APPENDIX M

Wetland Value Assessment and Conceptual Wetland Restoration Plan

IHNC New Lock Graving and Stockpile Sites WVA Assumptions

General Assumptions

Project Area acres – The project area acres were determined by the Corps based on the area needed for the graving site and stockpile area. The only loss applied was do to the potential of some development to the surrounding area over 50 years. The only other loss would be due to subsidence which wont show in the assessed time. All areas are assumed to continue supporting trees even with some subsidence with in the time period evaluated.

The graving site will be excavated to -31feet. The material excavated (664,000 cy) will be stockpiled adjacent to the graving site. Suitable material may be brought in to relocate the hurricane protection levee. After project completion the hurricane protection levee will be replaced to its original location and the material used to create the berms that protect the graving and stockpile site from the GIWW will be used along with the stockpiled material to restore the graving site to its previous grade. Its likely the stockpiled and berm material wont be enough to refill the entire graving site to its previous elevation as that volume would likely be reduced due to dewatering and loss of organic material and 7 years of weathering. We assume forested wetlands will begin to be supported on a portion (half) of the graving site and all of the stockpile site after TY7. In addition the hydrology is assumed to return to FWOP conditions for the portions that return to existing elevation after TY7.

Project footprint for the graving site is 19.26 acres and for the stockpile site is 14.56 acres. Of the graving site acres, 10.76 acres is on the protected side of the levee and 8.54 acres on the flood-side of the existing hurricane protection levee.

Bottomland Hardwood Assumptions

<u>V1 – Tree Species Association</u>
FWOP – class 1, Less than 25% of overstory consists of mast or other edible-seed producing trees. The Graving and stockpile sites are dominated by Chinese tallow which provides low- to no- quality mast.   The mid- and understory regeneration was also dominated by tallow but had some (very little) dogwoods, red maple, hackberry and willow regenerating (see V2 below). Thus this variable remained class 1 for all TYs.
FWP –class 1 for TY1-50 assume no mast while graving and stockpile site are being used. After construction the graving and stockpile sites are expected to revert back to tallow dominated BLH.

<u>V2 – Stand maturity of dominant and codominant trees</u>
FWOP – field data collected and spreadsheets were used to determine baseline and all TY dbh. Topped trees were assumed dead and not used. Tallow typically are not seen in nature above a 20” dbh. As tallow increased in size assumed the dbh maxed out at 20”dbh. Therefore 13 trees at TY50 where listed as 20” and remained in the data set. Twelve Red Maple, 4 boxelder, 4 dogwood, 1 willow, and 4 hackberry were grown in

from TY10 to TY50. Seven hackberry were combined with the predominantly tallow site at TY0.

FWP – Construction at the graving site is expected to take 8.75 years. From TY1 to TY10 the ground would have been cleared for use during construction. After completion of construction the graving and stockpile sites would grow in predominately tallow from natural recruitment from TY10 to TY50.

<u>V3 – Understory/midstory</u>

FWOP – Baseline taken from data sheets and remained the same for TY1. TY5 thru TY50 adjusted to reflect a reduction in understory and a slighter increase in midstory over time. The understory is expected to decrease as the forest grows and blocks out light.

FWP – TY1 thru TY10 there is no understory/midstory as the area would have been cleared for disposal. At the graving and stockpile sites TY10 to TY50 adjusted to show a high amount of understory/midstory in the beginning and reduced over time as the forest grows.

<u>V4 – Hydrology</u>

FWOP – Majority of the graving and stockpile sites are on the flood-side of the levee open to the GIWW but some of the graving site is on the protected-side of the levee. These sites contain some areas of standing water, some moist soil, and some dry areas based on the site visit.

The class choices in the BLH model for this variable aren't reflective what is actually occurring. On the protected side the hydrology is altered but not to the extent that class 2 describes, either extensively dry or extensively inundated/impounded. A more appropriate suitability index for the hydrology of this community is used in the WVA swamp models variable 3 for water regime. Assuming the flood-side (10.76 acres graving site plus 14.56 acres stockpile site, total 25.32 acres) would be seasonally flooded and the protected-side (8.54 acres graving site) is temporarily flooded. The flood-side would have high water flow/exchange being open to the GIWW and the protected-side would have a low or limited water exchange. The project area has a flood duration that is about 75% (open to GIWW) seasonally flooded with a high flow/exchange (1.00 HSI) and 25% is temporarily flooded with a low flow/exchange (0.65 HSI), giving a weighted average of (0.75*1 + 0.25*.65) = 0.91 HSI for the project area.

FWP –The graving and stockpile sites are expected to be behind a 7 foot berm/sheetpile system during construction (TY1-TY7 = 0.1HSI). After construction part of the sites is assumed to revert back to its existing hydrology. It is most likely the material available (664,000 cy of stockpile and berm material after 7 years of weathering and compaction) to refill the graving site wont be enough to refill the site completely back to existing elevations. We assumed what material is available will be concentrated at the levee location to ensure the levee is at appropriate elevation, result in a portion of the graving site remaining below existing elevation. We assumed half of the graving site (19.26ac/2

= 9.63ac) is expected to be inundated. We assumed half of the 9.63 (1/4 of the area – 4.82 acres) inundated acres are taken from in protected side (8.54 acres acres) of the levee and half taken from floodside (25.28 acres), leaving 3.72 (11%) that is temporarily flooded with a low flow/exchange (0.65 HSI) and 20.46 (60.5%) acres that is seasonally flooded with a high flow/exchange (1.00 HSI), respectively, and 28.5% that is inundated (0.01 HIS). Therefore the weighted average is (0.605*1+0.11*0.65+0.285*0.01) = 0.68 HSI.

<u>V5 – Size of contiguous forested area</u>
FWOP - The project area plus the adjacent forested wetlands accounts for between 20.1 and 100 acres of continuous forested wetlands. This is a class 3 for all TYs. The forested wetland area is not expected to change.

FWP – TY0-TY10 Once the forested wetlands are removed from the graving and stockpile sites there will be less than 5miles (class 1) of continuous forested wetlands. TY20 – TY50 after the graving and stockpile sites reestablish forested wetlands there will again be over 20 acres of continuous forested wetlands (class 3).

<u>V6 – Suitability and traversability of surrounding land use</u>
FWOP - We based this variable on site visits and delineating an areal map (see attached map) of the area separating the acres for each category type. Based on the map the following area was calculated:

	FWOP TY0	
	Acres	%
Total Area	849.3	
Development	27.4	3%
Water	221.4	26%
Pasture	77.0	9%
Forest/marsh	523.5	62%

The forested wetlands of the project area are predominately surrounded by wetlands. This area may develop further with Paris road adjacent to those areas. We assumed development over 50 years in some of the wetlands (primarily south of the GIWW and south of the levee near Paris road and some on the north shore of the GIWW). Therefore by TY50 this variable shifted to about 30 less wetlands which were distributed between development and pastures.

FWP – Same as FWOP.

<u>V7 – Disturbance</u>
FWP – For the Distance Class between 50 and 500 feet (Class 2) from the perimeter of the project area there is the GIWW and Paris road. The category type of the waterway and road is a Class 1 constant/major (major highways, industrial, commercial, major navigation) disturbance. We assumed no change thru TY50 because we assumed no new development less than 50 feet of the perimeter of the project area and the type class is already the most it can be.

FWP – same as FWOP.

IHNC New Lock WVA Assumptions for Contaminated Disposal Facility (CDF)

General Assumptions

Project Area acres – The project area acres were determined by the Corps based on the area needed for disposal of contaminated material. Development rate was not applied to this area. No other loss is shown for 50 years. The only other loss would be due to subsidence which wont show in the assessed time. All areas are assumed to continue supporting trees even with some subsidence with in the time period evaluated.

TY1-TY7 there will be various years of disposal of contaminated sediments. TY1-TY7 some material will be used for backfill behind the lock to fill in the created by-pass channel to land elevation. After the final lift the disposal site will be capped with clean material and then seeded for dust control. Its most likely the area after construction will revert to a scrub/shrub habitat dominated by tallow.

Bottomland Hardwood Assumptions

V1 – Tree Species Association
FWOP – class 1, Less than 25% of overstory consists of mast or other edible-seed producing trees. The CDS is dominated by Chinese tallow which provides low- to no-quality mast. The mid- and understory regeneration was also dominated by tallow but had some dogwoods regenerating (see V2 below). Thus this variable remained class 1 for all TYs.
FWP –class 1 for TY1-50 assume tallow will naturally recruit and dominate the new site as seen in FWOP.

V2 – Stand maturity of dominant and codominant trees
FWOP – field data collected and spreadsheets were used to determine baseline and all TY dbh. Topped trees were assumed dead and removed from the spreadsheets at TY5. Tallow typically are not seen in nature above a 20" dbh. As tallow increased in size assumed the dbh maxed out at 20"dbh. Therefore 12 trees at TY50 where listed as 20" and remained in the data set. Dogwoods were grown in and lived to TY20 but most were removed by TY30 with only a few remaining. This is representative of the dogwood lifecycle. They stop growing after 20-30 years. We left a few dogwood in to represent the few trees that made it to the overstory, though most would eventually be overtopped by other species.

FWP – TY1-TY7 ground would have been cleared and seeded with grass but trees will not be allowed to grow. TY8 to TY50 grow scrub/shrub and tallow from natural recruitment.

V3 – Understory/midstory
FWOP – Baseline taken from data sheets and remained the same for TY1. TY5 thru TY50 adjusted to reflect a reduction in understory and a slighter increase in midstory

over time. The understory is expected to decrease as the forest grows and blocks out light.

FWP – TY1-TY7 there is no understory/midstory through the construction years. TY8 to TY50 adjusted to show a high amount of understory/midstory in the beginning and reduced over time as the forest grows.

<u>V4 – Hydrology</u>
FWOP - Stormwater discharge from the nearby urban area is pumped into the origin of Bayou Bienvenue. The north bank of Bayou Bienvenue forms the southern border of the confined disposal site (CDS). Rainwater runoff from the CDS flows through cuts in the bank into Bayou Bienvenue though at times, depending on rainfall and tidal stage, the exchange can be reversed. Bayou Bienvenue is tidally influenced, with a connection to the Mississippi River Gulf Outlet through a floodgate. The CDS is higher in elevation than the open water area to the south, though elevations in the CDS vary and there is a series of containment dikes and associated borrow-ditches within the CDS which retain rainwater. The CDS contains some standing water, some moist soil, and a few dry areas.

The class choices in the BLH model for this variable aren't reflective what is actually occurring. The hydrology is altered but not to the extent that class 2 describes, either extensively dry or extensively inundated/impounded.   A more appropriate suitability index for the hydrology of this community is used in the WVA swamp models variable 3 for water regime. The project area has a flood duration that is temporarily flooded with a low flow/exchange (0.65 HSI).

FWP – TY1-TY7 assume no hydrology through the construction years (0.1 HSI). TY8 - TY50 assume the portion (66%) that will be used temporarily (material stockpiled for backfill) will return to the previous 0.65 HSI. The portion that will be permanently filled (34%) is expected to have no fow/exchange and permanently dry 0.01 HSI.   The weighted average is (0.66*0.65 + 0.34*0.1) = 0.46 HSI.

<u>V5 – Size of contiguous forested area</u>
FWOP - The project area plus the adjacent forested wetlands accounts for around 1,200 acres of continuous forested wetlands. This is a class 5 (>500 acres) for all TYs. The forested wetland area is not expected to change.

FWP – Same as FWOP.

<u>V6 – Suitability and traversability of surrounding land use</u>
FWOP - We based this variable on site visits and delineating an areal map (see attached map) of the area separating the acres for each category type. Based on the map the following area was calculated:

	Acres	FWOP TY0 %	FWP Acres	FWP TY1 %
Total Area	2326.3			
Development	198.4	9%	198.4	9%
Water	1122.6	48%	1122.6	48%
Pasture	287.6	12%	287.6	12%
Forest/marsh	717.7	31%	717.7	31%

The forested wetlands of the project area are surrounded by an already extensively developed area. This area is not expected to develop much further. We assumed minor development over 50 years in some of the forested wetlands (near the dump and on the north shore of the GIWW). Therefore by TY50 this variable shifted to about 10 less forested wetlands which were evenly distributed between development and pastures.

FWP – Same as FWOP (see table above).

<u>V7 – Disturbance</u>
FWP – Greater than 500 feet from the perimeter of the project area there is the GIWW and the active dump site. Both are to be in the category constant/major (major highways, industrial, commercial, major navigation) disturbance. We assumed no change thru TY50 because we assumed no new development within the 500 foot buffer zone (see attached map). Or this variable could be considered to have class 4 (insignificant/lightly used roads or levees) between 50.1 to 500 feet from the perimeter of the project area. Either way the SI value (1) is the same.

FWP – same as FWOP.

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Land Loss Spreadsheet

To calculate land loss, a loss rate for the marsh must be obtained from historical data.

Project: IHNC Lock Replacment - Marsh Establishment (100 acre)

Total Acres	**TYO Marsh Acres**	**TY0 Water Acres**
100	0	100

Oldest Year	**Recent Year**	**Oldest Year Acreage**	**Recent Year Acreage**	**Loss Rate**
1988	2005	17,915	15,318	-0.009170034

FWOP						FWP							
TY	Loss Rate	Marsh (acres)	% Marsh	Water (acres)	% Water	TY	Loss Rate	Marsh (acres)	% Marsh	Water (acres)	% Water		NET ACRES MARSH
0	-0.00917	0	0%	100	100%	0	-0.004585	0	0%	100	100%		0
1	-0.00917	0	0%	100	100%	1	-0.00459	100	100%	0	0%	10%	10
2	-0.00917	0	0%	100	100%	2	-0.00459	100	100%	0	0%		100
3	-0.00917	0	0%	100	100%	3	-0.00459	99	99%	1	1%	30%	30
4	-0.00917	0	0%	100	100%	4	-0.00459	99	99%	1	1%		99
5	-0.00917	0	0%	100	100%	5	-0.00459	98	98%	2	2%	100%	98
6	-0.00917	0	0%	100	100%	6	-0.00459	98	98%	2	2%		98
7	-0.00917	0	0%	100	100%	7	-0.00459	97	97%	3	3%		97
8	-0.00917	0	0%	100	100%	8	-0.00459	97	97%	3	3%		97
9	-0.00917	0	0%	100	100%	9	-0.00459	96	96%	4	4%		96
10	-0.00917	0	0%	100	100%	10	-0.00459	96	96%	4	4%		96
11	-0.00917	0	0%	100	100%	11	-0.00459	96	96%	4	4%		96
12	-0.00917	0	0%	100	100%	12	-0.00459	95	95%	5	5%		95
13	-0.00917	0	0%	100	100%	13	-0.00459	95	95%	5	5%		95
14	-0.00917	0	0%	100	100%	14	-0.00459	94	94%	6	6%		94
15	-0.00917	0	0%	100	100%	15	-0.00459	94	94%	6	6%		94
16	-0.00917	0	0%	100	100%	16	-0.00459	93	93%	7	7%		93
17	-0.00917	0	0%	100	100%	17	-0.00459	93	93%	7	7%		93
18	-0.00917	0	0%	100	100%	18	-0.00459	92	92%	8	8%		92
19	-0.00917	0	0%	100	100%	19	-0.00459	92	92%	8	8%		92
20	-0.00917	0	0%	100	100%	20	-0.00459	92	92%	8	8%		92
21	-0.00917	0	0%	100	100%	21	-0.00459	91	91%	9	9%		91
22	-0.00917	0	0%	100	100%	22	-0.00459	91	91%	9	9%		91
23	-0.00917	0	0%	100	100%	23	-0.00459	90	90%	10	10%		90
24	-0.00917	0	0%	100	100%	24	-0.00459	90	90%	10	10%		90
25	-0.00917	0	0%	100	100%	25	-0.00459	90	90%	10	10%		90
26	-0.00917	0	0%	100	100%	26	-0.00459	89	89%	11	11%		89
27	-0.00917	0	0%	100	100%	27	-0.00459	89	89%	11	11%		89
28	-0.00917	0	0%	100	100%	28	-0.00459	88	88%	12	12%		88
29	-0.00917	0	0%	100	100%	29	-0.00459	88	88%	12	12%		88
30	-0.00917	0	0%	100	100%	30	-0.00459	88	88%	12	12%		88
31	-0.00917	0	0%	100	100%	31	-0.00459	87	87%	13	13%		87
32	-0.00917	0	0%	100	100%	32	-0.00459	87	87%	13	13%		87
33	-0.00917	0	0%	100	100%	33	-0.00459	86	86%	14	14%		86
34	-0.00917	0	0%	100	100%	34	-0.00459	86	86%	14	14%		86
35	-0.00917	0	0%	100	100%	35	-0.00459	86	86%	14	14%		86
36	-0.00917	0	0%	100	100%	36	-0.00459	85	85%	15	15%		85
37	-0.00917	0	0%	100	100%	37	-0.00459	85	85%	15	15%		85
38	-0.00917	0	0%	100	100%	38	-0.00459	84	84%	16	16%		84
39	-0.00917	0	0%	100	100%	39	-0.00459	84	84%	16	16%		84
40	-0.00917	0	0%	100	100%	40	-0.00459	84	84%	16	16%		84
41	-0.00917	0	0%	100	100%	41	-0.00459	83	83%	17	17%		83
42	-0.00917	0	0%	100	100%	42	-0.00459	83	83%	17	17%		83
43	-0.00917	0	0%	100	100%	43	-0.00459	82	82%	18	18%		82
44	-0.00917	0	0%	100	100%	44	-0.00459	82	82%	18	18%		82
45	-0.00917	0	0%	100	100%	45	-0.00459	82	82%	18	18%		82
46	-0.00917	0	0%	100	100%	46	-0.00459	81	81%	19	19%		81
47	-0.00917	0	0%	100	100%	47	-0.00459	81	81%	19	19%		81
48	-0.00917	0	0%	100	100%	48	-0.00459	81	81%	19	19%		81
49	-0.00917	0	0%	100	100%	49	-0.00459	80	80%	20	20%		80
50	-0.00917	0	0%	100	100%	50	-0.00459	80	80%	20	20%		80

Land Loss Spreadsheet

To calculate land loss, a loss rate for the marsh must be obtained from historical data.

Project: IHNC Lock Replacment - Marsh Establishment (85 acre)

Total Acres	**TYO Marsh Acres**	**TY0 Water Acres**
85	0	85

Oldest Year	**Recent Year**	**Oldest Year Acreage**	**Recent Year Acreage**	**Loss Rate**
1988	2005	17,915	15,318	-0.00917

FWOP						FWP							
TY	Loss Rate	Marsh (acres)	% Marsh	Water (acres)	% Water	TY	Loss Rate	Marsh (acres)	% Marsh	Water (acres)	% Water		NET ACRES MARSH
0	-0.00917	0	0%	85	100%	0	-0.004585	0	0%	85	100%		0
1	-0.00917	0	0%	85	100%	1	-0.00459	85	100%	0	0%	10%	9
2	-0.00917	0	0%	85	100%	2	-0.00459	85	100%	0	0%		85
3	-0.00917	0	0%	85	100%	3	-0.00459	84	99%	1	1%	30%	25
4	-0.00917	0	0%	85	100%	4	-0.00459	84	99%	1	1%		84
5	-0.00917	0	0%	85	100%	5	-0.00459	83	98%	2	2%	100%	83
6	-0.00917	0	0%	85	100%	6	-0.00459	83	98%	2	2%		83
7	-0.00917	0	0%	85	100%	7	-0.00459	83	97%	2	3%		83
8	-0.00917	0	0%	85	100%	8	-0.00459	82	97%	3	3%		82
9	-0.00917	0	0%	85	100%	9	-0.00459	82	96%	3	4%		82
10	-0.00917	0	0%	85	100%	10	-0.00459	82	96%	3	4%		82
11	-0.00917	0	0%	85	100%	11	-0.00459	81	96%	4	4%		81
12	-0.00917	0	0%	85	100%	12	-0.00459	81	95%	4	5%		81
13	-0.00917	0	0%	85	100%	13	-0.00459	80	95%	5	5%		80
14	-0.00917	0	0%	85	100%	14	-0.00459	80	94%	5	6%		80
15	-0.00917	0	0%	85	100%	15	-0.00459	80	94%	5	6%		80
16	-0.00917	0	0%	85	100%	16	-0.00459	79	93%	6	7%		79
17	-0.00917	0	0%	85	100%	17	-0.00459	79	93%	6	7%		79
18	-0.00917	0	0%	85	100%	18	-0.00459	79	92%	6	8%		79
19	-0.00917	0	0%	85	100%	19	-0.00459	78	92%	7	8%		78
20	-0.00917	0	0%	85	100%	20	-0.00459	78	92%	7	8%		78
21	-0.00917	0	0%	85	100%	21	-0.00459	78	91%	7	9%		78
22	-0.00917	0	0%	85	100%	22	-0.00459	77	91%	8	9%		77
23	-0.00917	0	0%	85	100%	23	-0.00459	77	90%	8	10%		77
24	-0.00917	0	0%	85	100%	24	-0.00459	76	90%	9	10%		76
25	-0.00917	0	0%	85	100%	25	-0.00459	76	90%	9	10%		76
26	-0.00917	0	0%	85	100%	26	-0.00459	76	89%	9	11%		76
27	-0.00917	0	0%	85	100%	27	-0.00459	75	89%	10	11%		75
28	-0.00917	0	0%	85	100%	28	-0.00459	75	88%	10	12%		75
29	-0.00917	0	0%	85	100%	29	-0.00459	75	88%	10	12%		75
30	-0.00917	0	0%	85	100%	30	-0.00459	74	88%	11	12%		74
31	-0.00917	0	0%	85	100%	31	-0.00459	74	87%	11	13%		74
32	-0.00917	0	0%	85	100%	32	-0.00459	74	87%	11	13%		74
33	-0.00917	0	0%	85	100%	33	-0.00459	73	86%	12	14%		73
34	-0.00917	0	0%	85	100%	34	-0.00459	73	86%	12	14%		73
35	-0.00917	0	0%	85	100%	35	-0.00459	73	86%	12	14%		73
36	-0.00917	0	0%	85	100%	36	-0.00459	72	85%	13	15%		72
37	-0.00917	0	0%	85	100%	37	-0.00459	72	85%	13	15%		72
38	-0.00917	0	0%	85	100%	38	-0.00459	72	84%	13	16%		72
39	-0.00917	0	0%	85	100%	39	-0.00459	71	84%	14	16%		71
40	-0.00917	0	0%	85	100%	40	-0.00459	71	84%	14	16%		71
41	-0.00917	0	0%	85	100%	41	-0.00459	71	83%	14	17%		71
42	-0.00917	0	0%	85	100%	42	-0.00459	70	83%	15	17%		70
43	-0.00917	0	0%	85	100%	43	-0.00459	70	82%	15	18%		70
44	-0.00917	0	0%	85	100%	44	-0.00459	70	82%	15	18%		70
45	-0.00917	0	0%	85	100%	45	-0.00459	69	82%	16	18%		69
46	-0.00917	0	0%	85	100%	46	-0.00459	69	81%	16	19%		69
47	-0.00917	0	0%	85	100%	47	-0.00459	69	81%	16	19%		69
48	-0.00917	0	0%	85	100%	48	-0.00459	68	81%	17	19%		68
49	-0.00917	0	0%	85	100%	49	-0.00459	68	80%	17	20%		68
50	-0.00917	0	0%	85	100%	50	-0.00459	68	80%	17	20%		68

COMMUNITY HABITAT SUITABILITY MODEL
Bottomland Hardwoods

Project: IHNC Replacement Lock Confined Disposal Facility
Condition: Future Without Project (TY 0 through TY 8)

Variable		TY 0 Class/Value	TY 0 SI	TY 1 Class/Value	TY 1 SI	TY 8 Class/Value	TY 8 SI
V1	Species Assoc.	Class 1	0.20	Class 1	0.20	Class 1	0.20
V2	Maturity (input age or dbh, not both)	Age dbh 10.51	0.27	Age dbh 10.77	0.29	Age dbh 11.23	0.32
V3	Understory / Midstory	Understory % 49 Midstory % 58	0.96	Understory % 49 Midstory % 58	0.96	Understory % 45 Midstory % 60	0.95
V4	Hyrology	Class	0.65	Class	0.65	Class	0.65
V5	Forest Size	Class 5	1.00	Class 5	1.00	Class 5	1.00
V6	Surrounding Land Use	Values %		Values %		Values %	
	Forest / marsh	31	0.45	31	0.45	31	0.45
	Abandoned Ag	0		0		0	
	Pasture / Hay	12		12		12	
	Active Ag	48		48		48	
	Development	9		9		9	
V7	Disturbance						
	Type	Class 1	1.00	Class 1	1.00	Class 1	1.00
	Distance	Class 3		Class 3		Class 3	
		HSI =	0.41	HSI =	0.42	HSI =	0.43

Project: IHNC Replacement Lock Confined Disposal Facility
Condition: Future Without Project (TY 20 through TY 50)

Variable		TY 20 Class/Value	TY 20 SI	TY 50 Class/Value	TY 50 SI
V1	Species Assoc.	Class 1	0.20	Class 1	0.20
V2	Maturity (input age or dbh, not both)	Age dbh 7.57	0.09	Age dbh 16.29	0.75
V3	Understory / Midstory	Understory % 30 Midstory % 70	0.90	Understory % 20 Midstory % 70	0.75
V4	Hyrology	Class	0.65	Class	0.65
V5	Forest Size	Class 5	1.00	Class 5	1.00
V6	Surrounding Land Use	Values %		Values %	
	Forest / marsh	25	0.41	20	0.36
	Abandoned Ag	0		0	
	Pasture / Hay	15		17	
	Active Ag	48		48	
	Development	12		15	
V7	Disturbance				
	Type	Class 1	1.00	Class 1	1.00
	Distance	Class 3		Class 3	
		HSI =	0.30	HSI =	0.51

COMMUNITY HABITAT SUITABILITY MODEL

Bottomland Hardwoods

Project: IHNC Replacement Lock Confined Disposal Facility
Condition: Future With Project (TY 0 through TY 8)

Variable		TY 0		TY 1		TY 8	
		Class/Value	SI	Class/Value	SI	Class/Value	SI
V1	Species Assoc.	Class 1	0.20	Class 1	0.20	Class 1	0.20
V2	Maturity (input age or dbh, not both)	Age dbh 10.51	0.27	Age dbh 0.1	0.00	Age dbh 1	0.01
V3	Understory / Midstory	Understory % 49 Midstory % 58	0.96	Understory % 0 Midstory % 0	0.10	Understory % 50 Midstory % 0	0.55
V4	Hyrology	Class	0.65	Class	0.10	Class	0.46
V5	Forest Size	Class 5	1.00	Class 5	1.00	Class 5	1.00
V6	Surrounding Land Use	Values %		Values %		Values %	
	Forest / marsh	31	0.45	31	0.45	31	0.45
	Abandoned Ag	0		0		0	
	Pasture / Hay	12		12		12	
	Active Ag	48		48		48	
	Development	9		9		9	
V7	Disturbance Type	Class 1	1.00	Class 1	1.00	Class 1	1.00
	Distance	Class 3		Class 3		Class 3	
		HSI =	0.41	HSI =	0.05	HSI =	0.15

Project: IHNC Replacement Lock Confined Disposal Facility
Condition: Future With Project (TY 20 through TY 50)

Variable		TY 20		TY 50	
		Class/Value	SI	Class/Value	SI
V1	Species Assoc.	Class 1	0.20	Class 1	0.20
V2	Maturity (input age or dbh, not both)	Age dbh 4.6	0.05	Age dbh 11.3	0.33
V3	Understory / Midstory	Understory % 40 Midstory % 75	0.88	Understory % 30 Midstory % 40	1.00
V4	Hyrology	Class	0.46	Class	0.46
V5	Forest Size	Class 5	1.00	Class 5	1.00
V6	Surrounding Land Use	Values %		Values %	
	Forest / marsh	28	0.43	25	0.41
	Abandoned Ag	0		0	
	Pasture / Hay	13		15	
	Active Ag	48		48	
	Development	11		12	
V7	Disturbance Type	Class 1	1.00	Class 1	1.00
	Distance	Class 3		Class 3	
		HSI =	0.24	HSI =	0.41

AAHU CALCULATION, Bottomland Hardwoods

Alternative: Float-in-Place
Option: Containment and Fill Cell

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	209	0.41	85	
1	209	0.42	87	86
8	209	0.43	90	617
20	209	0.30	63	918
50	209	0.51	107	2559
		0.00		
			Total CHUs =	**4181**
			AAHUs =	**84**

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	209	0.41	85	
1	209	0.05	11	48
8	209	0.15	31	149
20	209	0.24	50	489
50	209	0.41	86	2041
		0.00		
			Total CHUs =	2728
			AAHUs =	**55**

NET CHANGE IN CHUs DUE TO PROJECT	
A. Future Without Project CHUs =	2728
B. Future With Project CHUs =	4181
Net Change (FWP - FWOP) =	-1453

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future Without Project AAHUs =	55
B. Future With Project AAHUs =	84
Net Change (FWP - FWOP) =	-29

AAHU CALCULATION, Bottomland Hardwoods

Alternative: Cast-in-Place
Option: Containment and Fill Cell

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	266	0.41	109	
1	266	0.42	110	110
8	266	0.43	114	786
20	266	0.30	81	1168
50	266	0.51	136	3257
		0.00		
			Total CHUs =	**5321**
			AAHUs =	**106**

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	266	0.41	109	
1	266	0.05	14	61
8	266	0.15	40	190
20	266	0.24	64	623
50	266	0.41	109	2598
		0.00		
			Total CHUs =	3471
			AAHUs =	**69**

NET CHANGE IN CHUs DUE TO PROJECT	
A. Future Without Project CHUs =	3471
B. Future With Project CHUs =	5321
Net Change (FWP - FWOP) =	-1849

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future Without Project AAHUs =	69
B. Future With Project AAHUs =	106
Net Change (FWP - FWOP) =	-37

AAHU CALCULATION, Bottomland Hardwoods

Alternative: Float-in-Place
Option: Fill Cell Only

Future Without Project			**Total**	**Cummulative**
TY	**Acres**	**x HSI**	**HUs**	**HUs**
0	138	0.41	56	
1	138	0.42	57	57
8	138	0.43	59	408
20	138	0.30	42	606
50	138	0.51	71	1690
		0.00		
			Total CHUs =	**2760**
			AAHUs =	**55**

Future With Project			**Total**	**Cummulative**
TY	**Acres**	**x HSI**	**HUs**	**HUs**
0	138	0.41	56	
1	138	0.05	7	32
8	138	0.15	21	98
20	138	0.24	33	323
50	138	0.41	57	1348
		0.00		
			Total CHUs =	1801
			AAHUs =	**36**

NET CHANGE IN CHUs DUE TO PROJECT	
A. Future Without Project CHUs =	1801
B. Future With Project CHUs =	2760
Net Change (FWP - FWOP) =	-959

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future Without Project AAHUs =	36
B. Future With Project AAHUs =	55
Net Change (FWP - FWOP) =	-19

AAHU CALCULATION, Bottomland Hardwoods

Alternative: Cast-in-Place
Option: Fill Cell Only

Future Without Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	170	0.41	69	
1	170	0.42	71	70
8	170	0.43	73	502
20	170	0.30	52	747
50	170	0.51	87	2082
		0.00		
			Total CHUs =	**3400**
			AAHUs =	**68**

Future With Project			Total	Cummulative
TY	Acres	x HSI	HUs	HUs
0	170	0.41	69	
1	170	0.05	9	39
8	170	0.15	26	121
20	170	0.24	41	398
50	170	0.41	70	1660
		0.00		
			Total CHUs =	2219
			AAHUs =	**44**

NET CHANGE IN CHUs DUE TO PROJECT	
A. Future Without Project CHUs =	2219
B. Future With Project CHUs =	3400
Net Change (FWP - FWOP) =	-1182

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future Without Project AAHUs =	44
B. Future With Project AAHUs =	68
Net Change (FWP - FWOP) =	-24

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Brackish Marsh

Project: IHNC Replacement Lock Marsh Establishment
Condition: Future Without Project (TY 0 through TY 5)

Variable		TY 0		TY 1		TY 5	
		Value	SI	Value	SI	Value	SI
V1	% Emergent	0	0.10	0	0.10	0	0.10
V2	% Aquatic	5	0.15	5	0.15	6	0.15
V3	Interspersion	%	0.10	%	0.10	%	0.10
	Class 1	0		0		0	
	Class 2	0		0		0	
	Class 3	0		0		0	
	Class 4	0		0		0	
	Class 5	100		100		100	
V4	%OW <= 1.5ft	85	0.90	80	1.00	75	1.00
V5	Salinity (ppt)	12	0.70	12	0.70	12	0.70
V6	Access Value	1.00	1.00	1.00	1.00	1.00	1.00
	Emergent Marsh HSI	**=**	**0.22**	**EM HSI =**	**0.22**	**EM HSI =**	**0.22**
	Open Water HSI	**=**	**0.37**	**OW HSI =**	**0.38**	**OW HSI =**	**0.39**

Project: IHNC Replacement Lock Marsh Establishment
Condition: Future Without Project (TY 50)

Variable		TY 50	
		Value	SI
V1	% Emergent	0	0.10
V2	% Aquatic	10	0.19
V3	Interspersion	%	0.10
	Class 1		
	Class 2		
	Class 3		
	Class 4		
	Class 5	100	
V4	%OW <= 1.5ft	50	0.74
V5	Salinity (ppt)	12	0.70
V6	Access Value	1.00	1.00
		EM HSI =	**0.22**
		OW HSI =	**0.40**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Brackish Marsh

Project: IHNC Replacement Lock Marsh Establishment
Condition: Future With Project (TY 0 thorugh TY 3)

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 3 Value	TY 3 SI
V1	% Emergent	0	0.10	10	0.19	30	0.37
V2	% Aquatic	5	0.15	0	0.10	0	0.10
V3	Interspersion	%		%		%	
	Class 1	0	0.10	100	1.00	100	1.00
	Class 2	0		0		0	
	Class 3	0		0		0	
	Class 4	0		0		0	
	Class 5	100					
V4	%OW <= 1.5ft	85	0.90	0	0.10	100	0.60
V5	Salinity (ppt)	12	0.70	12	0.70	12	0.70
V6	Access Value	1.00	1.00	0.00	0.10	1.00	1.00
	Emergent Marsh HSI	**=**	**0.22**	**EM HSI =**	**0.32**	**EM HSI =**	**0.55**
	Open Water HSI	**=**	**0.37**	**OW HSI =**	**0.21**	**OW HSI =**	**0.37**

Project: IHNC Replacement Lock Marsh Establishment
Condition: Future With Project (TY 5 thorugh TY 50)

Variable		TY 5 Value	TY 5 SI	TY50 Value	TY50 SI
V1	% Emergent	98	0.98	80	0.82
V2	% Aquatic	0	0.10	5	0.15
V3	Interspersion	%		%	
	Class 1	100	1.00		0.53
	Class 2	0		65	
	Class 3	0		35	
	Class 4	0		0	
	Class 5				
V4	%OW <= 1.5ft	90	1.00	80	1.00
V5	Salinity (ppt)	12	0.70	12	0.70
V6	Access Value	1.00	1.00	1.00	1.00
		EM HSI =	**0.96**	**EM HSI =**	**0.80**
		OW HSI =	**0.40**	**OW HSI =**	**0.41**

AAHU CALCULATION - EMERGENT MARSH (100 acre)

Future Without Project			Total	Cummulative
TY	**Marsh Acres**	**x HSI**	**HUs**	**HUs**
0	0	0.22	0	
1	0	0.22	0	0
5	0	0.22	0	0
50	0	0.22	0	0
			AAHUs =	**0**

Future With Project			Total	Cummulative
TY	**Marsh Acres**	**x HSI**	**HUs**	**HUs**
0	0	0.22	0	
1	10	0.32	3	1
3	30	0.55	17	18
5	98	0.96	94	101
50	80	0.80	64	3535
			AAHUs	**73**

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Emergent Marsh AAHUs =	73
B. Future Without Project Emergent Marsh AAHUs =	0
Net Change (FWP - FWOP) =	**73**

AAHU CALCULATION - OPEN WATER (100 acre)

Future Without Project			Total	Cummulative
TY	**Water Acres**	**x HSI**	**HUs**	**HUs**
0	100	0.37	37	
1	100	0.38	38	37
5	100	0.39	39	153
50	100	0.40	40	1773
			AAHUs =	**39**

Future With Project			Total	Cummulative
TY	**Water Acres**	**x HSI**	**HUs**	**HUs**
0	100	0.37	37	
1	0	0.21	0	16
3	1	0.37	0	0
5	2	0.40	1	1
50	20	0.41	8	200
			AAHUs	**4**

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Open Water AAHUs =	4
B. Future Without Project Open Water AAHUs =	39
Net Change (FWP - FWOP) =	**-35**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	73
B. Open Water Habitat Net AAHUs =	-35
Net Benefits= (2.6xEMAAHUs+OWAAHUs)/3.6	**43**

AAHU CALCULATION - EMERGENT MARSH (85 acre)

Future Without Project			Total	Cummulative
TY	**Marsh Acres**	**x HSI**	**HUs**	**HUs**
0	0	0.22	0	
1	0	0.22	0	0
5	0	0.22	0	0
50	0	0.22	0	0
			AAHUs =	**0**

Future With Project			Total	Cummulative
TY	**Marsh Acres**	**x HSI**	**HUs**	**HUs**
0	0	0.22	0	
1	9	0.32	3	1
3	25	0.55	14	15
5	83	0.96	79	85
50	68	0.80	55	2999
			AAHUs	**62**

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Emergent Marsh AAHUs =	62
B. Future Without Project Emergent Marsh AAHUs =	0
Net Change (FWP - FWOP) =	**62**

AAHU CALCULATION - OPEN WATER (85 acre)

Future Without Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	85	0.37	31	
1	85	0.38	32	32
5	85	0.39	33	130
50	85	0.40	34	1507
			AAHUs =	**33**

Future With Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	85	0.37	31	
1	0	0.21	0	13
3	1	0.37	0	0
5	2	0.40	1	1
50	17	0.41	7	173
			AAHUs	**4**

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Open Water AAHUs =	4
B. Future Without Project Open Water AAHUs =	33
Net Change (FWP - FWOP) =	**-30**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	62
B. Open Water Habitat Net AAHUs =	-30
Net Benefits= (2.6xEMAAHUs+OWAAHUs)/3.6	**37**

IHNC Lock Replacement
Wetland Value Assessment – Marsh Creation Area

The marsh creation area is 439 acres in area; however it is assumed that there is only an adequate volume of sediments dredged during lock construction to create between 80 and 104 acres of marsh. Of that are 85 acre area to be used for dredged material disposal for marsh creation to cover mitigation requirements and if the remaining acres are filled (to 104 acres) the additional 19 acres will be considered beneficial use. Currently in the 85 acre area 0 acres are vegetated wetlands and 85 acres are open water.

Variable V1 – Emergent Marsh
Assumption: At TY0 there is 0 percent of the marsh creation area is classified as marsh and is entirely shallow open water with dead cypress trees and stumps. Marsh loss rates were supplied by USGS, and those rates (0.92%/year) used in the model. A 50% reduction in the land loss rate (0.46%/year) was applied to FWP for the marsh creation area. It is assumed that the marsh creation area will not be planted with vegetation but will instead be allowed to naturally revegetate.

Future Without Project
TY0 – 0 acres (0 percent)
TY1 – 0 acres (0 percent)
TY5 – 0 acres (0 percent)
TY50 – 0 acres (0 percent)

Future With Project
TY0 – 0 acres (0 percent)
TY1 – 9 acres (10 percent)
TY3 – 25 acres (30 percent)
TY5 – 83 acres (98 percent)
TY50 – 68 acres (80 percent)

Variable V2 – Submerged Aquatic Vegetation

SAV coverage for TY0 is estimated to be 5 percent of the open water. Based upon surveys conducted by NMFS, much of the marsh creation area is too shallow to support SAV (less than 1 foot deep based upon 2001 spot elevation survey) and water clarity is also likely not adequate to support SAV. Under the FWOP it is assumed that the project area will deepen due to continued subsidence and the area supporting SAV will gradually increase. However with the continued urban runoff exposed to the area it is not expected that the SAVs will increase much. TY50 is 10%. Under the FWP it is assumed that the placement of dredged material will initially make the entire project area unsuitable for SAV.

Future Without Project
TY0 – 5 percent
TY1 – 5 percent

TY5 – 6 percent
TY50 – 10 percent

<u>Future With Project</u>
TY0 – 5 percent
TY1 – 0 percent
TY3 – 0 percent
TY5 – 0 percent
TY50 – 5 percent

Variable V3 – Interspersion
For TY0 it is assumed that the entire project area is interspersion Class 5 because the marsh area is less than 5 percent. Furthermore under the FWOP, the interspersion would remain entire Class 5 through TY50. For the FWP, most of the interspersion would be Class 1 following the placement of dredged material and would remain with very few open water bodies until TY5. By TY50, the interspersion is assumed to be 65 percent Class 2 and 35 percent Class 3.

Variable V4 – Water Depth

Based upon 2001 spot elevation survey information most of the open water in the project area is less than 1.5 feet deep (85 percent). It is assumed that under FWOP, water depth increases over time. Furthermore it is assumed that after the placement of dredged material under FWP, all of the open water in the project area would be less than 1.5 deep and that water depth would increase over time.

<u>Future Without Project</u>
TY0 – 85 percent
TY1 – 80 percent
TY5 – 75 percent
TY50 – 50 percent

<u>Future With Project</u>
TY0 – 85 percent
TY1 – 0 percent
TY3 – 100 percent
TY5 – 90 percent
TY50 – 80 percent

Variable V5 – Salinity

Based upon salinity data from 2001, emergent vegetation in the project area and salinity data from continuous recorders located near Bayou Bienvenue and the MRGO, the average salinity in the project area is 12 ppt. Under both FWOP and FWP it is assumed that salinities would remain the same in the future through TY50.

Variable V6 – Fishery Access

Fishery access is currently open and would remain so under FWP, except for TY1 when containment dikes would limit fisheries access. Therefore fishery access is 0.0001 in TY1 and then 1.0 in TY3 – 50 after the containment dikes are breached.

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CONCEPTUAL WETLAND RESTORATION PLAN FOR THE MITIGATION OF IMPACTS AT THE INNER HARBOR NAVIGATION CANAL LOCK REPLACEMENT PROJECT

U.S. Army Corps of Engineers
New Orleans District
P.O. Box 60267
New Orleans, Louisiana 70160-0267

February 2009

1.0 DESCRIPTION

1.1 SUMMARY

This conceptual wetland restoration plan was developed by CEMVN with the intent to restore 85 acres of intertidal marsh near Bayou Bienvenue in New Orleans, Orleans Parish, Louisiana. The objective of the wetland restoration is to mitigate impacts associated with the replacement of the Inner Harbor Navigation Canal (IHNC; *i.e*., Industrial Canal) Lock, located between the St. Claude Avenue and North Claiborne Avenue Bridges in New Orleans, Louisiana (Figure 1). The IHNC Lock allows for navigation between the higher water surface elevations of the Mississippi River and the lower water surface elevations of the IHNC, the eastern portion of the Gulf Intracoastal Waterway (GIWW) and the Mississippi River-Gulf Outlet (MRGO)**.** The recommended lock replacement plan would construct a new 110-foot wide, 1,200-foot long and 36-foot deep lock in the IHNC north of the Claiborne Avenue Bridge and extend Mississippi River floodwalls and levees from the existing lock to the new lock location. The recommended plan includes the replacement of the existing St. Claude Avenue Bridge with a low-level double-bascule bridge, modifications to the Claiborne Avenue Bridge to make it compatible with a new lock and demolition of the existing lock. The recommended plan also includes the construction of lock monoliths at an offsite construction area and the disposal of material dredged during lock construction. Wetland impacts occur from the construction activities at the offsite construction area, which is located on the south bank of the GIWW/MRGO east of the Paris Road Bridge, and from the disposal of dredged material in a confined disposal facility (CDF), which is located between the GIWW/MRGO and Bayou Bienvenue northeast of the IHNC Lock construction site. The proposed mitigation site is located south of Bayou Bienvenue, across the Bayou from the CDF location.

1.2 BASELINE CONDITIONS OF IMPACTED SITE

At the proposed offsite construction area on the south bank of the GIWW/MRGO and the CDF, wooded lands are present, and the dominant plant species are Chinese tallow (*Sapium sebiferum*), elderberry (*Sambucus canadensis*), red maple (*Acer rubrum*), box elder (*Acer negundo*), roughleaf dogwood (*Cornus drummondii*) and black willow (*Salix nigra*). Much of these wooded lands were heavily damaged by Hurricane Katrina and woody vegetation was blown down by the winds and high water from the storm. Very little mature vegetation remains in these areas and much of the recruitment is Chinese tallow.

Mid-story and understory vegetation present within the proposed offsite construction area and CDF include elderberry, poison ivy (*Toxicodendron radicans*), blackberry (*Rubus* sp.), rattlebox (*Sesbania* sp.), yaupon (*Ilex vomitoria*), wax myrtle (*Morella cerifera*), groundseltree (*Baccharis halimifolia*), smartweed (*Polygonum punctatum*) and dog fennel (*Eupatorium capillifolium*).

The majority of the wooded areas in the proposed CDF are periodically flooded, primarily from rainfall. These areas are at an elevation that is high enough to restrict tidal flows but are often saturated from rain events and close proximity to ground water. The majority of the proposed offsite construction area is located on the flood side of the GIWW/MRGO levee and is subject to tidal influence. Most of the time, the CDF and a small portion of the offsite construction area are not connected to nearby water bodies (*i.e.*, GIWW and Bayou Bienvenue); however, during major rain events and high tides, the area is hydraulically connected to exterior surface waters through eroded retention dikes. Most of the time, fish access is restricted.

The dredging of the MRGO/GIWW, which was conducted in the 1950s and 1960s, substantially altered the wetlands at the offsite construction area and CDF. The wooded areas where the offsite construction area and CDF would be located were historically utilized for dredged material disposal, which raised the elevation of both sites. With the construction of a flood protection levee along the MRGO/GIWW the proposed location for the CDF and a small portion of the proposed offsite construction area were isolated from tidal influence.

1.3 SELECTION OF MITIGATION SITE

The proposed mitigation site was selected because of its proximity to the location of dredging activities associated with the IHNC Lock Replacement project which will provide the material for restoration and because of the combined Federal, state and local interest in restoring wetlands at the proposed mitigation location. Furthermore, the proposed mitigation site is located adjacent to the impact site (*i.e.*, the CDF) allowing restored wetland functions to be as close to those impacted functions as physically possible.

1.4 BASELINE CONDITIONS OF MITIGATION SITE

The proposed restoration area is almost entirely unvegetated, and consists of open water and mud flats with dead cypress trees and stumps scattered throughout. The land use in the area is currently open space and historically was cypress swamp that has degraded due to subsidence and saltwater intrusion. The area is tidally influenced through a flood gate located at the confluence of Bayou Bienvenue and the GIWW. The estimate of the tidal range within the restoration area is approximately 6 inches, as measured by CEMVN and University of Wisconsin personnel during site visits in 2007 and 2008. The triangular-shaped area totals approximately 440 acres and is highly subsided with little freshwater input. Surface elevation in the proposed restoration area ranges from approximately -0.5 feet to -1.5 feet NAVD 88 (Hartman Engineering, Inc 2001). Currently the system experiences brackish water conditions (between 5 [winter/spring] and 15 [summer] parts per thousand), and even after the placement of dredged material and the increase in elevation relative to sea level, brackish conditions are expected to persist due to the lack of freshwater influence. Therefore, brackish marsh habitats are anticipated to be restored as a result of the mitigation effort.

1.5 CREDIT DETERMINATION METHODOLOGY

Impacts on wetlands from construction of the CDF and offsite construction area were analyzed using WVA methodology. The WVA methodology is a quantitative habitat-based assessment tool developed for use in determining wetland benefits of proposed projects submitted for funding under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA); however, the methodology is widely used to evaluate the impacts of coastal projects on wetland values. The results of the WVA, measured in Average Annual Habitat Units (AAHUs), provide an estimate of the positive or negative environmental effects of a potential project. Typically, for a CEMVN civil works project, the WVA analysis is applied to the habitats that will be impacted by the project, and if net negative impacts are determined, the WVA is applied to potential mitigation plans to develop appropriate compensatory mitigation.

The WVA has been developed for application to several habitat types along the Louisiana coast, and community models have been developed for fresh marsh, intermediate marsh, brackish marsh, salt marsh, fresh swamp, barrier islands, and barrier headlands. A WVA Procedural Manual has also been prepared to provide guidance to project planners in the use of the various community models (Environmental Working Group 2006). Two other habitat assessment models for bottomland hardwoods and coastal chenier/ridge habitat were developed for use outside of CWPPRA.

Habitat quality is estimated through the use of community models developed specifically for each habitat type. Each model consists of 1) a list of variables that are considered important in characterizing fish and wildlife habitat, 2) a Suitability Index (SI) graph for each variable, which defines the assumed relationship between habitat quality and different variable values, and 3) a mathematical formula that combines the SI for each variable into a single value for habitat quality; that single value is referred to as the Habitat Suitability Index (HSI).

An SI graph is a graphical representation of how fish and wildlife habitat quality or "suitability" of a given habitat type is predicted to change as values of the given variable change, and allows the model user to numerically describe, through the SI, the habitat quality of a wetland area for any variable value. Each SI ranges from 0.1 to 1.0, with 1.0 representing the optimal condition for the variable in question. SI graphs are constructed for each variable (Environmental Working Group 2006).

The final step in model development (Environmental Working Group 2006) is to construct a mathematical formula that combines all SIs into a single HSI value. Because the SIs range from 0.1 to 1.0, the HSI also ranges from 0.1 to 1.0, and is a numerical representation of the overall or "composite" habitat quality of the particular wetland area being evaluated. The HSI formula defines the aggregation of SIs in a manner unique to each wetland type depending on how the formula is constructed (Environmental Working Group 2006).

The net impacts of a proposed project are estimated by predicting future habitat conditions under two scenarios: future without-project and future with-project. Specifically, predictions are made as to how the model variables would change through time under the scenarios. Through that process, HSIs are established for baseline (pre-project) conditions and for future without- and future with-project scenarios for selected target years (TY) throughout the expected life of the project. Those HSIs are then multiplied by the project area acreage at each TY to arrive at Habitat Units (HUs). HUs represent a numerical combination of quality (HSI) and quantity (acres) existing at any given point in time. The HUs resulting from the future without- and future with-project scenarios are annualized, averaged over the project life, to determine AAHUs. The impact of a project can be quantified by comparing AAHUs between the future without- and future with-project scenarios. The difference in AAHUs between the two scenarios represents the net impact attributable to the project in terms of habitat quantity and quality (Environmental Working Group 2006). The same type of analysis is applied to proposed mitigation plans to develop appropriate compensatory mitigation for unavoidable project impacts.

WVA analysis for the 209-acre CDF determined that there would be a loss of 29.06 AAHUs as a result of its construction. This includes the temporary impacts from the fill cell and the permanent impacts from the disposal cell. Additionally, WVA analysis for the temporary impacts of the offsite construction area determined that there would be a loss of 7.22 AAHUs. Therefore, a total loss of 36.28 AAHUs would be the net impact of the IHNC Lock Replacement project. WVA analysis for the proposed restoration in the triangular-shaped area south of Bayou Bienvenue indicates that 36.56 AAHUs would be created by restoration of brackish marsh habitat and would fully mitigate for the project's wetland impacts.

1.6 RESPONSIBLE PARTIES

CEMVN is responsible for wetland restoration funding and design. CEMVN will also be responsible for maintenance and monitoring of the wetland restoration project. Annual monitoring reports during the maintenance and monitoring period will be prepared by CEMVN and provided to Federal and state regulatory agencies for review. The mitigation site is located on parcels owned by various entities including private and commercial landowners, and the City of New Orleans. The parcels comprising the mitigation site will be acquired in fee by CEMVN and will be held in perpetuity.

1.7 MITIGATION IMPLEMENTATION SCHEDULE

It is anticipated that approximately 253,450 cubic yards (cy) of material would be placed in the wetland mitigation area. Dredged material removed from Dredged Material Management Unites (DMMU) 3 Fill (F), 4/5 Native (N), 7 N (area underlying east bank fill), and 9 Non-native (NN; area north of the existing lock) would be placed into the triangular-shaped area for wetland creation, as shown in Table 1-1. The dredged material would be placed at the mitigation site the year in which it is dredged.

Table 1-1. Dredged Material Volumes for Wetland Restoration and Year of Placement

DMMU/Location	Material Type	Volume (cubic yards)	Approximate Year Dredged
DMMU 7	N	83,500	1
DMMU 3	F	62,850	2-3
DMMU 4/5	N	64,900	2-3
DMMU 9	NN	42,200	7
Total		**253,450**	

2.0 WETLAND RESTORATION OBJECTIVES

2.1 INTRODUCTION

The objective of wetland restoration is to mitigate for the functions and values of the wetland habitats lost due to the construction of an offsite construction area and CDF. The proposed wetland restoration area comprises 85 acres located in the western-most corner of the triangular-shaped area south of Bayou Bienvenue (see Figure 1).

The components of the wetland restoration implementation will be:

- Construction of a dredged material containment system;
- Dewatering of dredged material;
- Vegetation plantings following dewatering;
- Breaching of containment system and degradation of containment system; and
- Monitoring and maintenance for 20 years to ensure wetland mitigation success.

2.2 TYPES, FUNCTIONS, AND VALUES OF HABITAT TO BE RESTORED

The loss of 36.28 AAHUs would be mitigated by creating wetlands in the triangular area south of Bayou Bienvenue. WVA analysis determined that by creating 85 acres of wetlands in the triangular mitigation area, the net benefits would total 36.56 AAHUs, which would fully mitigate the impacts from the CDF and offsite construction area. The objective of the mitigation would be to create emergent marsh in an area which now contains shallow brackish water. The site would be built adjacent to the perimeter of the large triangular area, just south of Bayou Bienvenue, so that the existing land would act as a corridor for animals and plants to colonize the mitigation site. The dredged material would be placed so that after settling, consolidation and initial subsidence, the elevation would be suitable for the colonization of tidal marsh plant species. One of several methods to achieve marsh creation would be used. Low-level dikes constructed to contain the dredged material during placement could be constructed. The dikes would be breached at several locations after effluent discharge so that tidal exchange between the mitigation site and Bayou Bienvenue would occur. However, due to the condition of the foundation soils throughout the mitigation site, construction of some type of temporary structure, such as geo-textile tubes or hay bales, may be used instead to minimize flow of solids away from the intended placement area. Unrestricted open water disposal at the mitigation site is yet another possibility for placement of material in the mitigation site. For all of the possible construction methods it is anticipated that diluted effluent would ultimately discharge from the triangular area to Bayou Bienvenue, and discharge would be from weirs that allow for fish egress during dredged material placement.

2.3 COMPATIBILITY WITH PAST PROJECTS PROPOSED IN THE VICINITY

Two other projects have been proposed for wetland restoration/creation in the Bayou Bienvenue triangular-shaped restoration area. However, due in part to the instability of the soils, neither of the proposed projects has been implemented. In 2001, the State of Louisiana Department of Natural Resources (LDNR), Coastal Restoration Division and the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) proposed a plan to divert freshwater discharge from Pumping Station Number 5 into the restoration area.

Cordgrass (*Spartina* sp.) was to be planted along the channel banks and along terraces constructed within the open water of the restoration area. The proposed terraces were to be constructed from soil material (muck) from the project site. The project was eventually abandoned due to the expense of constructing the terraces over low-strength (unstable) organic clays and peat (Hartman Engineering 2001).

Following Hurricane Katrina in 2005, the New Orleans Sewerage and Water Board proposed a plan for wetland assimilation and restoration in the Bayou Bienvenue area. The plan called for restoration of the wetlands utilizing nutrient-rich effluent while also providing tertiary treatment for sewerage. In August 2007, the New Orleans Sewerage and Water Board, in conjunction with Saint Bernard Parish, contracted an environmental firm to execute a feasibility study for using portions of the 29,000 acre Bayou Bienvenue Central Wetland Unit (which includes the triangular-shaped area) as wetland assimilation discharge sites for tertiary treatment of its effluent. A portion of the assimilation area would also be restored to a cypress (*Taxodium distichum*) swamp.

The Holy Cross Neighborhood Association (HCNA) would also like the area to be restored to a cypress swamp. The University of Wisconsin has been studying methods for implementing a restoration plan in this location for the HCNA. Those recommendations also include the use of dredged material, diversion of freshwater from pump stations and revegetation.

CEMVN's 85-acre wetland restoration project would complement, and could become integrated into any of the ongoing proposals for restoration of the larger triangular-shaped area.

3.0 IMPLEMENTATION PLAN

3.1 IMPLEMENTATION OVERVIEW

Implementation of the restoration of the project site would be accomplished through a series of steps including preparation of plans and specifications followed by: site preparation, plant preparation, installation (*i.e*., structures and other features of the project and plants), maintenance and adaptive management, and monitoring. Activities included in site preparation are construction of dredged material containment structures and preparation of the site for dredged material placement. Plant preparation will include collecting and propagating plants or securing locally-adapted seeds, cuttings, and plugs. Structures and major features of the project would be then be constructed, followed by the installation of locally grown plants. Maintenance of the mitigation site will include ensuring the containment structures are in tact until dewatering is complete, ensuring the marsh surface elevation is at the desired height, removing and/or managing invasive species at the site (see Chapter 4), and allowing for adaptive management techniques. Adaptive management will allow for mid-course corrections during the 20-year monitoring of the project.

3.2 IMPLEMENTING PARTIES

CEMVN is responsible for implementation and construction of the wetland restoration project, as well as the maintenance and monitoring until specific performance criteria for success are met. CEMVN is also responsible for reporting activities. CEMVN will be the contracting entity, to provide contract oversight for implementation and monitoring.

3.3 WETLAND RESTORATION DESIGN

The wetland restoration design for the site employs several techniques to restore intertidal marsh. These are construction of a dredged material containment system, placement of dredged material to raise the elevation of the site relative to sea level, dewatering of the dredged material to allow for sediment consolidation, seeding of the dredged material for short-term sediment stability, breaching of containment system and planting wetland vegetation.

3.3.1 Site Design

Containment methods

Two containment methods for the dredged material could be considered – earthen berms and geo-textile cells. The earthen berms would be created with dredge material and the geo-textile cells would be filled with the dredge material. Both containment methods could be utilized on the instable soils. Hard structure containment is not an option for the mitigation area due to the instability of the substrate and difficulty in placing the hard structures.

Earthen containment berms would be designed to provide for complete containment of the applicable DMMU's in the year they are dredged. There would be at least three containment cells separated by earthen dikes (Figure 2). Material dredged in year 1 would be placed into the first cell and dewatered through the second and third areas. The water and any suspended sediments remaining after the settling time would pass through a weir to cell 2, and eventually to cell 3. The effluent leaving cell 3 would be passed through a silt curtain, if necessary, before discharging into Bayou Bienvenue. Each of the subsequent DMMU episodes (in years 2-3 and year 7) would be similarly designed and the same dewatering and sediment settlement methods would be utilized. Laboratory sedimentation tests would provide data for design of the containment area to meet effluent suspended soils criteria and to provide adequate storage capacity for the dredged solids.

The dredged material could also be contained in geo-textile cells. The cells would be staked in place and filled to provide the same level of containment for the three individual containment cells. Dredged material would be placed as described for the earthen containment berms. Due to site inaccessibility and the instability of the soils at the 85-acre mitigation site, geo-textile cells would likely be the preferred alternative for containment. Further engineering analysis would be completed before project implementation to ensure the appropriate containment method was chosen.

Full build-out designs would analyze and address the placement of the dredged material on the instable soils at the restoration site and the final elevation of material placement. At this time, it is unknown how much the sediment will settle or at what rate the material might settle. If the material does not settle to the desired elevation, the dike can be breached to allow the sediment to spill into an adjacent cell. Similarly, if the sediment settles too much, additional soil can be placed in the cell in subsequent years. Although it is recognized that some loss of aquatic species will occur from suffocation or burial during dredged material placement, full build-out designs will include weir designs that provide for fish egress, where possible.

All dikes or containment berms would be breached immediately following material containment and dewatering to insure adequate tidal exchange and fish access. Breaches would be placed at natural connections with waterways and provide as much exchange with Bayou Bienvenue as possible. Areas along dikes or berms that are at elevations greater than the marsh surface would be degraded so that no upland areas would remain within the mitigation site.

Dredged material volume

IHNC dredged material proposed for deposition in the mitigation area would be primarily native soil material from DMMUs 3, 4/5, 7 and 9. The native material found in the core tests for these DMMUs consisted of between 84 and 96 percent fine sediment (silt and clay), with sand fractions somewhat higher in DMMUs 3 and 4/5. The predominant fine grain size of the material will result in extended holding times for the material to allow for sediment settling prior to discharging of the decanted effluent into Bayou Bienvenue.

A total of 253,450 cubic yards of dredge material will be placed in the mitigation area over a period of 7 years. The scheduled delay of between 1 and 4 years between the placement of material from individual DMMUs will allow for sediment settling and material compaction in the mitigation area, such that a stable substrate can be established for planting vegetation in each disposal cell.

The amount of effluent resulting from dewatering of the dredged material from each DMMU cannot be estimated with accuracy. Over the length of the dewatering period, approximately two thirds of the initial volume of dredge material slurry entering the containment cell for each DMMU will be discharged as effluent. Precipitation over the life of the containment cells will also be discharged with the effluent.

Short term water management and effluent

Under either containment system (*e.g.*, earthen berms or geo-textile cells), there would be at least three cells with weirs that would allow the water to flow over the top and the sediment to settle in each cell. If there is still suspended sediment at the discharge point, a silt curtain would be placed over the discharge pipe to catch any finely suspended sediments remaining before the effluent is discharged into Bayou Bienvenue.

Initial fill elevation

Dredged material would be placed hydraulically in the mitigation site. The target initial fill elevation would be +4.5 feet NAVD 88 allowing for a minimum of 2 feet of consolidation for a target final elevation of +2.5 feet NAVD 88. The target final elevation of +2.5 feet NAVD88 would be at an elevation that is high enough to allow for an additional 0.5 to 1.0 foot of subsidence and compaction over the next 50 years and still remain intertidal and supportive of wetland vegetation. Calculations were made for the conceptual design assuming existing ground elevations varied from -1.5 feet to -0.5 feet NAVD 88 based upon previous surveys. Using the initial target and final target elevations along with existing ground elevations, it was determined that there is more than sufficient excess dredged material from the IHNC Lock Replacement project to create 85 acres of wetlands (253,450 cubic yards). Full build design plans and specifications for the mitigation site will further refine target initial and final elevations and dredged material volumes.

Wetland vegetation planting

The proposed wetland restoration site is sparsely vegetated with smooth cordgrass (*Spartina alterniflora*). Additional smooth cordgrass would be planted on 5 foot centers in the intertidal areas of the project site after the target elevation is reached. Natural recruitment from plants in the project area and the planted plugs would ensure successful colonization of this species. Marsh hay cordgrass (*Spartina patens*) would be also planted on 5 foot centers. Three-square bulrush (*Scirpus americanus*) would also be planted at 10 foot centers on higher elevation areas.

Most of the material to be placed at the site is native clay and silt soil. Because the soil would be lacking nutrients, fertilizer and organic material (such as straw mulch) would be added to the dredged material after placement. Plants could be fertilized with Osmocote or Mag Amp. In a fertilizer study on *S. alterniflora* transplants in North Carolina, tests showed that transplanted plants fertilized with Osmocote survived significantly better than the others and grew fastest (Broome et al. 1983). Plants fertilized with Mag Amp were slower to get started, but were showed greater long-term rates of growth.

4.0 MAINTENANCE PLAN

The maintenance phase may be revised based on the results of annual monitoring by CEMVN provided that the revisions improve the chances of the final success criteria being met or exceeded (see Section 5.2.1, Final Success Criteria).

4.1 MAINTENANCE OF DREDGED MATERIAL

The final elevation of the material in each containment cell will be controlled by the height of the weir in the containment dike for each cell. If the elevation of a cell is measured to be below target height, subsequent dredge events will be managed to provide additional material to bring the elevation to the desired height. Likewise, if during a fill event, it becomes obvious that too much material is being placed in the cell, then the weir can be lowered to allow more fill to enter the next cell. Final compacted cell heights can also be manipulated by mechanical equipment, if necessary, to bring the cell height to the desired elevation. Following dewatering of the containment cells, dikes would be breached in multiple locations to allow for increased tidal influence and fish passage, and degraded in areas where the ground surface elevation is too high to allow for colonization of wetland species.

Surveyed staff gages will be placed in each fill cell prior to dredged material placement. Monitoring of fill heights and rates of material compaction will occur throughout the dredging activities.

4.2 MAINTENANCE OF PLANTINGS

Monitoring of vegetation species, distribution, and percent cover (see Chapter 5 regarding monitoring requirements) will be used to evaluate the success of the plantings. Information from this monitoring program will direct maintenance activities and adjustments to planting areas or techniques to ensure the success of the mitigation.

One of the critical steps of installation is maintenance and monitoring of the site. Maintenance of the site will ensure the final success criteria will be met and that the marsh creation proceeds accordingly. Maintenance could include (Interagency Working Group 2008):

- Controlling non-native and invasive species;
- Controlling herbivores;
- Replacing plants;
- Maintaining breaches to allow for fish passage
- Reducing or preventing human intrusion; and
- Controlling local pollutants.

Non-native and invasive species would be monitored and controlled throughout the 20-year monitoring period. This involves suppressing non-native or invasive plants with herbicides, cutting them repeatedly during key times in the growing season, manually removing individual plants, and re-planting native species to eventually help shade out invasive plants.

Chinese tallow (*Sapium sebiferum*), an invasive, non-native tree, could colonize the mitigation area if uncontrolled. Although it produces seeds after 3 years of growth, it can also reproduce vegetatively. Seedlings found on the site could be manually removed, treated with a low-volume foliar herbicide, or the foliage and stem could be burned with a backpack burner. Herbicide selection would depend on the presence of standing water on the site and the size of the plants.

Herbivory would be monitored and if herbivory is determined to be a problem with meeting success criteria, structures would be constructed to keep the animals (*e.g.*, nutria) out of the restoration area. Warning signs would be erected to discourage human intrusion into the restoration area.

5.0 MONITORING PLAN

The goal of the monitoring plan is to provide feedback to the maintenance program and determine the success of the wetland restoration. The final success criteria are based on establishing brackish marsh habitat. Modifications or adjustments to the final success criteria for habitat restoration will be done by CEMVN, if necessary, in coordination with U.S. Environmental Protection Agency (EPA), LDEQ, U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries.

5.1 INTRODUCTION

Monitoring of the marsh surface elevation, water levels and vegetation will determine if the wetland habitat restoration requirements have been met. Attainment of the performance criteria outlined below will indicate that the wetland restoration is on the proper trajectory to meet the long-term habitat goals.

Restoration will be monitored over a 20 year period, starting after the plantings are in place, to calculate trend characteristics and provide feedback to the maintenance program. Trend characteristics will be used to assess growth rates toward the final success criteria. The results of the final year of monitoring will be compared to the final success criteria (*i.e.*, 65 percent plant cover) to determine if the restoration goals have been met. If the final success criteria have not been met (as described in Section 5.2.1 below), then monitoring results will be evaluated, additional maintenance will be accomplished, the monitoring plan revised accordingly, and the monitoring will continue until the final success criteria are achieved.

5.2 MONITORING

Monitoring completed over the 20 year period will include monitoring the marsh surface elevation annually, collecting aerial photography, determining plant cover by species across the site, and measuring water levels. Water levels and marsh surface elevation data will be used to calculate the frequency, depth and duration of flooding over the marsh surface

A surveyed (NAVD 88) staff gage will be placed in each of the three cells prior to the placement of dredged material. Monitoring of marsh surface elevation will be done by taking 20 random elevation measurements in each of the three cells and then tying those elevations into the datum of the surveyed staff gage. These 60 random elevation measurements will be collected annually for the first 5 years and then once every 5 years (years 10, 15 and 20) until monitoring is completed.

One continuous water recorder will be installed and surveyed to NAVD 88 within the restoration area immediately following planting. Water surface elevations and salinity measurements will be recorded hourly for 5 years, and then hourly for one year each in monitoring years 10, 15 and 20. Water surface elevations from the continuous recorder data will be tied to the marsh surface elevation data to determine the duration and depth of flooding across the marsh surface.

Color infrared aerial photography of the mitigation site will be collected in years 1, 3, 5, 10 and 20. The aerial photography will be georectified, photointerpreted, ground-truthed and mapped in GIS. The aerial photography will be used to document vegetated and non-vegetated areas within the mitigation site.

Ocular estimates of percent plant cover by species will be collected annually for the first 5 years, and in years 10, 15 and 20, in randomly placed 1 square meter quadrats. Quadrats would continue to be randomly sampled until no new plant species were found in five consecutive quadrats.

During year 5, sampling for fish use would occur on a quarterly basis using cast nets or seines to sample in open water within the mitigation area. Observation of wildlife use would also be recorded.

5.2.1 Success Criteria

Monitoring will be conducted for 20 years. When all final success criteria have been met or exceeded, all habitat restoration obligations will be considered complete. If all final success criteria have not been met at the end of the 20 year monitoring period, CEMVN shall undertake the necessary actions to correct the problem(s) and continue the monitoring for 2 additional years.

CEMVN shall consider the wetland restoration successful when sampling data demonstrate that all of the following success criteria have been met or exceeded:

1) Functional marsh elevation is achieved over 75 percent of the mitigation acreage.
2) Minimum 85 percent plant cover of marsh surface with facultative wetland or wetter species;
3) Demonstrated use of mitigation area by fish and wildlife species.

The following interim criteria will be used by CEMVN for adaptive management purposes and allow for an early resolution of any problems with the restoration:

Functional marsh surface elevation within the mitigation acreage:

Year 1: 80 percent	Year 10: 85 percent
Year 3: 90 percent	Year 15: 80 percent
Year 5: 90 percent	Year 20: 75 percent

Cover of marsh surface with facultative wetland or wetter species:

Year 1: 70 percent	Year 10: 90 percent
Year 3: 95 percent	Year 15: 85 percent
Year 5: 90 percent	Year 20: 85 percent

Additional Five-year Success Criteria would include:

1) Demonstrated use of bank area by estuarine-dependent marine fishery species

2) Observed use of created marsh by wildlife species typically found in natural marsh habitats of similar regime.

5.2.2 Monitoring Reports

A monitoring report will be prepared annually for the first 5 years and in years 10, 15 and 20 describing the monitoring results. Each monitoring report will contain a description of the conditions of the mitigation area, a comparison of collected data with interim success criteria, and progress towards final success criteria. In addition to success criteria, the health of the plantings and other vegetation, the presence of invasive plants, and other general observations will be collected and reported. Photo-documentation of restoration progress will be collected at the same locations at each monitoring event. Management recommendations to assure that final success criteria are met will be included in each monitoring report. The monitoring report will also include information and recommendations concerning revegetation site changes, such as acts of vandalism, lack of tidal influence, or any condition that may inhibit restoration efforts. The as-built plans for the mitigation area will be provided and annual monitoring reports submitted to EPA, LDEQ, USFWS and NOAA Fisheries by December 31st of each year during the monitoring period.

5.2.3 Adaptive Management

If monitoring reports indicate a failure to meet interim success criteria or sufficient progress towards final success criteria, CEMVN would take measures to achieve those criteria and initiate annual monitoring for two consecutive years or until all criteria are achieved. CEMVN would either deposit additional material or redistribute existing material as necessary to achieve functional marsh elevations over the target percentage of the mitigation acreage. If vegetative planting survival is not adequate to achieve target percentage of marsh surface coverage, CEMVN would address the causes of mortality and replace dead plantings. If adaptive management does not result in achievement of success criteria within two years, remedial actions would be developed in coordination with EPA, LDEQ, USFWS, and NOAA Fishers.

5.2.4 Completion of Monitoring Requirements

When final success criteria have been met, CEMVN will submit a final report to the EPA, LDEQ, USFWS and NOAA Fisheries. The final monitoring report will demonstrate that the wetland restoration is successful and include a summary of data trends from previous monitoring reports, as well as photo-documentation of representative sample plots. If, at the end of 20 years, the final success criteria have not been met, replacement plants will be installed, EPA, LDEQ, USFWS and NOAA Fisheries consulted, and monitoring continued for 2 additional years.

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