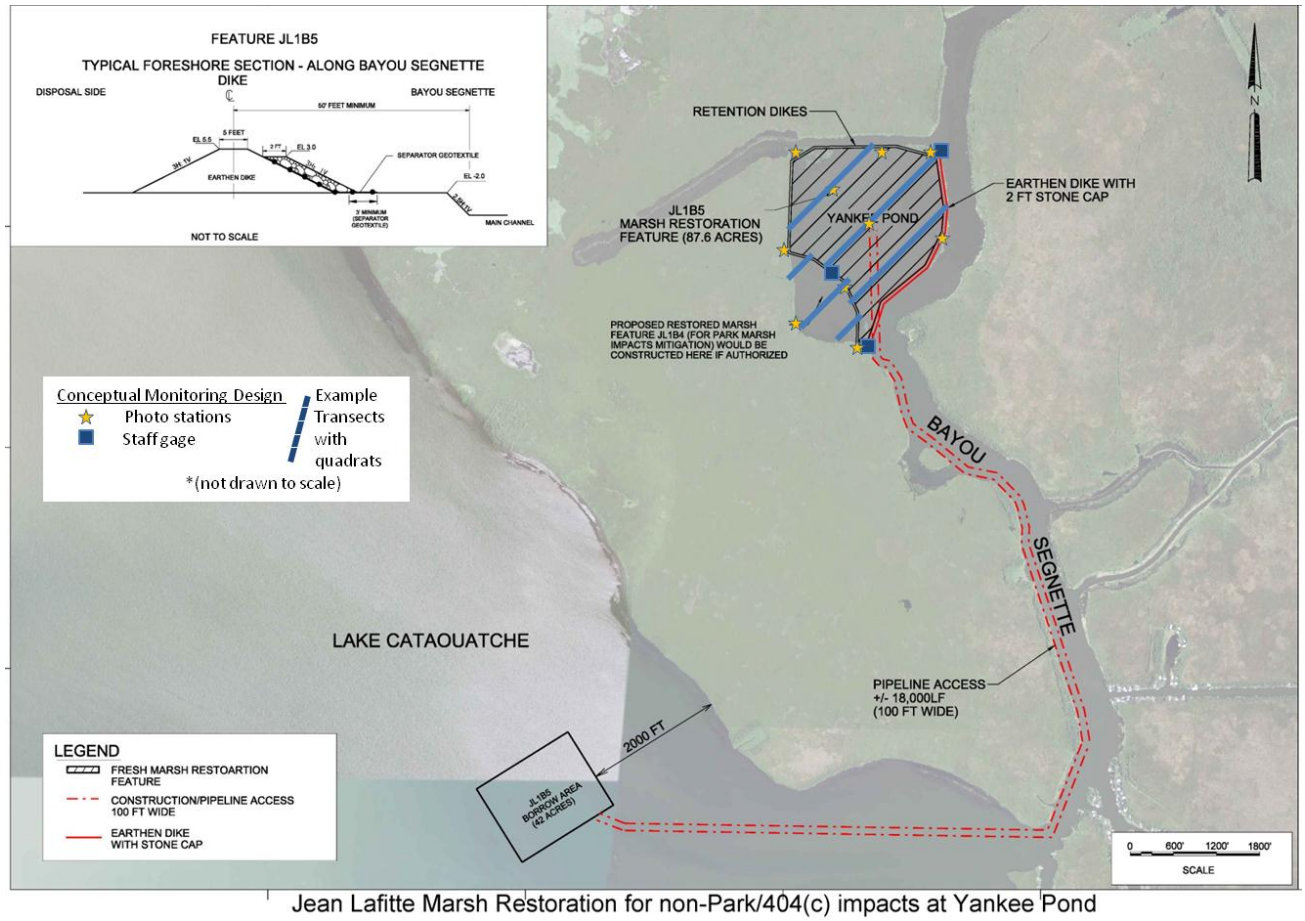

Figure 1. Areas of interest for monitoring plan design at mitigation sites JL1B4 & JL1B5

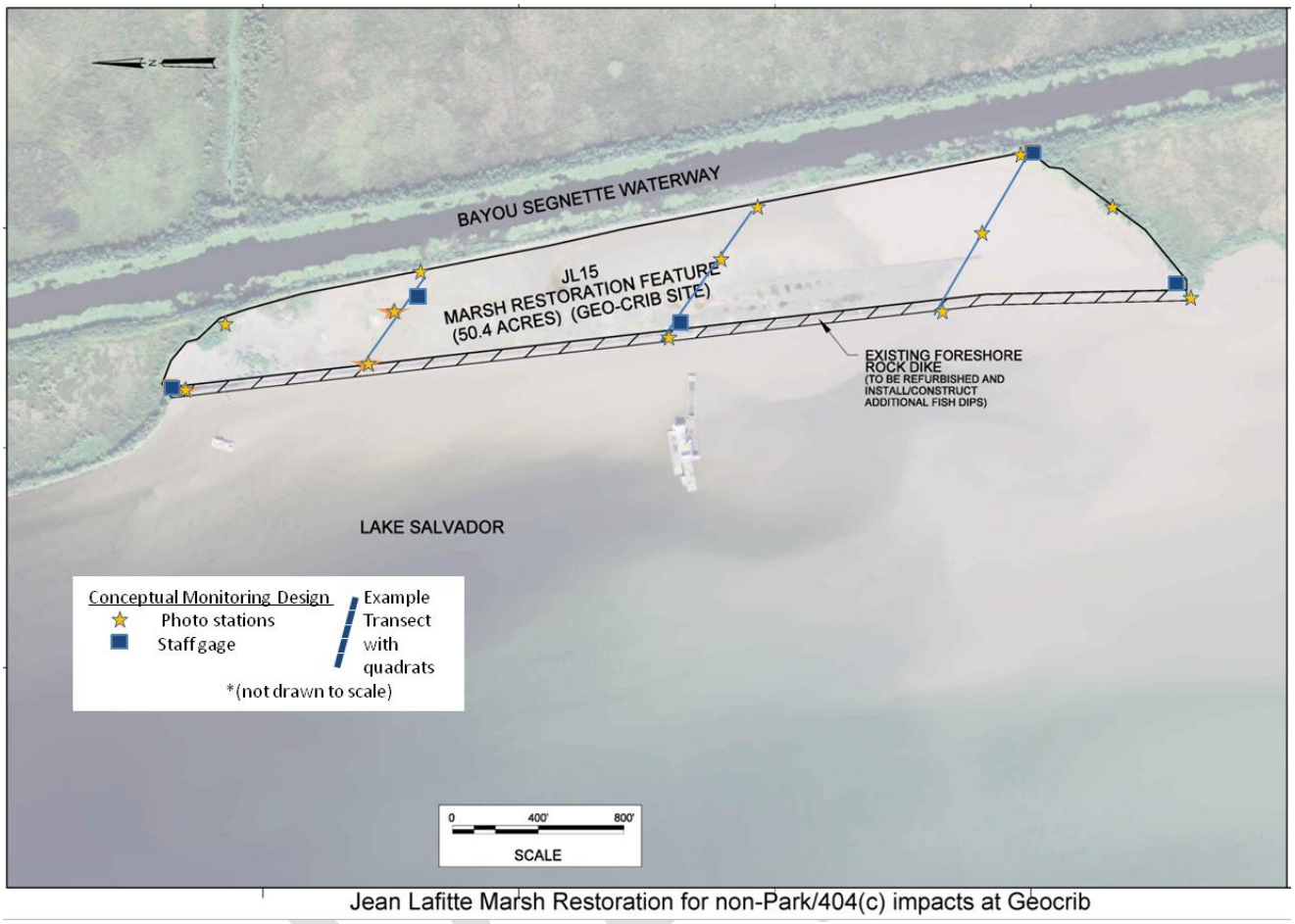

Figure 2. Areas of interest for monitoring plan design at mitigation site JL15

E. Water level elevation readings collected at the time of monitoring from a single staff gage installed within one of the restored marsh features. The final location of the staff gage will be determined during the initial site visit and installation of the gauges. Potential areas of interests for the gages are indicated in Figures 1 and 2. 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 stations will be identified and referenced within the monitoring report). The report will further address estimated mean high and mean low water elevations at the mitigation site based on field indicators such as observations of inundation, soil saturation, water marks, drift lines, sediment deposits or drainage patterns.

F. 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.

G. 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 if planted marsh features are added after initial construction. The number of monitoring transects and number of sampling quadrats per transect will vary depending on the mitigation site and will be finalized during the initial site visit and coordinated with the USACE. A conceptual design showing areas of interest for the transects is provided in Figures 1 and 2, these should represent the minimal number of transects. The methodology and locations chosen for the initial monitoring report must be followed for all subsequent reports.

   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

H. 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.

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

<u>Additional Monitoring Reports</u>

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

J. All items listed for the time zero baseline monitoring report.

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

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L. In addition to the above items, the monitoring report prepared for 1 year following completion of mitigation construction activities and the monitoring report prepared for TY 3 and 5 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 baseline 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.

M. Although not proposed in the initial mitigation plan, plantings 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 initial plantings 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 planted cross-referenced to a listing of the species and number of each species planted in each area.

<u>Monitoring Schedule and Responsibilities</u>

Monitoring for fresh marsh 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. See Table 8 and 9 for the schedule of the currently proposed monitoring events.

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

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

Monitoring events associated with the above will include the time zero, first or baseline monitoring event and a second monitoring event 1 year after the time zero monitoring event. 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 order to demonstrate attainment of success criteria 2.B and 4.C for fresh marsh 3 years after completion of construction. Thereafter, monitoring will be conducted every 5 years throughout the remaining 50-year period of analysis.

If certain success criteria are not achieved, failure to attain these criteria would trigger the need for additional monitoring events not addressed in the monitoring plan. 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:

- If the initial vegetative cover criterion is not achieved (i.e. the requirement specified in success criteria 2.A), 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.

- If topographic success criteria 4.A or 4.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:

- If the vegetative cover criterion specified for 3 years after completion of mitigation construction activities is not achieved (i.e. success criterion 2.B), 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.

- If the topographic success criterion 4.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 2.C. 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.

Tables 8 and 9 also provides the cost estimates based on the currently available information and would need to be revised in the future based on inflation and as additional information regarding the mitigation feature designs and construction schedule become available.

Table 8. Mitigation Monitoring Report Schedule and Costs for Fresh Marsh at JL1B5 & JL15

Target Year	Work Item	Work Item Description	Estimated Cost
0	Begin Initial Construction	Start of mitigation construction activities.	
1	Complete Initial Construction	Finish retention dikes, placement of dredged material at Yankee Pond; rock augmentation and invasive species control at Geocrib.	
2	Begin Final Construction	(1 year after completion of initial construction). Area settles to target grade. Begin: degrading/gapping dikes; installing fish dips in armored dikes as applicable; forming trenasses, interspersion features.	
	End Final Construction	Completion of activities above.	
	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	
	Analysis for Notice of Construction Complete	Review As-Builts and O&M manual	
	NCC	Notice of Construction Complete issued to the Non-Federal Sponsor. The USACE will continue to monitor and conduct activities necessary to ensure initial success criteria are met.	

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	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas (during or at end of final construction).	
	Monitoring & Report	Perform field mitigation monitoring Submit report by Dec. 31.	
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	
3	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in monitoring report.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	
	Monitoring & Report	Perform field mitigation monitoring). Submit report by Dec. 31.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	
	Analysis for satisfaction of initial success criteria.	Review monitoring report from prior year and other data to make determination to completely turn over project to Non-Federal Sponsor.	
4	**NFS Begins Monitoring**	Non-Federal Sponsor assumes monitoring responsibility in addition to other OMRR&R responsibilities (Feb. thru April?). Note: transfer of monitoring occurs early this year unless topographic corrections and/or marsh planting required.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
5	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	$50,000
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Aerial Photography	Obtain rectified aerial photo of restored marsh areas. Provide as part of mitigation monitoring report.	$14,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$43,750
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
6	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000

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7	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
8	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
9	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
10	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
11	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
12	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
13	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
14	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
15	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250

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	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
16	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
17	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
18	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
19	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
20	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
25	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
30	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
35	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250

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	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
40	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
45	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
50	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$44,100
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$30,250
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
		GRAND TOTAL	$1,929,475
		GRAND TOTAL + 15%	$ 2,218,896

Notes:
The costs for topographic/as-built surveys needed for monitoring are NOT included in the cost for the "monitoring and report" events. See separate line item costs for this.

Proposed fresh marsh habitats will not be planted. These will require planting only if vegetation success criteria are not achieved.

The contract to obtain plants for initial planting will need to be issued at least 13 to 14 months prior to the date that plants will be installed since the plants must be 1 year old at the time of installation (must start growing the plants at the nursery).

A total of 147 acres in JL1B5 and JL15 were used to develop cost estimates, revisions may be needed if acreages change

If all of the mitigation within the Park is implemented (i.e. marsh, swamp, BLH-wet) as currently proposed, the field monitoring and reporting activities for the 3 groups of habitat mitigation could be combined. This would likely result in a fairly significant cost reduction vs. the independent monitoring/reporting activities for which cost estimates are presently provided.

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Table 9. Mitigation Monitoring Report Schedule and Costs for Fresh Marsh at JL1B4

Target Year	Work Item	Work Item Description	Estimated Cost
0	Begin Initial Construction	Start of mitigation construction activities	
1	Complete Initial Construction	Finish retention dikes, placement of dredged material	
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	
2	Begin Final Construction	Approx. 1 year after completion of initial construction. Area settles to target grade. Begin: degrading/gapping dikes; installing fish dips in rip-rap dikes as applicable; forming trenasses, interspersion features.	
	End Final Construction	Completion of activities above.	
	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	
	Analysis for Notice of Construction Complete	Review As-Builts and O&M manual.	
	NCC	Notice of Construction Complete issued to the Non-Federal Sponsor. The USACE will continue to monitor and conduct activities necessary to ensure initial success criteria are met.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas (during or at end of final construction).	
	Monitoring & Report	Perform field mitigation. Submit report by Dec. 31.	
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	
3	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in monitoring report.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	
	Monitoring & Report	Perform field mitigation. Submit report by Dec. 31.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	
	Analysis for satisfaction of initial success criteria.	Review monitoring report from prior year and other data to make determination to turn over project monitoring to Non-Federal Sponsor.	
4	**NFS Begins Monitoring**	Non-Federal Sponsor assumes monitoring responsibility in addition to other OMRR&R responsibilities (Feb. thru April?). Note: transfer of monitoring occurs early this year unless topographic corrections and/or marsh planting required.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000

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	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
5	Topographic Survey	Perform as-built topographic survey of restored marsh areas. Results documented in mitigation monitoring report.	$40,000
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$17,380
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
6	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
7	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
8	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
9	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
10	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
11	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
12	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
13	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas .	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
14	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
15	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000

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16	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
17	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
18	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
19	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
20	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
25	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
30	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
35	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
40	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
45	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210
	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
50	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in restored marsh areas.	$6,000
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$12,210

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	Review and Coordination	Review monitoring reports and other data and coordination as necessary.	$5000
		GRAND TOTAL	$581,600
		GRAND TOTAL (CONSTRUCTION + OMRR&R) + 15%	$668,840

NOTES:
JLNHPP marsh restoration features for Park/404c marsh mitigation presently include 1 feature occupying 20 acres (basis of revised costs).

If all of the mitigation within the Park is implemented (i.e. marsh, swamp, BLH-wet) as currently proposed, the field monitoring and reporting activities for the 3 groups of habitat mitigation could be combined. This would likely result in a fairly significant cost reduction vs. the independent monitoring/reporting activities for which cost estimates are presently provided.

The costs for topographic/as-built surveys needed for monitoring are NOT included in the cost for the "monitoring and report" events. See separate line item costs for this.

Proposed fresh marsh habitats will not be planted. These will require planting only if vegetation success criteria are not achieved
The contract to obtain plants for initial planting will need to be issued at least 13 to 14 months prior to the date that plants will be installed since the plants must be 1 year old at the time of installation (must start growing the plants at the nursery).

Jean Lafitte FS BLH-Wet Restoration project (JL14A)

Baseline Monitoring Report (First Monitoring Report)

The mitigation site would be monitored and a baseline monitoring report prepared after final construction is complete. See Table 10. Monitoring and reporting requirements for the baseline report include the following items:

A. A detailed discussion of all mitigation activities completed.

B. A description of the various features and habitats within the mitigation site.

C. A plan view drawing of the mitigation site showing the approximate boundaries of the mitigation features, monitoring plots, monitoring transect locations, sampling quadrats locations and photo station locations. Conceptual designs and locations of the monitoring plots, transects, photo stations, and staff gage locations are shown in Figure 3.The exact locations of the monitoring plot, transects, quadrats, photo stations, and staff gage locations will be determined during the initial site visit and the baseline monitoring event. Once finalized the final monitoring design will need to be coordinate with the USACE. If available aerial imagery of the mitigation site will also be included.

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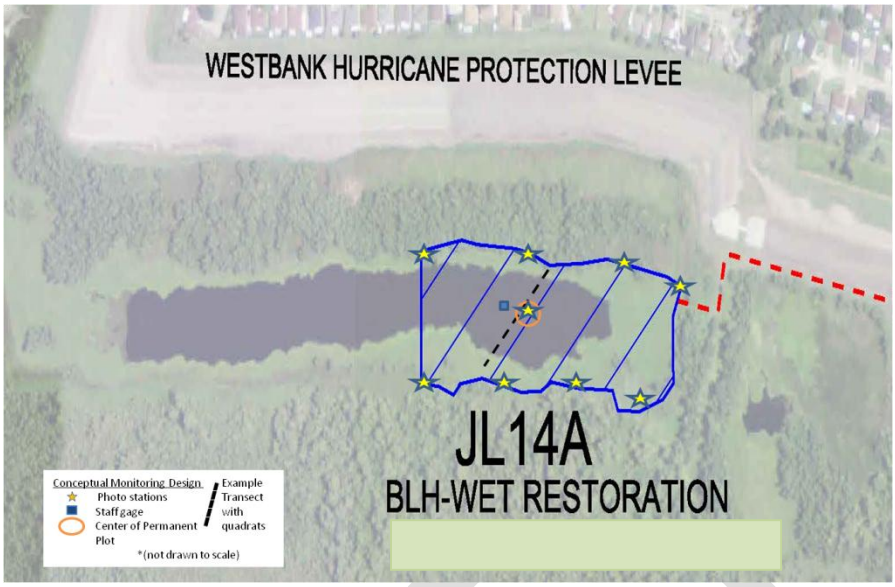

Figure 3. Mitigation Site JL14A Showing Conceptual Monitoring Plan Design

D. An as-built survey of surface elevations (topographic survey) of the project area would be conducted, along with an as-built survey of any construction as part of the specific mitigation features. Since the BLH habitat will be restored in existing open water areas of a borrow pit, the as-built survey must include a topographic survey of the entire restoration feature.

E. 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.

F. Photographs documenting conditions in the mitigation feature at the time of monitoring would be included. Photos would be taken at approximately 12 permanent photo stations within the mitigation feature. Preliminarily photo stations are planned at each of the 4 corners of the mitigation feature and along the outer boundaries of the mitigation feature. Four additional stations are planned to be placed east to west along the center of the project area. At least two photos would 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. See Figure 3.

G. Water level elevation readings would be collected at the time of monitoring from a single staff gauge. The monitoring report would provide the staff gauge data along with mean high and mean low water elevation data. The report would further address estimated mean high and mean low water elevations at the mitigation site based on field indicators. It is proposed that

the staff gauge be installed between the eastern and western limits of the project close to the mid-point along the northern limit of the project area so that it is accessible. See Figure 3 for the proposed location. The exact location of the proposed staff gauge would be determined during the initial site visit and the baseline monitoring event.

H. Various qualitative observations would be made in the mitigation site to help assess the status and success of mitigation and maintenance activities. These observations would 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; observations regarding general surface inundation indicators. General observations made during the course of monitoring would also address potential problem zones and other factors deemed pertinent to the success of the mitigation program.

I. 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.

J. 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 baseline/"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.

K. 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.

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

<u>Additional Monitoring Reports</u>

All monitoring reports generated after the initial baseline report would provide the following information unless otherwise noted:

M. All items listed for the baseline monitoring report with the exception of: (a) the topographic/as-built survey, unless additional topographic/as-built surveys are

available; (b) the inventory of planted species; although such an inventory must be provided in any monitoring report generated for a year in which a feature is re-planted to meet applicable success criteria.

N. Quantitative plant data collection and results. Methodology includes a combination of various sized plots for measuring the canopy, midstory, and understory/groundcover.

- Permanent Plots: 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. The permanent monitoring plots will be located within mitigation areas where initial planting of canopy and midstory species is necessary. A conceptual plan for siting the plot is provided as Figure 3, only one monitoring plot is proposed for the project site. It is proposed that the plot would be sited towards the middle of the project area and extends into existing BLH as much as possible. The exact location of the plot would be determined during the initial site visit and the baseline monitoring event. Whichever method is chosen for the initial monitoring report must be followed for all subsequent reports.

  - Data recorded in each permanent 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 the canopy stratum,
    - the wetland indicator status of each species the canopy stratum;
    - 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 midstory stratum,
    - and the wetland indicator status of each species midstory stratum;
    - 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).

  - Transects: 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. It is proposed that approximately 1-2 transects will be placed run diagonally across the project area extending into the existing BLH as much as possible. An example of the potential placement of a transect

is shown in Figure 3 (all required transects are not included). The methodology and transect location chosen for the initial monitoring report must be followed for all subsequent reports.

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 species present in the canopy and midstory strata (combined).

- Quadrats: Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive 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 methodology chosen for the initial monitoring report must be followed for all subsequent reports.

  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.

O. A summary of water elevation data (NAVD88 or current) collected from a water level recorder in the same immediate hydrologic area of the mitigation site. As determined by the USACE and the Interagency Team, if a nearby Coastwide Reference Monitoring System [CRMS] station is available, its data may be used. If no CRMS station is available, a data logger must be installed immediately adjacent to the project. Water level data will be collected to provide average annual mean, high and low water levels as determined by the USACE and the Interagency Team. Once hydrology success criteria

have been satisfied, water level 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 (e.g., wrack lines, water marks, etc.) and CRMS or other publicly available water level data in the same immediate hydrologic area.

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

Q. In addition to the above items, the monitoring report prepared upon completion of the final mitigation construction activities and the monitoring report prepared for 3 years following completion of final mitigation construction activities would include a topographic survey of each restoration feature. These surveys would cover the same components as described for the topographic survey conducted for the baseline monitoring report. In addition to the surveys themselves, each of the two monitoring reports involving topographic surveys would 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 would be made by USACE in coordination with the Interagency Team and NFS.

R. 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.

Monitoring Reports Involving Timber Management Activities

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. If timber management activities are 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).

Monitoring Reports Following Re-Planting Activities

Re-planting of certain areas within the restored habitat 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 or those planted, as applicable, cross-referenced to a listing of the species and number of each species planted in each area.

Monitoring Schedule and Responsibilities

Monitoring for BLH-Wet 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. See Table 10 for a schedule of the currently proposed monitoring events.

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

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

Monitoring events associated with the above will include the first or baseline monitoring event plus annual monitoring events thereafter until the monitoring responsibilities are transferred to the NFS. The NFS will be responsible for conducting the required monitoring events and preparing the associated monitoring reports 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 2C (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 criteria 2B), 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 2C), 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.

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.

Table 10 also provides a cost estimate based on the currently available information and may need to be revised in the future as additional information regarding the mitigation feature designs and construction schedule become available.

Table 10. Mitigation Monitoring Report Schedule and Costs for BLH at JL14A

Target Year	Work Item	Work Item Description	Estimated Cost
0	Begin Initial Construction	Start of mitigation construction activities	
1	Complete Initial Construction	Finish retention dikes (as applicable), placement of dredged/fill material	
	CNWB Nesting Abatement	Field work to prevent colonial-nesting wading birds from nesting during construction.	
2	Begin Final Construction	Degrading/gapping dikes as applicable; install weirs as applicable; forming trenasses as applicable.	

	CNWB Nesting Abatement	Field work to prevent colonial-nesting wading birds from nesting during construction.	
	Topographic/As-Built Survey	Perform as-built topographic survey of restored features. Includes survey of any structures installed. Results documented in mitigation monitoring report.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Initial Plantings	Initial (first) planting of restored features. Install canopy and midstory species.	
	Nutria guards	Install nutria guards for all initial plantings	
	End Final Construction	Completion of activities above.	
3	Topographic Survey	Perform as-built topographic survey of restored features. Results documented in mitigation monitoring report.	
	Analysis for Notice of Construction Complete	Review As-Builts and O&M manual.	
	NCC	Notice of Construction Complete issued to the Non-Federal Sponsor. The USACE will continue to monitor and conduct activities necessary to ensure initial success criteria are met	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	
	Analysis for satisfaction of initial success criteria.	Review monitoring report from prior year and other data to make determination to completely turn over project to Non-Federal Sponsor. (Jan.)	
4	**NFS Begins Monitoring**	Non-Federal Sponsor assumes monitoring responsibilities in addition to other OMRR&R responsibilities (Feb. thru April?). Note: transfer of monitoring occurs early this year unless topographic corrections and/or marsh planting required.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$11,800

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	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
5	Additional Plantings*	Re-plant restoration features where plant survival success criteria not achieved.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report*	Perform field mitigation monitoring. Submit report by Dec. 31. This monitoring required only if area had to be replanted in TY5 per success criteria requirements.	$10,620
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
6	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report*	Perform field mitigation monitoring. Submit report by Dec. 31. This monitoring required only if area had to be replanted in TY5 per success criteria requirements.	$10,000
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
7	Aerial Photography	Obtain rectified aerial photo of restoration features if available. Provide as part of mitigation monitoring report.	
	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$10,000
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
8	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000

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10	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
12	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
17	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
22	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
27	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
32	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000

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37	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
42	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
47	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
52	Invasive/Nuisance Plant Eradication	Eradicate invasive plant species in mitigation features. Ground application.	$1,600
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$8,500
	Review and Coordination	Review monitoring reports and other data as compared to success criteria. Coordination with Interagency team as needed.	$5,000
		GRAND TOTAL (CONSTRUCTION + OMRR&R)	$321,464
		GRAND TOTAL (CONSTRUCTION + OMRR&R) + 25%	$401,830

*The costs for topographic/as-built surveys needed for monitoring are NOT included in the cost for the "monitoring and report" events.

*Cost for initial plantings should already be in Engineering's cost estimate; thus not repeated herein.
*Assume mitigation features will require 1 re-planting event to meet vegetation success criteria. For cost, assume that 20% of the total quantity of plants used in the initial planting will be the quantity needed for re-planting.
* A total of 8 acres were used to develop cost estimates, revisions may be needed if acreages change.
* If all of the mitigation within the Park is implemented (i.e. marsh, swamp, BLH-wet) as currently proposed, the field monitoring and reporting activities for the 3 groups of habitat mitigation could be combined. This would likely result in a fairly significant cost reduction vs. the independent monitoring/reporting activities for which cost estimates are presently provided.

*The contract to obtain plants for initial planting will need to be issued at least 13 to 14 months prior to the date that plants will be installed since the plants must be 1 year old at the time of installation (must start growing the plants at the nursery).

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Jean Lafitte FS Swamp Enhancement project (JL7)

<u>Baseline Monitoring Report (First Monitoring Report)</u>

Shortly after completion of all initial mitigation activities, the mitigation site will be monitored and a baseline or monitoring report will be prepared. See Table 11. Monitoring and reporting requirements for the baseline report include the following items:

A. A detailed discussion of all mitigation activities completed.

B. A description of the various features and habitats within the mitigation site.

C. A plan view drawing of the mitigation site showing the approximate boundaries of different mitigation features (ex. topographic features, spoil bank gaps, etc.), monitoring transect locations, sampling plot locations, photo stations, and staff gage locations. A map showing proposed areas of interest is included as Figure 4. The exact locations will be determined during the initial site visit and the baseline monitoring event. Once determined the final monitoring design will need to be coordinate with the USACE. If available aerial imagery of the mitigation site will also be included.

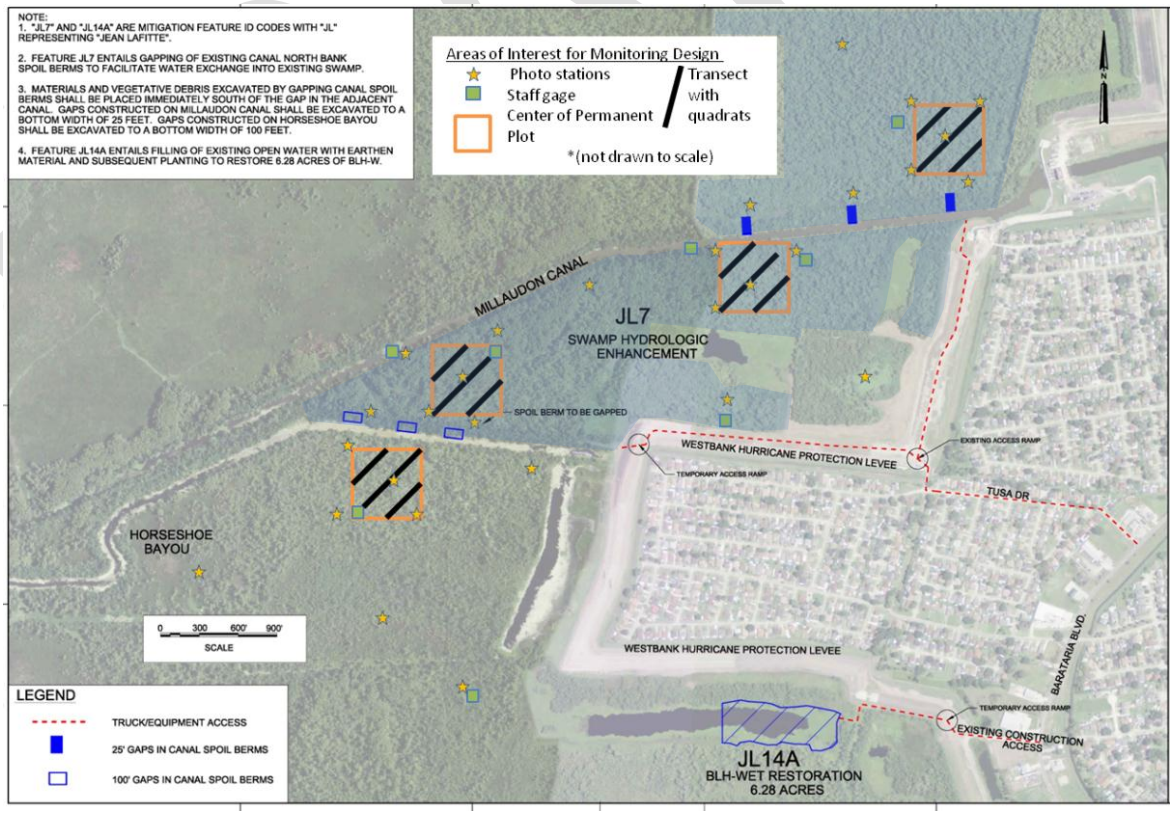

Figure 4. Mitigation Site (Feature JL7) depicting areas of interest to consider when selecting final locations for photo stations, gages, permanent monitoring plots, transects and quadrats as part of the monitoring plan design

D. An as-built survey of topographic alterations (i.e. berms/spoil banks) including cross-sections of the features sufficient to represent typical conditions.

E. Photographs documenting conditions in the mitigation site at the time of monitoring would be included. Photos will be taken at permanent photo stations within the mitigation site. At least four photos will be taken at each station with the view of each photo always oriented north, south, east and west. The locations of the permanent photo stations will be determined during the first site visit and coordinated with the USACE. Potential locations of interest for the photo stations are identified on Figure 4. The stations will primarily be established in areas where the hydrologic changes are expected (i.e. near gapping of existing spoil banks and expected new locations of sheetflow) but stations will also be placed within the permanent plots and throughout the project area to document conditions and changes during the monitoring period. Minimally photo stations will be placed in the center of the permanent plots, along transects lines and areas of topographic alterations.

F. 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.

G. 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.

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

I. Quantitative plant data collected from permanent monitoring plots measuring approximately 90 feet X 90 feet in size. The permanent monitoring plots will typically be located within mitigation areas where hydrologic enhancement is expected to take place and in areas where changes in hydrology are expected.

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See Figure 4 for potential areas for locating the monitoring plots based on the current understanding of the expected hydrologic benefits and extent. The final locations will be determined and documented during the initial site visit and baseline monitoring report. 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).

J. Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive plant species will be gathered from permanent <u>sampling quadrats nested within the permanent monitoring plots</u> 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.

K. 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 preferred methodology and locations will be

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coordinated with the USACE and will be documented and followed for all subsequent reports.

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 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).

L. Quantitative data concerning plants in the understory (ground cover) stratum and concerning invasive 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. The methodology chosen for the initial monitoring report must be followed for all subsequent reports. Each sampling quadrat will be approximately 2 meters X 2 meters in size. The total number of sampling quadrats needed to adequately measure the success criteria will be coordinated with the USACE.

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.

M. 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.

Additional Monitoring Reports

All monitoring reports generated after the initial baseline report will include the following information unless otherwise noted:

N. All items listed for the time zero baseline monitoring report.

O. 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.

P. Although not proposed as part of the initial construction of the mitigation feature, in the future planting of certain areas within the mitigation site may be necessary to ensure attainment of applicable native vegetation success criteria and implemented under Contingency Management (See Appendix E). Any monitoring report submitted following completion of a planting event must include a detailed 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.

Q. A summary of water elevation data (NAVD88 or current) collected from a water level recorder hydrologically connected to Millaudon and Horseshoe canals adjacent to the gaps [e.g. a Coastwide Reference Monitoring System (CRMS) station], from a water level recorder installed within the swamp feature adjacent to the gaps and from staff gages in and adjacent to the swamp feature. Water level data will be collected to provide average annual mean, high and low water levels as determined by the USACE and the Interagency Team. The purpose is to 1) document increased flow and hydrologic connectivity after construction of gaps and 2) monitor the swamp hydrology against the optimal swamp hydrology as previously outlined in Appendix L of PIER 37 and summarized below:

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.

The following provides some general hydrologic guidelines for mitigation projects involving swamp enhancement. 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.

- 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).
- 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.
- 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).

MITIGATION MONITORING SCHEDULE, RESPONSIBILITIES AND COSTS

Monitoring for swamp 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. See Table 11 for a schedule of the currently proposed monitoring events. The timing of these events may be modified or shifted once the final project design and construction schedule have been identified.

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 – 1A
2. Native Vegetation – 2A.
3. Topography – 4A.
4. Hydrology – 6A.

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. 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.B (native vegetation criterion) must be demonstrated. Thereafter, monitoring will typically be conducted every 5 years throughout the 50-year period of analysis. See Table 11 for a schedule of the currently proposed monitoring events. The timing of these events may be modified or shifted once the final project design and construction schedule have been identified.

If the vegetative success criterion 2.A, is not achieved a monitoring report will be required for each consecutive year until two annual sequential reports indicate that all 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 criterion 2.B are not achieved (i.e. native vegetation success), 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.

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 construction, 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.

Table 11 also provides a cost estimate based on the currently available information and may need to be revised in the future as additional information regarding mitigation feature designs and the construction schedule becomes available. Additional cost savings may be found when combining the monitoring of the adjoining BLH-Wet (JL14a site).

Table 11. Mitigation Monitoring Report Schedule and Costs for Swamp Restoration at the JL7 Site

Target Year	Work Item	Work Item Description	Estimated Cost
0	Begin Construction	Start of mitigation construction activities	

	CNWB Nesting Abatement	Field work to prevent colonial-nesting wading birds from nesting during construction.	
1	Complete Construction	Gapping and disposal of gap material. Installation of water level logger.	
	Topographic/As-Built Survey	Perform as-built topographic survey of restored features. Includes survey of any structures installed. Results documented in mitigation monitoring report.	
2	Analysis for Notice of Construction Complete	Review As-Builts and O&M manual.	
	NCC	Notice of Construction Complete issued to the Non-Federal Sponsor. The USACE will continue to monitor and conduct activities necessary to ensure initial success criteria are met.	
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	
3	Topographic Survey	Perform as-built topographic survey of restored features. Results documented in mitigation monitoring report.	
	Analysis for satisfaction of initial success criteria.	Review monitoring report from prior year and other data to make determination to completely turn over project to Non-Federal Sponsor. (Jan.)	
	NFS Begins Monitoring	Non-Federal Sponsor assumes monitoring responsibilities in addition to other OMRR&R responsibilities (Feb. thru April?). Note: transfer of monitoring occurs early this year unless topographic corrections and/or marsh planting required.	
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$33,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
4	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$33,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
5	Monitoring & Report*	Perform field mitigation monitoring. Submit report by Dec. 31. This monitoring required only if area had to be planted in TY5 per success criteria requirements.	$33,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
6	Monitoring & Report*	Perform field mitigation monitoring. Submit report by Dec. 31. This monitoring required only if area had to be replanted in TY5 per success criteria requirements.	$27,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
7	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$40,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
8	Analysis for Notice of Transfer	Review monitoring report from prior year and other data to make determination to turn over project monitoring to Non-Federal Sponsor.	$4,200

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	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
10	Adaptive Management if neeeded -Invasive/Nuisance Plant Eradication	Eradicate invasive and nuisance plant species in mitigation features. Ground application.	$17,200
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
12	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
17	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$25,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
22	Adaptive Management if neeeded -Invasive/Nuisance Plant Eradication	Eradicate invasive and nuisance plant species in mitigation features (April or May). Ground application.	$17,200
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
27	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
32	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Adaptive Management if neeeded -Invasive/Nuisance Plant Eradication	Eradicate invasive and nuisance plant species in mitigation features (April or May). Ground application.	$17,200
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
37	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
42	Adaptive Management if neeeded -Invasive/Nuisance Plant Eradication	Eradicate invasive and nuisance plant species in mitigation features. Ground application.	$17,200
	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
47	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
52	Adaptive Management if neeeded -Invasive/Nuisance Plant Eradication	Eradicate invasive and nuisance plant species in mitigation features. Ground application.	$17,200

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	Monitoring & Report	Perform field mitigation monitoring. Submit report by Dec. 31.	$22,000
	Review and Coordination	Review monitoring reports and other data as compared to success critieria. Coordination with Interagency team as needed.	$5,000
		Total Cost during OMRR&R Phase (after NFS begins monitoring)	$342,000
		Total Cost during OMRR&R Phase (after NFS begins monitoring) + 25%	$427,500

ADDITIONAL REFERENCE DOCUMENT FOR MONITORING

All project monitoring would follow the procedures detailed within this monitoring plan with support from with the procedures outlined in the following document if additional information is needed: A Standard Operating Procedures Manual for the Coast-wide Reference Monitoring System (CRMS) – Wetlands: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control, prepared by the Louisiana Coastal Protection and Restoration Authority, January 27, 2012. The referenced document is specific to coastal Louisiana wetlands and provides very detailed methodology for conducting field collections. The detailed methods provided in the CRMS Standard Operating Procedures Manual are incorporated by reference and are intended to supplement as needed but not replace the procedures documented within this monitoring plan.

DEFINITION OF TERMS

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.

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 Coastal Protection and Restoration Authority, and Louisiana Department of Natural Resources.

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.

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*). If any additional invasive species are identified by the USACE, State of Louisiana, or the NPS during the 50 year monitoring period, these species would be added to the list for eradication and control within the mitigation sites.

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.

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).

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 NFS and Interagency Team.

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.

Target Year
This document often refers to a "Target Year". Target Years are the years in which construction or monitoring activities are expected to occur, based on Target Year 1 as the year in which the initial mitigation construction activities are anticipated to be completed, which is presently estimated to occur in calendar year 2016. Target Year 2 (2017) is the year in which the final construction contract is expected to be completed. Target years increase from this time forward in concert with the corresponding calendar year.

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 the current National Wetland Plant List, available at http://wetland_plants.usace.army.mil/, using the Region 2 listing contained therein.

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Appendix E

Contingency Management Plan

APPENDIX E

CONTINGENCY MANAGEMENT PLAN

TIERED INDIVIDUAL ENVIRONMENTAL REPORT

JEAN LAFITTE NATIONAL HISTORIC PARK AND PRESERVE MITIGATION FEATURES
PIER 37, TIER 1

1.0. Introduction

This Contingency Management (CM) Plan is for the Jean Lafitte National Park mitigation features covered under the PIER 37, TIER 1. The projects are designed to mitigate for impacts to BLH wet, swamp and fresh marsh on Park/404c lands and other general flood side impacts resulting from construction of the WBV component of the Hurricane and Storm Damage Risk Reduction System (HSDRRS). The Water Resources Development Act (WRDA) of 2007, Section 2036(a) and U.S Army Corps of Engineers (USACE) implementation guidance for Section 2036(a) (CECW-PC Memorandum dated August 31, 2009: "Implementation Guidance for Section *2036 (a) of the Water Resources Development Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetland Losses*") requires adaptive management and monitoring plans be included in all mitigation plans for fish and wildlife habitat and wetland losses. Full descriptions of the mitigation features are included in the PIER 37, TIER 1.

2.0. Adaptive Management Planning

Initial adaptive management planning was conducted during the planning process for the (PIER) 37 and was reviewed and revised for TIER. Adaptive management planning elements included: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management Plan is a living document and will be refined as necessary.

2.1. Conceptual Ecological Model

A CEM was developed to identify the major stressors and drivers affecting the proposed mitigation projects under PIER 37, TIER 1 (see Table 1). The CEM does not attempt to explain all possible relationships of potential factors influencing the mitigation sites; rather, the CEM presents only those relationships and factors deemed most relevant to obtaining the required acres/average annual habitat units (AAHUs). Furthermore this CEM represents the current understanding of these factors and will be updated and modified, as necessary, as new information becomes available. Stressors and Drivers identified in the CEM were identified during the PIER and TIER Alternative Evaluation Process (AEP) process to evaluate relative risks associated with each mitigation alternative.

Table 1. Conceptual Ecological Model

Alternatives/Issues/Drivers	Flood Side Park/404c BLH Wet (JL14A)	Flood Side Park/404c Swamp (JL7)	Park/404c and general Flood Side Fresh Marsh (JL1B4 & JL1B5)	Flood side Fresh Marsh (JL15)
Freshwater Input	+/-	+/-	+/-	+/-
Salinity Impacts	+/-	+/-	+/-	+/-
Elevation/Subsidence	-	-	-	-
Sea Level Rise	-	-	-	-
Runoff	-	-	-	-
Wave Action	-	-	-	-
Storm Surge	-	-	-	-
Vegetative Invasive Species	-	-	-	-
Herbivory	-	-	-	-
Hydrology (water table; wet/dry days; soil inundation)	+/-	+/-	+/-	+/-

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

2.2. Sources of Uncertainty and Associated Risks

A fundamental tenet underlying adaptive management is decision making and achieving desired project outcomes in the face of uncertainties. There are many uncertainties associated with restoration of the coastal systems. The project delivery team identified the following uncertainties during the planning process.

A. Climate change, such as relative sea level rise, drought conditions, and variability of tropical storm frequency, intensity, and timing
B. Subsidence and water level trends at the mitigation sites
C. Uncertainty Relative to Achieving Ecological Success:
    i. Water, sediment, and nutrient requirements for BLH Wet, Swamp and Marsh
    ii. Magnitude and duration of wet/dry cycles for BLH Wet and Swamp
    iii. Nutrients required for desired productivity for BLH Wet, Swamp and Marsh
    iv. Growth curves based on hydroperiod and nutrient application for BLH Wet, Swamp and Marsh
    v. Tree and marsh litter production based on nutrient and water levels for BLH Wet and Swamp
    vi. Tree propagation in relation to management/regulation of hydroperiod for BLH Wet and Swamp
D. Loss rate of vegetative plantings due to herbivory
E. Long-Term Sustainability of Project Benefits

2.3. Adaptive Management Evaluation

As part of PIER 37, TIER 1, the project sites were evaluated and planned through the AEP to develop a project with minimal risk and uncertainty. The items listed below were incorporated into the mitigation project implementation plan and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) plans to minimize project risks.

- Specified success criteria (i.e., mitigation targets)
- Detailed planting guidelines for BLH Wet, Swamp and Fresh Marsh
- Invasive species control for BLH Wet and Fresh Marsh
- Supplementary plantings as necessary (contingency)
- Corrective actions to meet topographic and hydrologic success as required (contingency)

Subsequently, as part of the adaptive management planning effort the mitigation project features were re-evaluated against the CEM and sources of uncertainty and risk were identified to determine if there was any need for additional adaptive management actions.

Based on the uncertainties and risks associated with the project implementation the following contingency/adaptive management actions have been identified to be implemented if needed to address the identified uncertainties and better ensure the required AAHUs are met.

Potential Action #1. Additional vegetative plantings as needed to meet identified success criteria.

Uncertainties addressed: A, B, C, D, E

Potential Action #2. Renourishment of mitigation sites by adding sediment or degrading of mitigation sites to obtain elevations necessary for specified vegetative establishment and maintenance. This could be applicable to the BLH-wet, swamp or marsh sites.

Uncertainties addressed: A, B, C, E

Potential Action #3. Potential need to adjust the gapping in the spoil banks or permanent dikes in the future to maintain sufficient hydrology and connectivity.

Uncertainties addressed: A, B, C, E

Potential Action #4. Invasive species control to ensure survival of native species and meet required success criteria.

Uncertainties addressed: E

Actions 1 is not recommended as separate adaptive management actions for the BLH and marsh sites since they are already built into the mitigation plan and success criteria. In the event that monitoring reveals the project does not meet the identified vegetation success criteria, additional plantings would be conducted under the mitigation project. Actions 1 is recommended as separate adaptive management actions for the Swamp Enhancement project since additional plantings are not included in the mitigation plan. The cost for Action 1 at the JL7 Swamp Enhancement site is estimated at $65,000.

Actions 2 & 3 are not recommended as separate adaptive management actions since they are already built into the mitigation plan and success criteria. In the event that monitoring reveals the project does not meet the identified topographic, or hydrologic success criteria, additional construction activities would be conducted under the mitigation project, thus a separate Adaptive Management action would not be needed.

Specific measures to implement Actions 2 if determined necessary to achieve project benefits, would be coordinated with the NFS and other agencies to determine the appropriate course of action. If it is determined that the project benefits are significantly compromised because of improper elevation, additional fill material may need to be pumped into or removed from the project area. Actions 2 and 3 are obviously potentially very costly actions. Before implementing such an action, the Corps would coordinate with the NFS and other agencies to determine if other actions, such as purchasing of credits in a mitigation bank or building additional marsh mitigation elsewhere, would be more cost-effective options to fulfill any shortfalls in the overall project success.

Action 4 is not recommended as separate adaptive management actions for BLH or marsh project sites since it is are already built into the mitigation plan and success criteria, it is however recommended as an Adaptive Management under the Swamp Enhancement project (JL7) since it is not incorporated into the success criteria.

Under Action 4 the USACE, in cooperation with the Interagency Team, may determine that removal of invasive species at JL7 is warranted to maintain or enhance the ecological value of the swamp site, if monitoring reports document increased invasive species coverage as compared to the baseline conditions and invasive species are negatively impacting the success of native species. The cost for Action 4 is estimated at approximately $20,000 per event with an assumed need of 5 events over the project life.

The USACE would be responsible for the proposed mitigation construction and monitoring until the initial success criteria are met. Initial construction and monitoring would be funded in accordance with all applicable cost-share agreements with the NFS. The USACE would monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive/nuisance plant species control, and/or plantings are necessary to achieve initial mitigation success criteria. Once the USACE determines that the mitigation has met the initial success criteria, monitoring would be performed by the NFS as part of its OMRR&R obligations. If after meeting

initial success criteria, the mitigation fails to meet its intermediate and/or long-term ecological success criteria, the USACE would consult with other agencies and the NFS to determine the appropriate management or remedial actions required to achieve ecological success. The USACE would retain the final decision on whether or not the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If structural changes are deemed necessary to achieve ecological success, the USACE would implement appropriate adaptive management measures in accordance with the contingency plan and subject to cost-sharing requirements, availability of funding, and current budgetary and other guidance.

Appendix F

Abbreviations

APPENDIX F

ABBREVIATIONS

AAHU	Average Annual Habitat Units
AM	Adaptive Management
BARA	Barataria Preserve
BLH-Dry	Bottomland Hardwood Dry
BLH-Wet	Bottomland Hardwood Wet
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
CFR	Code of Federal Regulations
CIAP	Coastal Impact Assistance Program
CPRA	Coastal Protection and Restoration Authority
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
dB	Decibel
dBA	Weighted Decibel
DNL	Day-Night Average Sound Level
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
°F	Fahrenheit
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
HSDRRS	Hurricane and Storm Damage Risk Reduction System
HTRW	Hazardous, Toxic, or Radioactive Waste
IER	Individual Environmental Report
JELA	Jean Lafitte National Historical Park and Preserve
LA	Louisiana
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LDEQ	Louisiana Department of Environmental Quality
LPV	Lake Pontchartrain and Vicinity
L&WCF	Land and Water Conservation Fund
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor

NMFS	National Marine Fisheries Service
NOV	New Orleans to Venice
NPS	National Park Service
PDT	Project Delivery Team
PIER	Programmatic Individual Environmental Report
PL	Public Law
ppt	Parts per Thousand
PM	Particulate Matter
PS	Protected Side
RSLR	Relative Sea Level Rise
SAV	Submerged Aquatic Vegetation
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SHPO	State Historic Preservation Office
TSMP	Tentatively Selected Mitigation Project
USACE	United States Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
WBV	West Bank and Vicinity
WMA	Wildlife Management Area
WRDA	Water Resources Development Act
WVA	Wetland Value Assessment

Appendix G

Supporting Documents

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National Bald Eagle Management Guidelines

Standard Protection Measures for the West Indian Manatee

NATIONAL BALD EAGLE MANAGEMENT GUIDELINES

U.S. Fish and Wildlife Service

May 2007

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INTRODUCTION

The bald eagle (*Haliaeetus leucocephalus*) is protected by the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). The MBTA and the Eagle Act protect bald eagles from a variety of harmful actions and impacts. The U.S. Fish and Wildlife Service (Service) developed these National Bald Eagle Management Guidelines to advise landowners, land managers, and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities. A variety of human activities can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young. The Guidelines are intended to help people minimize such impacts to bald eagles, particularly where they may constitute "disturbance," which is prohibited by the Eagle Act.

The Guidelines are intended to:

(1) Publicize the provisions of the Eagle Act that continue to protect bald eagles, in order to reduce the possibility that people will violate the law,

(2) Advise landowners, land managers and the general public of the potential for various human activities to disturb bald eagles, and

(3) Encourage additional nonbinding land management practices that benefit bald eagles (see Additional Recommendations section).

While the Guidelines include general recommendations for land management practices that will benefit bald eagles, the document is intended primarily as a tool for landowners and planners who seek information and recommendations regarding how to avoid disturbing bald eagles. Many States and some tribal entities have developed state-specific management plans, regulations, and/or guidance for landowners and land managers to protect and enhance bald eagle habitat, and we encourage the continued development and use of these planning tools to benefit bald eagles.

Adherence to the Guidelines herein will benefit individuals, agencies, organizations, and companies by helping them avoid violations of the law. However, the Guidelines themselves are not law. Rather, they are recommendations based on several decades of behavioral observations, science, and conservation measures to avoid or minimize adverse impacts to bald eagles.

The U.S. Fish and Wildlife Service strongly encourages adherence to these guidelines to ensure that bald and golden eagle populations will continue to be sustained. The Service realizes there may be impacts to some birds even if all reasonable measures are taken to avoid such impacts. Although it is not possible to absolve individuals and entities from liability under the Eagle Act or the MBTA, the Service exercises enforcement discretion to focus on those individuals, companies, or agencies that take migratory birds without regard for the consequences of their actions and the law, especially when conservation measures, such as these Guidelines, are available, but have not been implemented. The Service will prioritize its enforcement efforts to focus on those individuals or entities who take bald eagles or their parts, eggs, or nests without implementing appropriate measures recommended by the Guidelines.

The Service intends to pursue the development of regulations that would authorize, under limited circumstances, the use of permits if “take” of an eagle is anticipated but unavoidable. Additionally, if the bald eagle is delisted, the Service intends to provide a regulatory mechanism to honor existing (take) authorizations under the Endangered Species Act (ESA).

During the interim period until the Service completes a rulemaking for permits under the Eagle Act, the Service does not intend to refer for prosecution the incidental “*take*” of any bald eagle under the MBTA or Eagle Act, if such take is in full compliance with the terms and conditions of an incidental take statement issued to the action agency or applicant under the authority of section 7(b)(4) of the ESA or a permit issued under the authority of section 10(a)(1)(B) of the ESA.

The Guidelines are applicable throughout the United States, including Alaska. The primary purpose of these Guidelines is to provide information that will minimize or prevent violations only of *Federal* laws governing bald eagles. In addition to Federal laws, many states and some smaller jurisdictions and tribes have additional laws and regulations protecting bald eagles. In some cases those laws and regulations may be more protective (restrictive) than these Federal guidelines. If you are planning activities that may affect bald eagles, we therefore recommend that you contact both your nearest U.S. Fish and Wildlife Service Field Office (see the contact information on p.16) and your state wildlife agency for assistance.

LEGAL PROTECTIONS FOR THE BALD EAGLE

The Bald and Golden Eagle Protection Act

The Eagle Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who “take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof.” The Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” “Disturb’’ means:

> "Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle=s return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

A violation of the Act can result in a criminal fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

The Migratory Bird Treaty Act
The MBTA (16 U.S.C. 703-712), prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted by regulation. The MBTA was enacted in 1918; a 1972 agreement supplementing one of the bilateral treaties underlying the MBTA had the effect of expanding the scope of the Act to cover bald eagles and other raptors. Implementing regulations define "take" under the MBTA as "pursue, hunt, shoot, wound, kill, trap, capture, possess, or collect."

Copies of the Eagle Act and the MBTA are available at: http://permits.fws.gov/ltr/ltr.shtml.

State laws and regulations
Most states have their own regulations and/or guidelines for bald eagle management. Some states may continue to list the bald eagle as endangered, threatened, or of special concern. If you plan activities that may affect bald eagles, we urge you to familiarize yourself with the regulations and/or guidelines that apply to bald eagles in your state. Your adherence to the Guidelines herein does not ensure that you are in compliance with state laws and regulations because state regulations can be more specific and/or restrictive than these Guidelines.

NATURAL HISTORY OF THE BALD EAGLE

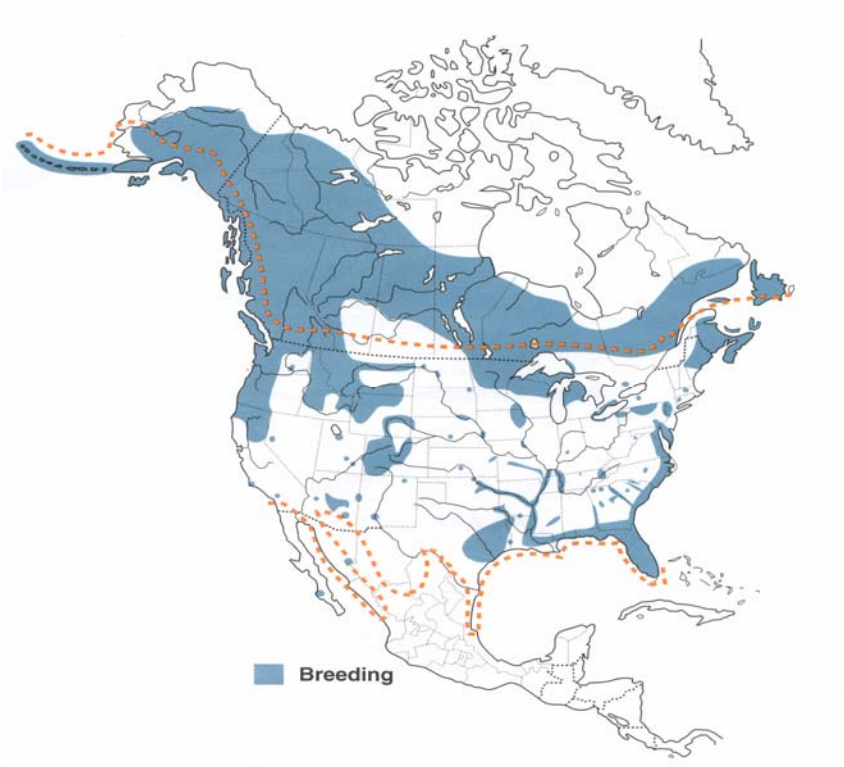
Bald eagles are a North American species that historically occurred throughout the contiguous United States and Alaska. After severely declining in the lower 48 States between the 1870s and the 1970s, bald eagles have rebounded and re-established breeding territories in each of the lower 48 states. The largest North American breeding populations are in Alaska and Canada, but there are also significant bald eagle populations in Florida, the Pacific Northwest, the Greater Yellowstone area, the Great Lakes states, and the Chesapeake Bay region. Bald eagle distribution varies seasonally. Bald eagles that nest in southern latitudes frequently move northward in late spring and early summer, often summering as far north as Canada. Most eagles that breed at northern latitudes migrate southward during winter, or to coastal areas where waters remain unfrozen. Migrants frequently concentrate in large numbers at sites where food is abundant and they often roost together communally. In some cases, concentration areas are used year-round: in summer by southern eagles and in winter by northern eagles.

Juvenile bald eagles have mottled brown and white plumage, gradually acquiring their dark brown body and distinctive white head and tail as they mature. Bald eagles generally attain adult plumage by 5 years of age. Most are capable of breeding at 4 or 5 years of age, but in healthy populations they may not start breeding until much older. Bald eagles may live 15 to 25 years in the wild. Adults weigh 8 to 14 pounds (occasionally reaching 16 pounds in Alaska) and have wingspans of 5 to 8 feet. Those in the northern range are larger than those in the south, and females are larger than males.

Where do bald eagles nest?

Breeding bald eagles occupy "territories," areas they will typically defend against intrusion by other eagles. In addition to the active nest, a territory may include one or more alternate nests (nests built or maintained by the eagles but not used for nesting in a given year). The Eagle Act prohibits removal or destruction of both active and alternate bald eagle nests. Bald eagles exhibit high nest site fidelity and nesting territories are often used year after year. Some territories are known to have been used continually for over half a century.

Bald eagles generally nest near coastlines, rivers, large lakes or streams that support an adequate food supply. They often nest in mature or old-growth trees; snags (dead trees); cliffs; rock promontories; rarely on the ground; and with increasing frequency on human-made structures such as power poles and communication towers. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest that can weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water where the eagles usually forage. Shoreline trees or snags located in reservoirs provide the visibility and accessibility needed to locate aquatic prey. Eagle nests are constructed with large sticks, and may be lined with moss, grass, plant stalks, lichens, seaweed, or sod. Nests are usually about 4-6 feet in diameter and 3 feet deep, although larger nests exist.



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The range of breeding bald eagles in 2000 (shaded areas). This map shows only the larger concentrations of nests; eagles have continued to expand into additional nesting territories in many states. The dotted line represents the bald eagle's wintering range.

When do bald eagles nest?

Nesting activity begins several months before egg-laying. Egg-laying dates vary throughout the U.S., ranging from October in Florida, to late April or even early May in the northern United States. Incubation typically lasts 33-35 days, but can be as long as 40 days. Eaglets make their first unsteady flights about 10 to 12 weeks after hatching, and fledge (leave their nests) within a few days after that first flight. However, young birds usually remain in the vicinity of the nest for several weeks after fledging because they are almost completely dependent on their parents for food until they disperse from the nesting territory approximately 6 weeks later.

The bald eagle breeding season tends to be longer in the southern U.S., and re-nesting following an unsuccessful first nesting attempt is more common there as well. The following table shows the timing of bald eagle breeding seasons in different regions of the country. The table represents the range of time within which the majority of nesting activities occur in each region and does not apply to any specific nesting pair. Because the timing of nesting activities may vary within a given region, you should contact the nearest U.S. Fish and Wildlife Service Field Office (see page 16) and/or your state wildlife conservation agency for more specific information on nesting chronology in your area.

Chronology of typical reproductive activities of bald eagles in the United States.

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.
SOUTHEASTERN U.S. (FL, GA, SC, ~~NC~~, AL, MS, LA, TN, KY, AR, eastern 2 of TX)											
Nest Building											
	Egg Laying/Incubation										
		Hatching/Rearing Young									
					Fledging Young						
CHESAPEAKE BAY REGION (NC, VA, MD, DE, southern 2 of NJ, eastern 2 of PA, panhandle of WV)											
		Nest Building									
				Egg Laying/Incubation							
					Hatching/Rearing Young						
								Fledging Young			
NORTHERN U.S. (ME, NH, MA, RI, CT, NY, northern 2 of NJ, western 2 of PA, OH, WV exc. panhandle, IN, IL, MI, WI, MN, IA, MO, ND, SD, NB, KS, CO, UT)											
			Nest Building								
					Egg Laying/Incubation						
						Hatching/Rearing Young					
									Fledging Young		
PACIFIC REGION (WA, OR, CA, ID, MT, WY, NV)											
				Nest Building							
					Egg Laying/Incubation						
						Hatching/Rearing Young					
									Fledging Young		
SOUTHWESTERN U.S. (AZ, NM, OK panhandle, western 2 of TX)											
		Nest Building									
				Egg Laying/Incubation							
					Hatching/Rearing Young						
								Fledging Young			
ALASKA											
					Nest Building						
							Egg Laying/Incubation				
								Hatching/Rearing Young			
Ing Young											Fledg-
Sept.	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**Aug.**

How many chicks do bald eagles raise?
The number of eagle eggs laid will vary from 1-3, with 1-2 eggs being the most common. Only one eagle egg is laid per day, although not always on successive days. Hatching of young occurs on different days with the result that chicks in the same nest are sometimes of unequal size. The overall national fledging rate is approximately one chick per nest, annually, which results in a healthy expanding population.

What do bald eagles eat?
Bald eagles are opportunistic feeders. Fish comprise much of their diet, but they also eat waterfowl, shorebirds/colonial waterbirds, small mammals, turtles, and carrion. Because they are visual hunters, eagles typically locate their prey from a conspicuous perch, or soaring flight, then swoop down and strike. Wintering bald eagles often congregate in large numbers along streams to feed on spawning salmon or other fish species, and often gather in large numbers in areas below reservoirs, especially hydropower dams, where fish are abundant. Wintering eagles also take birds from rafts of ducks at reservoirs and rivers, and congregate on melting ice shelves to scavenge dead fish from the current or the soft melting ice. Bald eagles will also feed on carcasses along roads, in landfills, and at feedlots.

During the breeding season, adults carry prey to the nest to feed the young. Adults feed their chicks by tearing off pieces of food and holding them to the beaks of the eaglets. After fledging, immature eagles are slow to develop hunting skills, and must learn to locate reliable food sources and master feeding techniques. Young eagles will congregate together, often feeding upon easily acquired food such as carrion and fish found in abundance at the mouths of streams and shallow bays and at landfills.

The impact of human activity on nesting bald eagles
During the breeding season, bald eagles are sensitive to a variety of human activities. However, not all bald eagle pairs react to human activities in the same way. Some pairs nest successfully just dozens of yards from human activity, while others abandon nest sites in response to activities much farther away. This variability may be related to a number of factors, including visibility, duration, noise levels, extent of the area affected by the activity, prior experiences with humans, and tolerance of the individual nesting pair. The relative sensitivity of bald eagles during various stages of the breeding season is outlined in the following table.

Nesting Bald Eagle Sensitivity to Human Activities

Phase	Activity	Sensitivity to Human Activity	Comments
I	Courtship and Nest Building	Most sensitive period; likely to respond negatively	Most critical time period. Disturbance is manifested in nest abandonment. Bald eagles in newly established territories are more prone to abandon nest sites.
II	Egg laying	Very sensitive period	Human activity of even limited duration may cause nest desertion and abandonment of territory for the breeding season.
III	Incubation and early nestling period (up to 4 weeks)	Very sensitive period	Adults are less likely to abandon the nest near and after hatching. However, flushed adults leave eggs and young unattended; eggs are susceptible to cooling, loss of moisture, overheating, and predation; young are vulnerable to elements.
IV	Nestling period, 4 to 8 weeks	Moderately sensitive period	Likelihood of nest abandonment and vulnerability of the nestlings to elements somewhat decreases. However, nestlings may miss feedings, affecting their survival.
V	Nestlings 8 weeks through fledging	Very sensitive period	Gaining flight capability, nestlings 8 weeks and older may flush from the nest prematurely due to disruption and die.

If agitated by human activities, eagles may inadequately construct or repair their nest, may expend energy defending the nest rather than tending to their young, or may abandon the nest altogether. Activities that cause prolonged absences of adults from their nests can jeopardize eggs or young. Depending on weather conditions, eggs may overheat or cool too much and fail to hatch. Unattended eggs and nestlings are subject to predation. Young nestlings are particularly vulnerable because they rely on their parents to provide warmth or shade, without which they may die as a result of hypothermia or heat stress. If food delivery schedules are interrupted, the young may not develop healthy plumage, which can affect their survival. In addition, adults startled while incubating or brooding young may damage eggs or injure their young as they abruptly leave the nest. Older nestlings no longer require constant attention from the adults, but they may be startled by loud or intrusive human activities and prematurely jump from the nest before they are able to fly or care for themselves. Once fledged, juveniles range up to ¼ mile from the nest site, often to a site with minimal human activity. During this period, until about six weeks after departure from the nest, the juveniles still depend on the adults to feed them.

The impact of human activity on foraging and roosting bald eagles

Disruption, destruction, or obstruction of roosting and foraging areas can also negatively affect bald eagles. Disruptive activities in or near eagle foraging areas can interfere with feeding, reducing chances of survival. Interference with feeding can also result in reduced productivity (number of young successfully fledged). Migrating and wintering bald eagles often congregate at specific sites for purposes of feeding and sheltering. Bald eagles rely on established roost sites because of their proximity to sufficient food sources. Roost sites are usually in mature trees where the eagles are somewhat sheltered from the wind and weather. Human activities near or within communal roost sites may prevent eagles

from feeding or taking shelter, especially if there are not other undisturbed and productive feeding and roosting sites available. Activities that permanently alter communal roost sites and important foraging areas can altogether eliminate the elements that are essential for feeding and sheltering eagles.

Where a human activity agitates or bothers roosting or foraging bald eagles to the degree that causes injury or substantially interferes with breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or nest abandonment, the conduct of the activity constitutes a violation of the Eagle Act's prohibition against disturbing eagles. The circumstances that might result in such an outcome are difficult to predict without detailed site-specific information. If your activities may disturb roosting or foraging bald eagles, you should contact your local Fish and Wildlife Service Field Office (see page 16) for advice and recommendations for how to avoid such disturbance.

RECOMMENDATIONS FOR AVOIDING DISTURBANCE AT NEST SITES

In developing these Guidelines, we relied on existing state and regional bald eagle guidelines, scientific literature on bald eagle disturbance, and recommendations of state and Federal biologists who monitor the impacts of human activity on eagles. Despite these resources, uncertainties remain regarding the effects of many activities on eagles and how eagles in different situations may or may not respond to certain human activities. The Service recognizes this uncertainty and views the collection of better biological data on the response of eagles to disturbance as a high priority. To the extent that resources allow, the Service will continue to collect data on responses of bald eagles to human activities conducted according to the recommendations within these Guidelines to ensure that adequate protection from disturbance is being afforded, and to identify circumstances where the Guidelines might be modified. These data will be used to make future adjustments to the Guidelines.

To avoid disturbing nesting bald eagles, we recommend (1) keeping a distance between the activity and the nest (distance buffers), (2) maintaining preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and (3) avoiding certain activities during the breeding season. The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees.

The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site. In open areas where there are little or no forested or topographical buffers, such as in many western states, distance alone must serve as the buffer. Consequently, in open areas, the distance between the activity and the nest may need to be larger than the distances recommended under Categories A and B of these guidelines (pg. 12) if no landscape buffers are present. The height of the nest above the ground may also ameliorate effects of human activities; eagles at higher nests may be less prone to disturbance.

In addition to the physical features of the landscape and nest site, the appropriate size for the distance buffer may vary according to the historical tolerances of eagles to human activities in particular localities, and may also depend on the location of the nest in relation

to feeding and roosting areas used by the eagles. Increased competition for nest sites may lead bald eagles to nest closer to human activity (and other eagles).

Seasonal restrictions can prevent the potential impacts of many shorter-term, obtrusive activities that do not entail landscape alterations (e.g. fireworks, outdoor concerts). In proximity to the nest, these kinds of activities should be conducted only outside the breeding season. For activities that entail both short-term, obtrusive characteristics and more permanent impacts (e.g., building construction), we recommend a combination of both approaches: retaining a landscape buffer *and* observing seasonal restrictions.

For assistance in determining the appropriate size and configuration of buffers or the timing of activities in the vicinity of a bald eagle nest, we encourage you to contact the nearest U.S. Fish and Wildlife Service Field Office (see page 16).

Existing Uses

Eagles are unlikely to be disturbed by routine use of roads, homes, and other facilities where such use pre-dates the eagles' successful nesting activity in a given area. Therefore, in most cases *ongoing* existing uses may proceed with the same intensity with little risk of disturbing bald eagles. However, some *intermittent, occasional, or irregular* uses that pre-date eagle nesting in an area may disturb bald eagles. For example: a pair of eagles may begin nesting in an area and subsequently be disturbed by activities associated with an annual outdoor flea market, even though the flea market has been held annually at the same location. In such situations, human activity should be adjusted or relocated to minimize potential impacts on the nesting pair.

ACTIVITY-SPECIFIC GUIDELINES

The following section provides the Service=s management recommendations for avoiding bald eagle disturbance as a result of new or intermittent activities proposed in the vicinity of bald eagle nests. Activities are separated into 8 categories (A – H) based on the nature and magnitude of impacts to bald eagles that usually result from the type of activity. Activities with similar or comparable impacts are grouped together.

In most cases, impacts will vary based on the visibility of the activity from the eagle nest and the degree to which similar activities are already occurring in proximity to the nest site. Visibility is a factor because, in general, eagles are more prone to disturbance when an activity occurs in full view. For this reason, we recommend that people locate activities farther from the nest structure in areas with open vistas, in contrast to areas where the view is shielded by rolling topography, trees, or other screening factors. The recommendations also take into account the existence of similar activities in the area because the continued presence of nesting bald eagles in the vicinity of the existing activities indicates that the eagles in that area can tolerate a greater degree of human activity than we can generally expect from eagles in areas that experience fewer human impacts. To illustrate how these factors affect the likelihood of disturbing eagles, we have incorporated the recommendations for some activities into a table (categories A and B).

First, determine which category your activity falls into (between categories A – H). If the activity you plan to undertake is not specifically addressed in these guidelines, follow the recommendations for the most similar activity represented.

If your activity is under A or B, our recommendations are in table form. The vertical axis shows the degree of visibility of the activity from the nest. The horizontal axis (header row) represents the degree to which similar activities are ongoing in the vicinity of the nest. Locate the row that best describes how visible your activity will be from the eagle nest. Then, choose the column that best describes the degree to which similar activities are ongoing in the vicinity of the eagle nest. The box where the column and row come together contains our management recommendations for how far you should locate your activity from the nest to avoid disturbing the eagles. The numerical distances shown in the tables are the closest the activity should be conducted relative to the nest. In some cases we have included additional recommendations (other than recommended *distance* from the nest) you should follow to help ensure that your activity will not disturb the eagles.

Alternate nests

For activities that entail permanent landscape alterations that may result in bald eagle disturbance, these recommendations apply to both active and alternate bald eagle nests. Disturbance becomes an issue with regard to alternate nests if eagles return for breeding purposes and react to land use changes that occurred while the nest was inactive. The likelihood that an alternate nest will again become active decreases the longer it goes unused. If you plan activities in the vicinity of an alternate bald eagle nest and have information to show that the nest has not been active during the preceding 5 breeding seasons, the recommendations provided in these guidelines for avoiding disturbance around the nest site may no longer be warranted. The nest itself remains protected by other provisions of the Eagle Act, however, and may not be destroyed.

If special circumstances exist that make it unlikely an inactive nest will be reused before 5 years of disuse have passed, and you believe that the probability of reuse is low enough to warrant disregarding the recommendations for avoiding disturbance, you should be prepared to provide all the reasons for your conclusion, including information regarding past use of the nest site. Without sufficient documentation, you should continue to follow these guidelines when conducting activities around the nest site. If we are able to determine that it is unlikely the nest will be reused, we may advise you that the recommendations provided in these guidelines for avoiding disturbance are no longer necessary around that nest site.

This guidance is intended to minimize disturbance, as defined by Federal regulation. In addition to Federal laws, most states and some tribes and smaller jurisdictions have additional laws and regulations protecting bald eagles. In some cases those laws and regulations may be more protective (restrictive) than these Federal guidelines.

Temporary Impacts

For activities that have temporary impacts, such as the use of loud machinery, fireworks displays, or summer boating activities, we recommend seasonal restrictions. These types of activities can generally be carried out outside of the breeding season without causing disturbance. The recommended restrictions for these types of activities can be lifted for alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched (depending on the distance between the alternate nest and the active nest).

In general, activities should be kept as far away from nest trees as possible; loud and disruptive activities should be conducted when eagles are not nesting; and activity between the nest and the nearest foraging area should be minimized. If the activity you plan to undertake is not specifically addressed in these guidelines, follow the recommendations for the most similar activity addressed, or contact your local U.S. Fish and Wildlife Service Field Office for additional guidance.

If you believe that special circumstances apply to your situation that increase or diminish the likelihood of bald eagle disturbance, or if it is not possible to adhere to the guidelines, you should contact your local Service Field Office for further guidance.

Category A:
Building construction, 1 or 2 story, with project footprint of ½ acre or less.
Construction of roads, trails, canals, power lines, and other linear utilities.
Agriculture and aquaculture – new or expanded operations.
Alteration of shorelines or wetlands.
Installation of docks or moorings.
Water impoundment.

Category B:
Building construction, 3 or more stories.
Building construction, 1 or 2 story, with project footprint of more than ½ acre.
Installation or expansion of marinas with a capacity of 6 or more boats.
Mining and associated activities.
Oil and natural gas drilling and refining and associated activities.

	If there is no similar activity within 1 mile of the nest	***If there is similar activity closer than 1 mile from the nest***
If the activity will be visible from the nest	660 feet. Landscape buffers are recommended.	660 feet, or as close as existing tolerated activity of similar scope. Landscape buffers are recommended.
If the activity will not be visible from the nest	Category A: 330 feet. Clearing, external construction, and landscaping between 330 feet and 660 feet should be done outside breeding season. Category B: 660 feet.	330 feet, or as close as existing tolerated activity of similar scope. Clearing, external construction and landscaping within 660 feet should be done outside breeding season.

The numerical distances shown in the table are the closest the activity should be conducted relative to the nest.

Category C. Timber Operations and Forestry Practices

- Avoid clear cutting or removal of overstory trees within 330 feet of the nest at any time.

- Avoid timber harvesting operations, including road construction and chain saw and yarding operations, during the breeding season within 660 feet of the nest. The distance may be decreased to 330 feet around alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, after eggs laid in another nest within the territory have hatched.

- Selective thinning and other silviculture management practices designed to conserve or enhance habitat, including prescribed burning close to the nest tree, should be undertaken outside the breeding season. Precautions such as raking leaves and woody debris from around the nest tree should be taken to prevent crown fire or fire climbing the nest tree. If it is determined that a burn during the breeding season would be beneficial, then, to ensure that no take or disturbance will occur, these activities should be conducted only when neither adult eagles nor young are present at the nest tree (i.e., at the beginning of, or end of, the breeding season, either before the particular nest is active or after the young have fledged from that nest). Appropriate Federal and state biologists should be consulted before any prescribed burning is conducted during the breeding season.

- Avoid construction of log transfer facilities and in-water log storage areas within 330 feet of the nest.

Category D. Off-road vehicle use (including snowmobiles). No buffer is necessary around nest sites outside the breeding season. During the breeding season, do not operate off-road vehicles within 330 feet of the nest. In open areas, where there is increased visibility and exposure to noise, this distance should be extended to 660 feet.

Category E. Motorized Watercraft use (including jet skis/personal watercraft). No buffer is necessary around nest sites outside the breeding season. During the breeding season, within 330 feet of the nest, (1) do not operate jet skis (personal watercraft), and (2) avoid concentrations of noisy vessels (e.g., commercial fishing boats and tour boats), except where eagles have demonstrated tolerance for such activity. Other motorized boat traffic passing within 330 feet of the nest should attempt to minimize trips and avoid stopping in the area where feasible, particularly where eagles are unaccustomed to boat traffic. Buffers for airboats should be larger than 330 feet due to the increased noise they generate, combined with their speed, maneuverability, and visibility.

Category F. Non-motorized recreation and human entry (e.g., hiking, camping, fishing, hunting, birdwatching, kayaking, canoeing). No buffer is necessary around nest sites outside the breeding season. If the activity will be visible or highly audible from the nest, maintain a 330-foot buffer during the breeding season, particularly where eagles are unaccustomed to such activity.

Category G. Helicopters and fixed-wing aircraft.
Except for authorized biologists trained in survey techniques, avoid operating aircraft within 1,000 feet of the nest during the breeding season, except where eagles have demonstrated tolerance for such activity.

Category H. Blasting and other loud, intermittent noises.
Avoid blasting and other activities that produce extremely loud noises within 1/2 mile of active nests, unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area. This recommendation applies to the use of fireworks classified by the Federal Department of Transportation as Class B explosives, which includes the larger fireworks that are intended for licensed public display.

RECOMMENDATIONS FOR AVOIDING DISTURBANCE AT FORAGING AREAS AND COMMUNAL ROOST SITES

1. Minimize potentially disruptive activities and development in the eagles' direct flight path between their nest and roost sites and important foraging areas.

2. Locate long-term and permanent water-dependent facilities, such as boat ramps and marinas, away from important eagle foraging areas.

3. Avoid recreational and commercial boating and fishing near critical eagle foraging areas during peak feeding times (usually early to mid-morning and late afternoon), except where eagles have demonstrated tolerance to such activity.

4. Do not use explosives within ½ mile (or within 1 mile in open areas) of communal roosts when eagles are congregating, without prior coordination with the U.S. Fish and Wildlife Service and your state wildlife agency.

5. Locate aircraft corridors no closer than 1,000 feet vertical or horizontal distance from communal roost sites.

ADDITIONAL RECOMMENDATIONS TO BENEFIT BALD EAGLES

The following are additional management practices that landowners and planners can exercise for added benefit to bald eagles.

1. Protect and preserve potential roost and nest sites by retaining mature trees and old growth stands, particularly within ½ mile from water.

2. Where nests are blown from trees during storms or are otherwise destroyed by the elements, continue to protect the site in the absence of the nest for up to three (3) complete breeding seasons. Many eagles will rebuild the nest and reoccupy the site.

3. To avoid collisions, site wind turbines, communication towers, and high voltage transmission power lines away from nests, foraging areas, and communal roost sites.

4. Employ industry-accepted best management practices to prevent birds from colliding with or being electrocuted by utility lines, towers, and poles. If possible, bury utility lines in important eagle areas.

5. Where bald eagles are likely to nest in human-made structures (e.g., cell phone towers) and such use could impede operation or maintenance of the structures or jeopardize the safety of the eagles, equip the structures with either (1) devices engineered to discourage bald eagles from building nests, or (2) nesting platforms that will safely accommodate bald eagle nests without interfering with structure performance.

6. Immediately cover carcasses of euthanized animals at landfills to protect eagles from being poisoned.

7. Do not intentionally feed bald eagles. Artificially feeding bald eagles can disrupt their essential behavioral patterns and put them at increased risk from power lines, collision with windows and cars, and other mortality factors.

8. Use pesticides, herbicides, fertilizers, and other chemicals only in accordance with Federal and state laws.

9. Monitor and minimize dispersal of contaminants associated with hazardous waste sites (legal or illegal), permitted releases, and runoff from agricultural areas, especially within watersheds where eagles have shown poor reproduction or where bioaccumulating contaminants have been documented. These factors present a risk of contamination to eagles and their food sources.

CONTACTS

The following U.S. Fish and Wildlife Service Field Offices provide technical assistance on bald eagle management:

Alabama	Daphne	(251) 441-5181
Alaska	Anchorage	(907) 271-2888
	Fairbanks	(907) 456-0203
	Juneau	(907) 780-1160
Arizona	Phoenix	(602) 242-0210
Arkansas	Conway	(501) 513-4470
California	Arcata	(707) 822-7201
	Barstow	(760) 255-8852
	Carlsbad	(760) 431-9440
	Red Bluff	(530) 527-3043
	Sacramento	(916) 414-6000
	Stockton	(209) 946-6400
	Ventura	(805) 644-1766
	Yreka	(530) 842-5763
Colorado	Lakewood	(303) 275-2370
	Grand Junction	(970) 243-2778
Connecticut	(See New Hampshire)	
Delaware	(See Maryland)	
Florida	Panama City	(850) 769-0552
	Vero Beach	(772) 562-3909
	Jacksonville	(904) 232-2580
Georgia	Athens	(706) 613-9493
	Brunswick	(912) 265-9336
	Columbus	(706) 544-6428
Idaho	Boise	(208) 378-5243
	Chubbuck	(208) 237-6975
Illinois/Iowa	Rock Island	(309) 757-5800
Indiana	Bloomington	(812) 334-4261
Kansas	Manhattan	(785) 539-3474
Kentucky	Frankfort	(502) 695-0468
Louisiana	Lafayette	(337) 291-3100
Maine	Old Town	(207) 827-5938
Maryland	Annapolis	(410) 573-4573
Massachusetts	(See New Hampshire)	
Michigan	East Lansing	(517) 351-2555
Minnesota	Bloomington	(612) 725-3548
Mississippi	Jackson	(601) 965-4900
Missouri	Columbia	(573) 234-2132
Montana	Helena	(405) 449-5225
Nebraska	Grand Island	(308) 382-6468
Nevada	Las Vegas	(702) 515-5230
	Reno	(775) 861-6300
New Hampshire	Concord	(603) 223-2541
New Jersey	Pleasantville	(609) 646-9310
New Mexico	Albuquerque	(505) 346-2525
New York	Cortland	(607) 753-9334
	Long Island	(631) 776-1401
North Carolina	Raleigh	(919) 856-4520
	Asheville	(828) 258-3939
North Dakota	Bismarck	(701) 250-4481
Ohio	Reynoldsburg	(614) 469-6923
Oklahoma	Tulsa	(918) 581-7458
Oregon	Bend	(541) 383-7146
	Klamath Falls	(541) 885-8481
	La Grande	(541) 962-8584
	Newport	(541) 867-4558
	Portland	(503) 231-6179
	Roseburg	(541) 957-3474
Pennsylvania	State College	(814) 234-4090
Rhode Island	(See New Hampshire)	
South Carolina	Charleston	(843) 727-4707
South Dakota	Pierre	(605) 224-8693
Tennessee	Cookeville	(931) 528-6481
Texas	Clear Lake	(281) 286-8282
Utah	West Valley City	(801) 975-3330
Vermont	(See New Hampshire)	
Virginia	Gloucester	(804) 693-6694
Washington	Lacey	(306) 753-9440
	Spokane	(509) 891-6839
	Wenatchee	(509) 665-3508
West Virginia	Elkins	(304) 636-6586
Wisconsin	New Franken	(920) 866-1725
Wyoming	Cheyenne	(307) 772-2374
	Cody	(307) 578-5939

National Office
U.S. Fish and Wildlife Service
Division of Migratory Bird Management
4401 North Fairfax Drive, MBSP-4107
Arlington, VA 22203-1610
(703) 358-1714
http://www.fws.gov/migratorybirds

State Agencies

To contact a state wildlife agency, visit the Association of Fish & Wildlife Agencies' website at http://www.fishwildlife.org/where_us.html

GLOSSARY

The definitions below apply to these National Bald Eagle Management Guidelines:

Communal roost sites – Areas where bald eagles gather and perch overnight – and sometimes during the day in the event of inclement weather. Communal roost sites are usually in large trees (live or dead) that are relatively sheltered from wind and are generally in close proximity to foraging areas. These roosts may also serve a social purpose for pair bond formation and communication among eagles. Many roost sites are used year after year.

Disturb – To agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

In addition to immediate impacts, this definition also covers impacts that result from human-caused alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle=s return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

Fledge – To leave the nest and begin flying. For bald eagles, this normally occurs at 10-12 weeks of age.

Fledgling – A juvenile bald eagle that has taken the first flight from the nest but is not yet independent.

Foraging area – An area where eagles feed, typically near open water such as rivers, lakes, reservoirs, and bays where fish and waterfowl are abundant, or in areas with little or no water (i.e., rangelands, barren land, tundra, suburban areas, etc.) where other prey species (e.g., rabbit, rodents) or carrion (such as at landfills) are abundant.

Landscape buffer – A natural or human-made landscape feature that screens eagles from human activity (e.g., strip of trees, hill, cliff, berm, sound wall).

Nest – A structure built, maintained, or used by bald eagles for the purpose of reproduction. An **active** nest is a nest that is attended (built, maintained or used) by a pair of bald eagles during a given breeding season, whether or not eggs are laid. An **alternate** nest is a nest that is not used for breeding by eagles during a given breeding season.

Nest abandonment – Nest abandonment occurs when adult eagles desert or stop attending a nest and do not subsequently return and successfully raise young in that nest for the duration of a breeding season. Nest abandonment can be caused by altering habitat near a nest, even if the alteration occurs prior to the breeding season. Whether the eagles migrate during the non-breeding season, or remain in the area throughout the non-breeding season, nest abandonment can occur at any point between the time the eagles return to the nesting site for the breeding season and the time when all progeny from the breeding season have

dispersed.

Project footprint – The area of land (and water) that will be permanently altered for a development project, including access roads.

Similar scope – In the vicinity of a bald eagle nest, an existing activity is of similar scope to a new activity where the types of impacts to bald eagles are similar in nature, and the impacts of the existing activity are of the same or greater magnitude than the impacts of the potential new activity. Examples: (1) An existing single-story home 200 feet from a nest is similar in scope to an additional single-story home 200 feet from the nest; (2) An existing multi-story, multi-family dwelling 150 feet from a nest has impacts of a greater magnitude than a potential new single-family home 200 feet from the nest; (3) One existing single-family home 200 feet from the nest has impacts of a lesser magnitude than three single-family homes 200 feet from the nest; (4) an existing single-family home 200 feet from a communal roost has impacts of a lesser magnitude than a single-family home 300 feet from the roost but 40 feet from the eagles' foraging area. The existing activities in examples (1) and (2) are of similar scope, while the existing activities in example (3) and (4) are not.

Vegetative buffer – An area surrounding a bald eagle nest that is wholly or largely covered by forest, vegetation, or other natural ecological characteristics, and separates the nest from human activities.

RELATED LITERATURE

Andrew, J.M. and J.A. Mosher. 1981. Bald eagle nest site selection and nesting habitat in Maryland. Journal of Wildlife Management 46:382-390.

Anonymous. 1977. Bald Eagle Habitat Management Guidelines, Forest Service – California Region. U.S Forest Service, San Francisco, CA.

Anthony, R.G. 2001. Low productivity of bald eagles on Prince of Wales Island, southeast Alaska. Journal of Raptor Research 35:1-8.

Anthony, R.G., R.W. Frenzel, F.B. Isaacs, and M.G. Garrett. 1994. Probable causes of nesting failures in Oregon's bald eagle population. Wildlife Society Bulletin 22:576-582.

Anthony, R.G. and F.B. Isaacs. 1989. Characteristics of bald eagle nest sites in Oregon. Journal of Wildlife Management 53:148-158.

Arizona Game and Fish Department. 1999. Bald Eagle Conservation Assessment and Strategy (draft).

Avian Power Line Interaction Committee (APLIC). 1996. Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996. Edison Electric Institute, Raptor Research Foundation, Washington, D.C.

Bangs, E.E., T.N. Bailey and V.D. Berns. Ecology of nesting bald eagles on the Kenai National Wildlife Refuge, Alaska. (USFWS staff)

Becker, J.M. 2002. Response of wintering bald eagles to industrial construction in southeastern Washington. Wildlife Society Bulletin 30:875-878.

Brauning, D.W. and J.D. Hassinger. 2000. Pennsylvania Recovery and Management Plan for the Bald Eagle (draft). Pennsylvania Game Commission. Harrisburg, PA.

Brown, B.T., G.S. Mills, C. Powels, W.A. Russell, G.D. Therres and J.J. Pottie. 1999. The influence of weapons-testing noise on bald eagle behavior. Journal of Raptor Research 33:227-232.

Brown, B.T. and L.E. Stevens. 1997. Winter bald eagle distribution is inversely correlated with human activity along the Colorado River, Arizona. Journal of Raptor Research31:7-10.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). *In* The Birds of North America, No. 506 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Buehler, D.A., T.J. Mersmann, J.D. Fraser, and J.K.D. Seegar. 1991. Effects of human activity on bald eagle distribution on the northern Chesapeake Bay. Journal of Wildlife Management 55:282-290.

Buehler, D.A., T.J. Mersmann, J.D. Fraser, and J.K.D. Seegar. 1991. Nonbreeding bald eagle communal and solitary roosting behavior and roost habitat on the northern Chesapeake Bay. Journal of Wildlife Management 55:273-281.

Chandler, SK., J.D. Fraser, D.A. Buehler and J.K.D. Seegar. 1995. Perch trees and shoreline development as predictors of bald eagle distribution on the Chesapeake Bay. Journal of Wildlife Management 59:325-332.

Cline, K. 1985. Bald Eagles in the Chesapeake: A Management Guide for Landowners. National Wildlife Federation. Washington, D.C.

Dell, D.D. and P.J. Zwank. 1986. Impact of a high-voltage transmission line on a nesting pair of southern bald eagles in southeast Louisiana. Journal of Raptor Research 20(3/4):117-119.

Dunwiddie, P.W. and R.C. Kuntz. 2001. Long-term trends of bald eagles in winter on the Skagit River, Washington. Journal of Wildlife Management 65(2):290-299.

Fletcher, R.J. et. al. 1999. Effects of recreational trails on wintering diurnal raptors along riparian corridors in a Colorado grassland. Journal of Raptor Research 33(3):233-239.

Fraser, J.D. 1981. The breeding biology and status of the bald eagle on the Chippewa National Forest. PhD. Dissertation, University of Minnesota.

Fraser, J.D., LD. Frenzel and J.E. Mathisen. 1985. The impact of human activities on breeding bald eagles in north-central Minnesota. Journal of Wildlife Management 49(3):585-592.

Garrett, M.G., J.W. Watson, and R.G. Anthony. 1993. Bald eagle home range and habitat use in the Columbia River Estuary. Journal of Wildlife Management 57(1):19-27.

Gerrard J.M. and G.R. Bortolotti. 1988. The Bald Eagle: Haunts and Habits of a Wilderness Monarch. Smithsonian Institution Press. Washington, D.C.

Grier, J.W. 1969. Bald eagle behavior and productivity responses to climbing to nests. Journal of Wildlife Management 33:961-966.

Grier, J.W. and J.E. Guinn. 2003. Bald eagle habitats and responses to human disturbance in Minnesota. Report to the Minnesota Department of Natural Resources.

Grubb, T.G. 1976. Survey and analysis of bald eagle nesting in western Washington. M.S. thesis, Univ. of Washington, Seattle.

Grubb, T.G. and R.M. King. 1991. Assessing human disturbance of breeding bald eagles with classification tree models. Journal of Wildlife Management 55:500-511.

Grubb, T.G., W.L. Robinson and W.W. Bowerman. 2002. Effects of watercraft on bald eagles nesting in Voyagers National Park, Minnesota. Wildlife Society Bulletin 30:156-161.

Grubb, T.G. and W.W. Bowerman. 1997. Variations in breeding bald eagle response to jets, light planes and helicopters. Journal of Raptor Research 31:213-222.

Grubb, T.G., W.W. Bowerman, A.J. Bath, J.P. Giesy, D.V.C. Weseloh. 2003. Evaluating Great Lakes bald eagle nesting habitat with Bayesian inference. RMRS-RP-45. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO, 10 pp.

Hansen, J.A. 1977. Population dynamics and night roost requirements of bald eagles wintering in the Nooksack River Valley, WA. Huxley College of Environmental Studies, Western Washington State College, Bellingham, WA. (Problem Series)

Hansen, J.A., M.V. Stalmaster and J.R. Newman. 1980. Habitat characteristics, function, and destruction of bald eagle communal roosts in western Washington. Huxley college of Environmental Studies, Western Washington University.

Hunt, W.G., D.E. Driscoll, E.W. Bianchi, and R.E. Jackman. 1992. Ecology of bald eagles in Arizona. Report to U.S. Bureau of Reclamation, Contract 6-CS-30-04470. BioSystems Analysis Inc., Santa Cruz, California.

Isaacs, F.B and R.G. Anthony. 1987. Abundance, foraging, and roosting of bald eagles wintering in the Harney Basin, Oregon. Northwest Science 61(2), pp. 114-121.

Juenemann, B.G. 1973. Habitat evaluations of selected bald eagle nest sites on the Chippewa National Forest. M.S. thesis, University of Minnesota, Minneapolis.

Keister, G.P., R.G. Anthony and E.J. O'Neill. 1987. Use of communal roosts and foraging area by bald eagles wintering in the Klamath Basin. Journal of Wildlife Management 51(2):415-420.

Knight, R. and S.K. Knight. 1984. Responses of wintering bald eagles to boating activity. Journal of Wildlife Management 48:999-1004.

Linscombe, J.T., T.J. Hess, Jr., and V.L. Wright. 1999. Effects of seismic operations on Louisiana's nesting bald eagles. Proceedings of the Southeastern Association of Fish and Wildlife Agencies. 54:235-242.

Maine (State of) Inland Fisheries and Wildlife Rules. Chapter 8.05 Essential Habitat for Species Listed as Threatened or Endangered.

Mathisen, J.E. 1968. Effects of human disturbance on nesting bald eagles. Journal of Wildlife Management 32(1): 1-6.

McGarigal, K., R.G. Anthony and F.B. Isaacs. 1991. Interactions of humans and bald eagles on the Columbia River estuary. Wildlife Monographs 115:1-47.

McKay, K.J., J.W. Stravers, B.R. Conklin, U. Konig, S. Hawks, C.J. Kohrt, J.S. Lundh and G.V. Swenson. 2001. Potential human impacts on bald eagle reproductive success along the Upper Mississippi River.

McKewan, L.C. and D.H. Hirth. 1979. Southern bald eagle productivity and nest site selection. Journal of Wildlife Management 43:585-594.

Millsap, B.A. Status of wintering bald eagles in the conterminous 48 States. 1986. Wildlife Society Bulletin 14:433-440.

Millsap, B.A, T. Breen, E. McConnell, T. Steffer, L. Phillips, N. Douglass, and S. Taylor. In Press. Comparative fecundity and survival of bald eagles fledged from suburban and rural natal areas in Florida. Journal of Wildlife Management 68(4).

Montana Bald Eagle Working Group. 1986. Montana Bald Eagle Management Plan. Department of the Interior, Bureau of Land Management. Billings, MT.

Nesbitt, S.A., M.J. Folk and D.A. Wood. 1993. Effectiveness of bald eagle habitat protection guidelines in Florida. Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies.

Newman, J.R., W.H. Brennan and L.M. Smith. 1977. Twelve-year changes in nesting patterns of bald eagles on San Juan Island, Washington. The Murrelet 58(2)37-39.

Postapulsky, S. 1974. Raptor reproductive success: some problems with methods, criteria, and terminology. Pages 21-31 *in* F.N. Hammerstrom, Jr., B.E. Harrell, and R.R. Olendorff, eds. Management of raptors. Raptor Res. Found., Vermillion, S.D.

Rodgers, J.A. and Schwikert, S.T. 2003. Buffer zone distances to protect foraging and loafing waterbirds from disturbance by airboats in Florida. Waterbirds 26(4): 437-443.

Russell, D. 1980. Occurrence and human disturbance sensitivity of wintering bald eagles on the Sauk and Suiattle Rivers, Washington. In R.L. Knight, G.T. Allen, M.V. Stalmaster and C.W. Servheen [eds.]. Proceedings of the Washington Bald Eagle Symposium. Nature Conservancy, Seattle, Washington, pp. 165-174.

Shapiro, A.E., F. Montalbano, and D. Mager. 1982. Implications of construction of a flood control project upon bald eagle nesting activity. Wilson Bulletin 94(1), pp. 55-63.

Skagen, S.K. 1980. Behavioral responses of wintering bald eagles to human activity on the Skagit River, Washington. In R.L.Knight, G.T. Allen, M.V. Stalmaster and C.W. Servheen [eds.]. Proceedings of the Washington Bald Eagle Symposium. Nature Conservancy, Seattle, Washington, pp. 231-241.

Skagen, S.K., R.L. Knight and G.J.H. Orians. 1991. Human disturbance of an avian scavenging guild. Ecological Applications 1:215-225. (Internet)

Stalmaster, M.V. 1976 Winter ecology and effects of human activity on bald eagles in the Nooksack River Valley, Washington. MS Thesis, Western Washington State College, Bellingham.

Stalmaster, M.V. 1980. Management strategies for wintering bald eagles in the Pacific Northwest. Proceedings of the Washington Bald Eagle Symposium, pp 49-67.

Stalmaster, M.V. and J.L. Kaiser. 1998. Effects of recreational activity on wintering bald eagles. Wildlife Monographs 137:1-46.

Stalmaster, M.V. and J.L. Kaiser. 1997. Flushing responses of wintering bald eagles to military activity. Journal of Wildlife Management 61:1307-1313.

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. Journal of Wildlife Management 42:506-513.

Steenhof, K. 1978. Management of Wintering Bald Eagles. FWS/OBS-78/79. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C.

Steidl, R.J. and R.G. Anthony. 2000. Experimental Effects of Human Activity on Breeding Bald Eagles. Ecological Applications 10(1), pp. 258-268.

Therres, G.D., M.A. Byrd and D.S. Bradshaw. 1993. Effects of development on nesting bald eagles: case studies from Chesapeake Bay. Transactions of the North American Wildlife and Natural Resources Conference 58:62-69.

U.S. Fish and Wildlife Service. 1979. Bald Eagle Management Guidelines: Oregon – Washington. Portland. OR.

U.S. Fish and Wildlife Service. 1983. Northern States bald eagle recovery plan. Appendices E, F, and G. U.S. Fish and Wildlife Service, Region 6, Denver, CO.

U.S. Fish and Wildlife Service. 1987. Habitat Management Guidelines for the Bald Eagle in the Southeast Region. U.S Fish and Wildlife Service, Region 4. Atlanta, GA.

U.S. Fish and Wildlife Service. 1993. Bald Eagle Basics. Anchorage, AK.

U.S. Fish and Wildlife Service. 1993. Habitat Management Guidelines for Bald Eagles in Texas. Austin, TX.

U.S. Fish and Wildlife Service and Virginia Department of Game and Inland Fisheries. 2001. Bald Eagle Protection Guidelines for Virginia. Gloucester and Richmond, VA.

Watson, J.W. 1993. Responses of nesting bald eagles to helicopter surveys. Wildlife Society Bulletin 21:171-178.

Watson, J.W. 2004. Responses of nesting bald eagles to experimental pedestrian activity. Journal of Raptor Research 38:295-305.

Wood, P.B. 1999. Bald eagle response to boating activity in northcentral Florida. Journal of Raptor Research 33:97-101.

Wood, P.B., T.C. Edwards Jr. and M.W. Collopy. 1989. Characteristics of bald eagle nesting habitat in Florida. Journal of Wildlife Management 53(2):441-449.

Young, L.S. 1980. A quantitative evaluation of human disturbance impacts on breeding eagle ecology of bald eagles in the San Juan Islands, Washington. Washington Department of Game, Olympia.

Standard Protection Measures for the West Indian manatee (*Trichechus manatus*)

All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees. All construction personnel would be responsible for observing water-related activities for the presence of manatees. Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., the work area), and at least one sign would be placed where it is visible to the vessel operator. Siltation barriers, if used, would be made of material in which manatees could not become entangled and would be properly secured and monitored. If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: moving equipment would not operate within 50 ft of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area of its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed. Any manatee sighting would be immediately reported to the U.S. Fish and Wildlife Service (337/291-3100) and the Louisiana Department of Wildlife and Fisheries (LDWF), Natural Heritage Program (225/765-2821).