Coastal Protection and Restoration Authority of Louisiana

State of Louisiana
Office of Coastal Protection and Restoration
Operations Division

2011 Operations, Maintenance, and Monitoring Report

for

Grand-White Lake Land Bridge Protection

State Project Number ME-19
Priority Project List 10

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Cameron Parish

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2011 Operations, Maintenance, and Monitoring Report
For
Grand-White Lake Land Bridge Protection (ME-19)

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I. Introduction

The Grand-White Lake Land Bridge Protection project (ME-19) is a shoreline protection project from the 10th priority list of the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA), comprised of 1,530 ac (619 ha) of fresh marsh and open water in the Mermentau Basin of Cameron Parish, Louisiana. The project area includes shoreline along a portion of the southeast Grand Lake, the northern half of Collicon Lake shoreline, and Round Lake (figure 1). In 2001, 35% of the project area was classified as fresh marsh and 65% as open water shrub/scrub (Linscombe and Chabreck n.d.; obtained from the Coastwide Reference Monitoring System (CRMS) website (http://www.lacoast.gov/crms_viewer/) on August 30, 2011). Soils in the area between Grand Lake, Collicon Lake, and adjacent to the old GIWW are Larose muck. The northeastern shore of Collicon Lake consists of organic Allemands muck. Both Larose muck and Allemands Muck are very poorly drained soils and are extremely vulnerable to erosion when exposed to hydrologic energy (USDA 1995).

Grand Lake and Collicon Lake are in danger of breaching into each other endangering the 13,281 acre (5374.6 ha) Grand-White Lake Land Bridge area. Wave induced erosion of the southeast shoreline of Grand Lake (15 mi/24.1 km northwest fetch) and the west shoreline of Collicon Lake (2 mi/3.2 km southeast fetch) has removed the lake rims and is endangering the narrow land bridge between the two lakes which is less than 450 ft (140 m) wide at the narrowest point. Measurements of shoreline loss at 10 transects at the southeast portion of Grand Lake yielded loss rates from 23.9-36.2 ft (7.3-11.0 m) per year (Clark et al. 1999). The small strip of marsh separating Collicon and Round Lake could be lost and the entire project area could become part of Grand Lake. Consequently, shoreline erosion would accelerate in the marsh between the former Collicon Lake and Alligator Lake and Lake Le Bleu as the shorelines of Grand Lake and White Lake advance towards each other through the Grand-White Lake Land Bridge.

The objective of the project is to prevent the coalescence of Grand, Collicon, and Round lakes by:

a. Stopping erosion along the southeastern shoreline of Grand Lake and the northern and western shorelines of Collicon Lake.
b. Creating a total of 17 acres of emergent marsh along the southeastern shoreline of Grand Lake and 10 acres of emergent marsh along the northern and western shorelines of Collicon Lake.
c. Reducing erosion along the southern shoreline of Round Lake by 50 %.

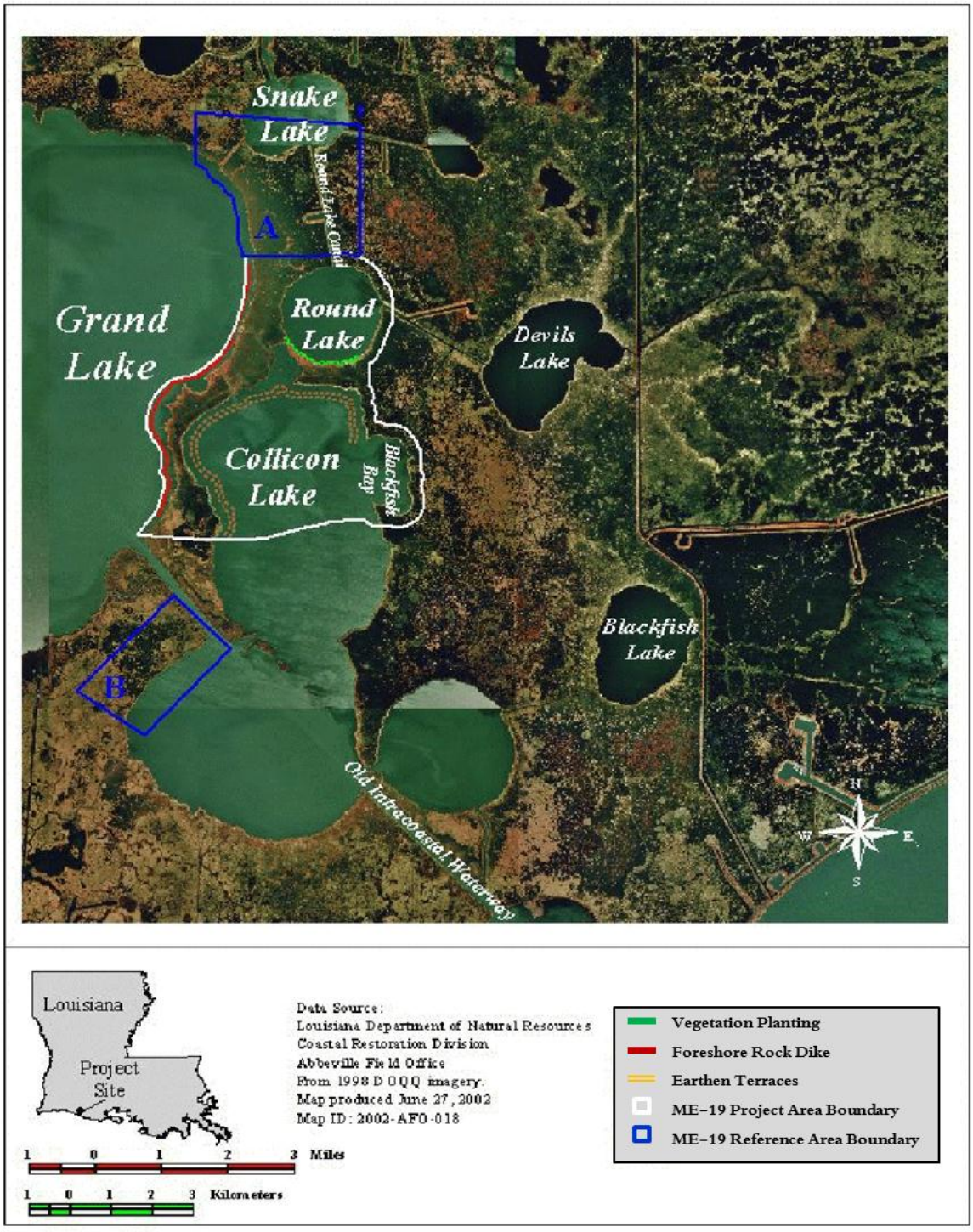


Figure 1. Grand-White Lake Bridge Protection Project (ME-19) project and reference areas showing shoreline planting, shoreline stabilization, and terrace locations.

The project features designed to attain the objectives were divided into two construction units.

Unit 1, Grand Lake Shoreline Stabilization, features included installation of a foreshore dike with gaps constructed from limestone lakeward of the southeastern Grand Lake shoreline. Subaerial land was created in open water behind foreshore dike with access channel dredged material during construction. More specifically, construction in this unit included the following items:

1. Excavation of a barge access canal lakeward of the foreshore dike;
2. Placement of 12,024 ft (3,666 m) of limestone rock as a foreshore dike150–250 ft (45.72–76.2 m) lakeward of the shoreline with 50 ft (15 m) gaps every 700–1,000 ft (213.36–304.8 m) for hydrologic connectivity and fish and wildlife access. Initial dimensions of the foreshore dike were 2.5 feet NAVD 88 (~1 ft [0.30 m] above average water level), a 3 ft wide crown, a 29 ft (8.84 m) or less base width, and 3:1 side slopes;
3. Dredge material from the access canal was used to create subaerial land behind the foreshore dike; the material was seeded to reduce erosion and enhance marsh establishment (Clark and Dubois 2002).

In Unit 2, the Collicon Lake Terraces, earthen terraces were constructed to reduce erosion of fringing fresh marsh, create marsh, facilitate marsh building by trapping suspended sediments in adjacent shallow open water, and stimulate the growth of submerged aquatic vegetation. Unit 2 construction features consist of the following items.

1. Construction of two parallel rows of 83-385 ft (25-117 m) long terrace segments (92 total segments), with gaps between each segment. Total length was 19,544 ft (5,959 m).
2. Planting of terrace tops with three rows of *Paspalum vaginatum* (seashore paspalum) planted on 5 ft (1.52 m) centers. Terrace side slopes were planted with *Zizaniopis miliacea* (giant cutgrass) in one row on 5 ft (1.52 m) centers. The side slope facing Collicon Lake had two rows on 5 ft (1.52 m) centers.
3. Planting along the southern shoreline of Round Lake included one row of *Z. miliacea* alternated with *Schoenoplectus californicus* (California bulrush) on 5 ft (1.52 m) centers for a total distance of 4,000 ft (1,219.2 m).

Construction of the foreshore rock dike, Unit 1, was initiated in July 2003 and completed in November 2003. Construction of the lake terraces, Unit 2, was initiated in July 2004 and completed in September 2004.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Grand-White Lakes Landbridge Protection Project (ME-19) is to evaluate the constructed project features, identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, OCPR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs. The annual inspection report also contains a summary of maintenance projects, if any, which were completed since completion of constructed project features and an estimated projected budget for the upcoming three (3) years for operation, maintenance and rehabilitation. The three (3) year projected operation and maintenance budget is shown in Appendix C.

An inspection of the Grand-White Lakes Landbridge Protection Project (ME-19) was held on June 29, 2011 under clear skies and hot temperatures. In attendance were Mel Guidry, Stan Aucoin, and Dion Broussard of (OCPR). Representatives of (USFWS) were invited but could not attend. All parties met at the boat launch on the Superior Canal, and traveled north to the Grand-White Lakes Landbridge Protection Project Site. The annual inspection began at approximately 10:00 a.m. at the southeastern end of the rock dike along Grand Lake.

The field inspection included a complete visual inspection of all project features. Staff gauge readings were not available to determine approximate elevations of water, earthen terraces, rock dike, and other project features. Photographs were taken at each project feature (see Appendix B) and Field Inspection notes were completed in the field to record measurements and any notable deficiencies (see Appendix D).

b. Inspection Results

Grand Lake Shoreline Protection

The foreshore rock dike feature is in excellent condition. No maintenance is required at this time. (Photos: Appendix B, Photo 1)

Collicon Lake Terraces

Marsh side and lake side earthen terraces along Collicon Lake continue to experience erosion, with the lake side sacrificial terraces being more severe. Original giant cutgrass plantings along the marsh side terraces were visible. (Photos: Appendix B, Photo 2)

II. Maintenance Activity (continued)

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

ii. Programmatic/ Routine Repairs

Overall, the foreshore rock dike feature of the Grand-White Lake Landbridge Project is in excellent condition and is functioning as designed, however there is still concern about the erosion of the sacrificial terraces on Lake Collicon. Consideration will be given for a possible maintenance event to armor these terraces into the future.

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since September 2004, the construction completion date of the Grand-White Lake Landbridge Protection Project (ME-19).

2009 Stream Wetland Services, LLC – The lakeside earthen terraces were planted with 3,242 Roseau Cane plants to help with erosion of the terraces. The work was completed in March of 2009. The costs associated with this maintenance event were as follows:

E&D (Done by OCPR)	$ 5,000.00
Construction Contract	$24,120.48
TOTAL	**$29,120.48**

III. Operation Activity

a. Operation Plan

No water control structures are associated with this project; therefore, no Structural Operation Plan is required.

b. Actual Operations

No water control structures are associated with this project; therefore, no required structural operations.

IV. Monitoring Activity

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System-*Wetlands* (CRMS) for CWPPRA, updates were made to the ME-19 Monitoring Plan to merge it with CRMS and provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. There are two CRMS sites adjacent to the ME-19 project area (CRMS0595 to the northeast and CRMS0584 to the south) and another site within the Grand-White Lake Land Bridge area (CRMS0574). To account for the rapid erosion of terraces, revisions to the monitoring plan were finalized on June 15, 2011 (McGinnis 2011) and are adapted in this report.

a. Monitoring Goals

The objective of the Grand-White Lake Land Bridge project is to prevent the coalescence of Grand and Collicon Lakes by stopping erosion and creating emergent marsh along the southeastern shoreline of Grand Lake and the north and western shorelines of Collicon Lake along with reducing erosion along the southern shoreline of Round Lake by 50 %.

The following monitoring strategies will be used to evaluate progress towards the project objectives for this report:

1. Evaluate changes in Land:Water ratios.
2. Evaluate rate of erosion along the eastern shoreline of Grand Lake and the north western shoreline of Collicon Lake.
3. Evaluate establishment of emergent vegetation on planted terraces.

b. Monitoring Elements

Aerial Photography

To evaluate the extent of marsh creation and erosion within the project and reference areas, near-vertical, color-infrared aerial photography (1:12,000 scale) was obtained as built in November 2004 ("as-built" following terrace construction) and will be obtained in post-construction year 2013. The photography was georectified, mosaicked, and land/water ratios determined using standard operating procedures described in Steyer et al. (1995, revised 2000). Land and water analysis from 1956, 1978, 1988, 2004, 2006, and 2008 archived in CRMS website (http://www.lacoast.gov/crms_viewer/) was used generate percent land change trends for ME-19 area before and after project construction to provide a historical context.

To provide historical context, the land change analysis (1956-1998) performed by the USGS for the environmental assessment of this project (Clark and Dubois 2003) was expanded through 2010 and includes a pre- versus post construction analysis of change rates. Distances from ten transects crossing the land bridge between Grand and Collicon/Round Lakes (figure

2.) were measured over time from aerial photography (historical pre-construction: 1956, 1978, 1988, 1994, 1998; post construction: 2004, 2005, 2007, 2008, 2010). The historical pre-construction data was compiled from the environmental assessment, and the post construction data was collected from imagery on the SONRIS GIS platform. Cumulative change starting from 1956 was averaged from all transects and plotted. Change rates were determined via linear regression for each transect then averaged to compare pre- versus post construction periods with a least square means ANOVA (SAS Institute Inc. 2010).

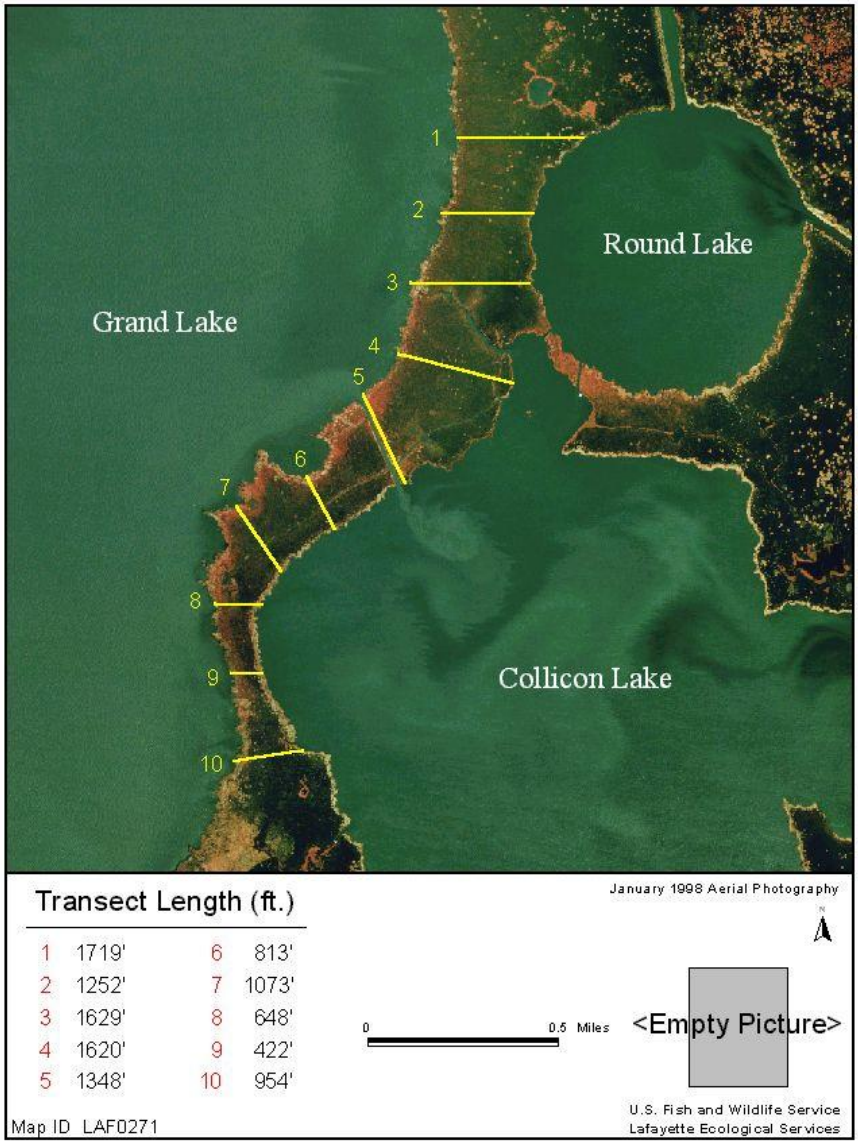


Figure A5. 1998 Transects in Grand-White Lakes Land Bridge Project Area.

Figure 2. Transects from ME-19 Environmental Assessment (taken from Clark and Dubois 2003) used for land bridge change analysis.

Shoreline Survey

To document shoreline movement, differential GPS was used to map the shoreline in both the project (behind the project features) and reference areas (Steyer et al. 1995). Contiguous, emergent vegetation was used to delineate the shoreline. Shoreline mapping behind the foreshore dike and its reference area was conducted in Novemeber 2003 (as built) and August 2006 (post construction). Shoreline mapping behind the earthen terraces and its reference area was conducted in October 2004 (as built). Post construction shoreline mapping behind the foreshore dike and terraces was conducted in October 2008 and will be conducted in late summer/early fall 2014 and 2021. Change rates for time intervals were calculated using Digital Shoreline Analysis System (DSAS) version 4.0, an ArcGIS application. Transects spaced 20 m apart were established for the shoreline reaches, and change rates (EPR, m/y) were determined between dates of interest (Thieler et al. 2009).

Terrace Vegetation

The condition of the natural emergent, seeded, and planted vegetation on the Lake Collicon terraces is monitored at 10% of the total planted terraces over the life of the project. The 12 terraces were grouped by potential wave exposure, 6 are lakeside terraces (higher exposure) and 6 are marshside terraces (lower exposure). Four sampling stations were established on selected terraces consisting of a station on the inner and outer slope and 2 stations on the crown. At each station (4 m^2 sample area) species composition, percent cover (total and by species), and dominant plant heights were documented (Steyer et al. 1995). Each station was marked with 2 corner poles to allow for revisiting the sites over time. Vegetation was evaluated at the sampling sites in the fall of 2004 (as built) and 2005 (post construction). Sampling was scheduled to continue in 2008, 2013, and 2021; however, by 2008 many of the terraces (especially the lakeside terraces) had eroded to the point that the permanent vegetation stations did not exist.

Because the permanent vegetation stations are eroding with the terraces, the evaluation of terrace vegetation was changed to a more adaptable method than fixed stations. Vegetation on the 12 terraces used for the initial vegetation evaluation will be documented over the entire terrace rather than permanent vegetation stations. Previous vegetation data (2004 and 2005) collected from permanent vegetation stations was combined to describe each terrace and compare to future vegetation data collected at the terrace level. A full factor ANOVA of terrace position (lakeside, marshside) and time (2004, 2005, 2010) compared species richness and total percent cover (SAS Institute Inc. 2010), and a species list grouped by terrace position and time is tabulated for percent occurrence and cover of individual species. In addition, vegetated portions of the twelve terraces will be mapped to compliment the terrace vegetation evaluation and track the condition of the terraces over time. The twelve terraces will be mapped using differential GPS (Steyer et al. 1995) as conducted for shoreline mapping. Terrace vegetation evaluation and mapping was conducted in March 2010 and is scheduled concurrently with shoreline mapping in 2014 and 2021. Terrace areas calculated from dGPS mapping (2010) will be compared to terrace areas calculated from the terrace construction As-built Drawings (September 2004) and digitized from photography taken in November 2005 to describe changes over time.

c. Preliminary Monitoring Results and Discussion

Aerial Photography

Baseline aerial photography for the project area was flown on November 25, 2004 immediately following terrace construction (figure 3). The total project area was 32% land; the reference area for the foreshore dike (to the north) was 76% land, and the reference area for the terraces (to the south) was 63% land. Land to water analysis to evaluate land change and compare among areas will be conducted after the post construction photographs are obtained in 2013. From a historical perspective within the ME-19 project area, land change rates were very similar prior to construction (1956-1988: -0.38 %/y) as after construction (2004-2008: -0.34 %/y) as the project area has continued to loose land overall despite the addition of terraces and dredge spoil deposition. Based on the land area change map from Couvillion et al. (2011), pre construction loss appeared to be more associated with shoreline erosion, where as post construction loss is more associated with interior marsh loss.

In a historical perspective within the project area, the rate of change in the land-bridge width differed significantly as the land bridge quickly narrowed during pre-construction (1956-2004: -22.2 ft/y [6.6 m/y]) and slowly broadened during post-construction (2004-2010: 1.0 ft/y [0.3 m/y]) periods (F_1=101.1; p<0.0001). An example of this is at the narrowest width of the land bridge (Transect 9) which shrunk from 1405 ft (428 m) in 1956 to 422 ft (129 m) in 1998 then broadened to 456 ft (139 m) in 2010. Graphically, two trends are predominant; the land bridge sharply narrowed 25.9 ft/y (7.9 m/y) from 1956-1994 while it slightly broadened by 0.5 ft/y (0.15 m/y) from 1994-2010 (figure 4). During the recent time period, the project area held steady during the pre-construction period (1994-2004: 0 ft/y [0 m/y]) and has slowly broadened since construction (2004-2010: 1.0 ft/y [0.3 m/y]).

Shoreline Survey

Overall, shoreline change rates from construction to 2008 among the areas were statistically different (F_3=31.1, p<0.0001, figure 5). The shoreline behind the foreshore dike along Grand Lake was the only shoreline to gain land since construction, and its rate was significantly greater than the reference area to the north (figure 5). The shoreline behind the earthen terraces along Collicon Lake slightly receded overall since construction, and it eroded at significantly lesser rate than the reference area to the south which experienced the greatest erosion of the areas (figure 5). Although the shoreline advanced behind the foreshore dike along Grand Lake and slightly receded behind the terraces along Collicon Lake, the terraces (1.2 m/y less loss than its reference) reduced shoreline loss about twice as much as the foreshore dike (0.52 m/y less loss than its reference) relative to their references as shoreline erosion was greatest along the Collicon Lake reference area (figure 5, note inset table). Shorelines where terrace and land bridge vegetation merged (Roseau cane and alligator weed; picture 1) were not included in the analysis because the vegetation was floating on the water and not emergent; however, they will be included if the vegetation roots into the underlying sediment and converts from floating into emergent land.

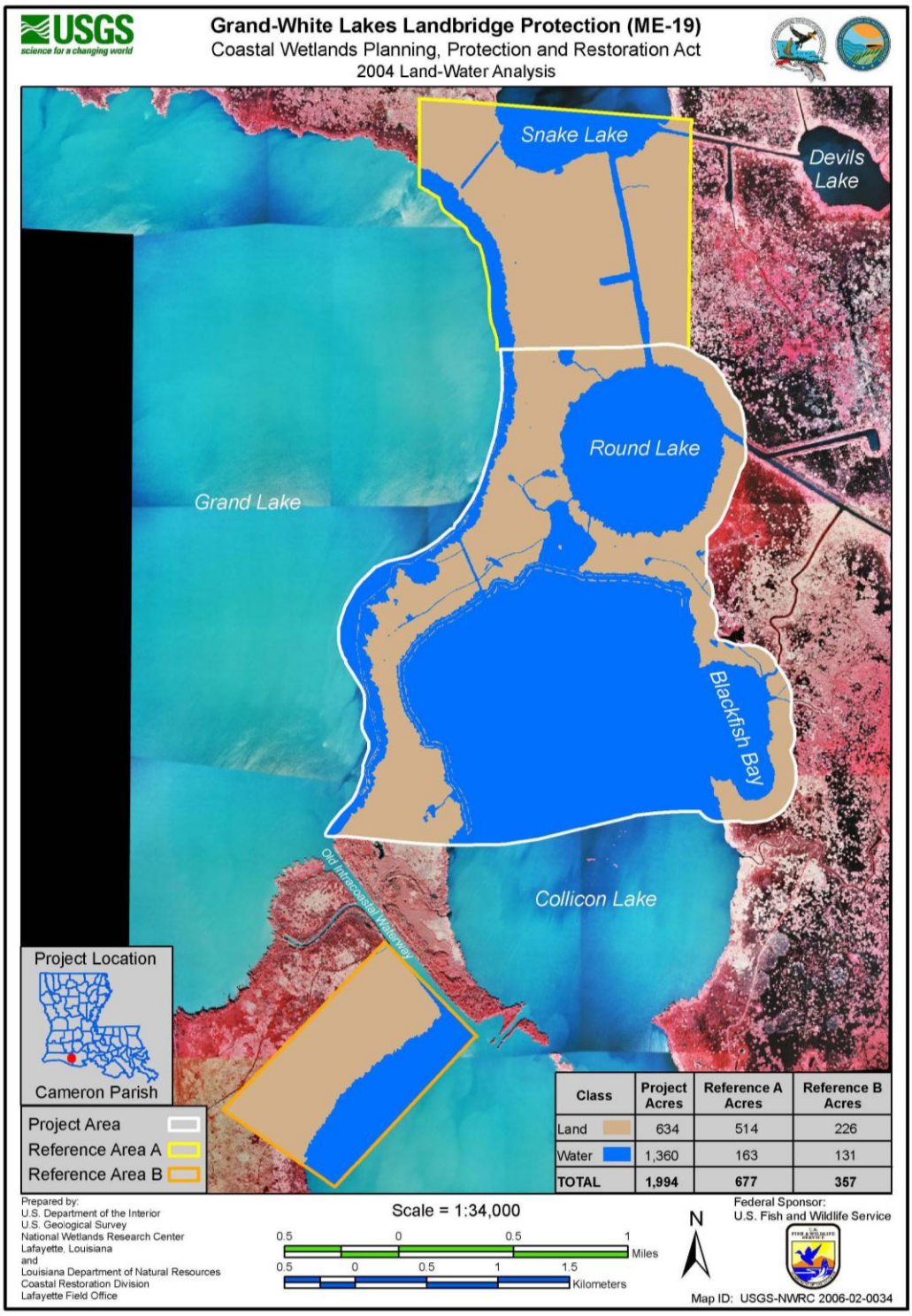


Figure 3. Land to water analysis for Grand-White Lake Landbridge Protection (ME-19), flown November 24, 2004 following completion of construction.

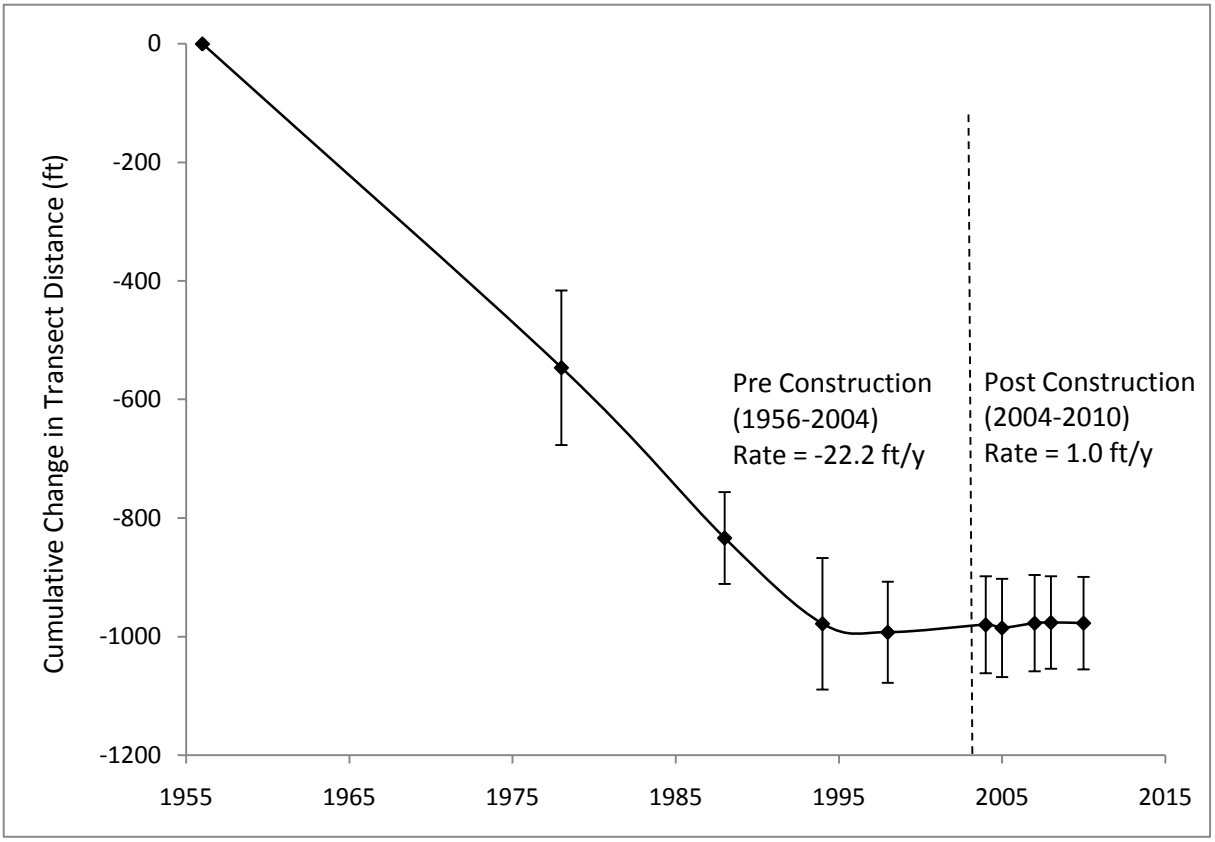


Figure 4. Historical and post construction change in land bridge width over time (1959-2010) in the ME-19 project area. The values are the means (±1 SE) for cumulative change in distance of transects (t_i-t_0) since 1959 (n=10).

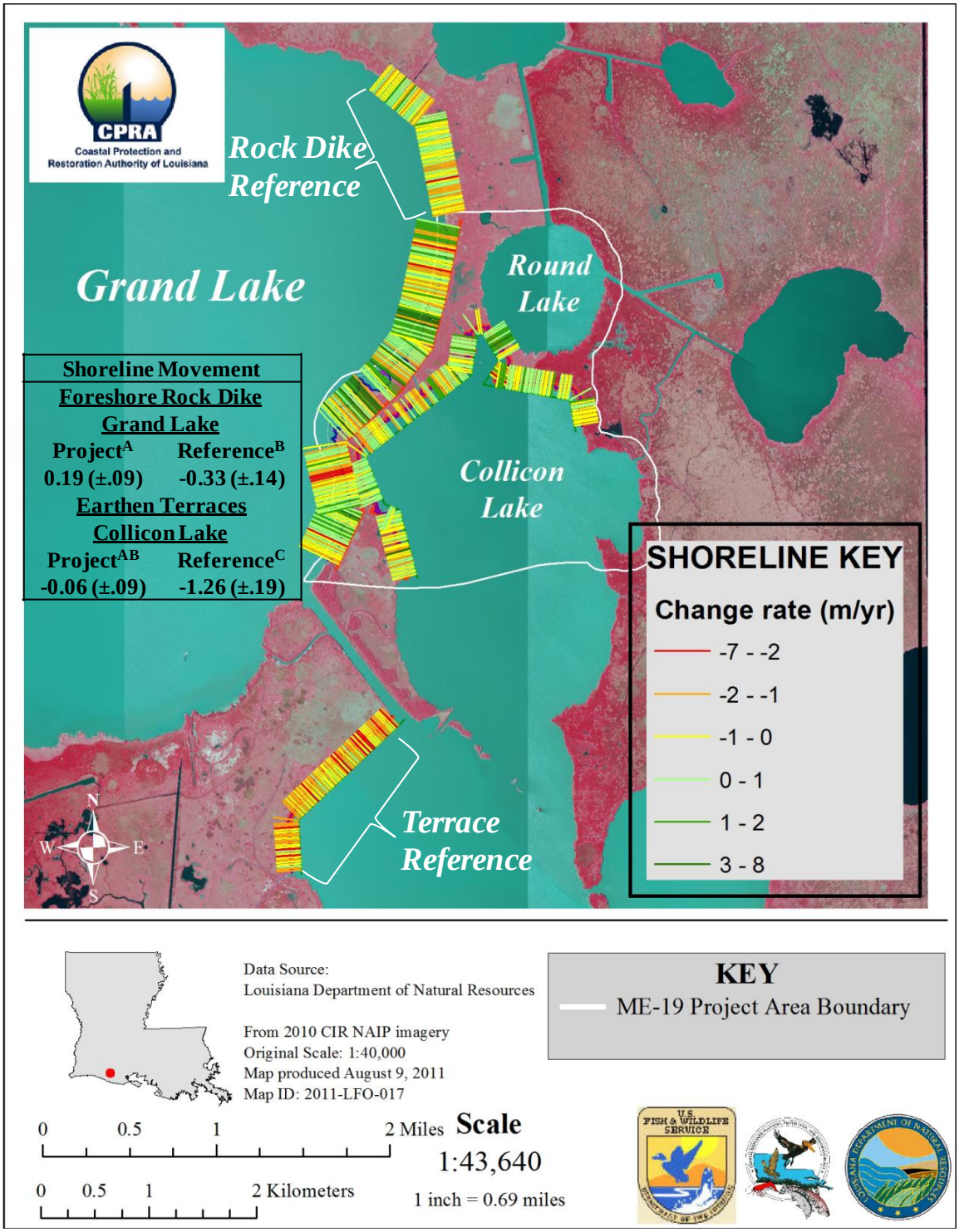
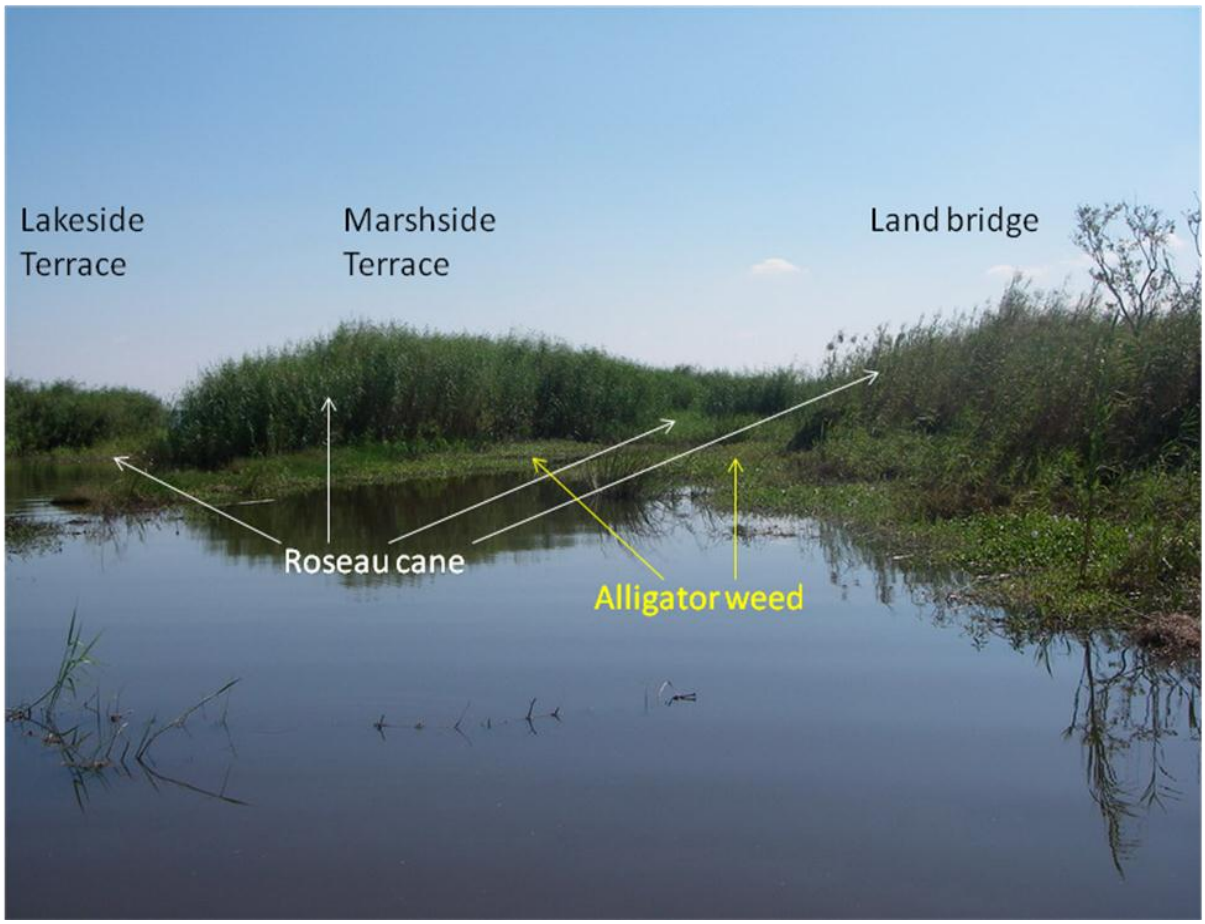


Figure 5. Shoreline mapping was conducted behind project structures (foreshore rock dike along Grand Lake and terraces along Collicon Lake) and corresponding reference areas of the ME-19 project area soon after construction (foreshore rock dike, November 2003; terraces, October 2004) and in October 2008. Shoreline movement rates (mean±SE m/y) were calculated from 20 m spaced transects along Grand Lake and Collicon Lake; negative change rates indicate loss while positive change rates indicate gains. Different letters in inset table indicate significantly different rates among areas (Tukey's Honest Significant Difference post-test; $\alpha = 0.05$).



Picture 1. Vegetation along Collicon Lake expands as terrace and land-bridge vegetation merge. At the time of this photograph (October 21, 2008) the vegetation between the land-bridge and terrace was floating; therefore, the vegetative expansion was not included in the shoreline change analysis. If the merging vegetation anchors into the soil below, then it will be considered emergent and define the vegetated shoreline of the land bridge.

Terrace Vegetation

Of the twelve terraces selected for vegetative evaluation (6 lakeside and 6 marshside), erosion was much greater from lakeside (14 %/y) than marshside (6 %/y) terraces from construction to March 2010 (r^2=0.43; F_1=7.65; p=0.0199). Percent change in terrace area was different between the terrace locations (lakeside and marshside) over the time intervals (2004-2005 and 2005-2010) (r^2=0.64; $F_{1,1}$=15.94; p=0.0007; figures 6 and 7). Initially after construction (2004-2005), % terrace area diverged as the sacrificial lakeside terraces sharply eroded (picture 2) while the buffered, marshside terraces expanded (figure 6). Assessment of the high rate of lakeside terrace loss (2004-2005) is confounded by immaturity of the plantings in a highly exposed environment and the effects of Hurricane Rita. The initial and continued (although significantly reduced) loss of the lakeside terrace area decreased the protection of the marshside terraces as they eroded from 2005-2010 (figures 6 and 7).

Vegetation has matured over time on the remaining terrace area as both species richness and percent vegetative cover increased since construction (Table 1; figure 8). Species richness was greater on the marshside terraces which are closer to the marsh and buffered from wave energy by the lakeside terraces. Species richness increased over time after an initial dip in 2005 caused by Hurricane Rita (Thibodeaux and Guidry 2007). Since construction (2004) and Hurricane Rita (2005), the percent vegetative cover of the remaining terrace area increased by 3.5 times as of 2010.

Species planted on the terraces in 2004 have endured as both *Zizaniopis miliacea* (terrace slopes) and *Paspalum vaginatum* (terrace crowns) were found on at least two-thirds of the remaining terraces in 2010 (Table 2). *Echinochloa crus-galli*, which had been seeded on the crown, did not occur in the 2005 sampling but was found on one marshside terrace in 2010. The total richness of plant species has increased over time as the vegetative communities on the terraces mature (Table 2). The occurrence and coverage of *Phragmites australis* (Roseau cane) has increased over time. Of the 12 terraces used for this report, Roseau cane had not been planted during construction; it occurred at only 1 terrace (lakeside) in 2005, and by 2010, Roseau cane occurred on all but 1 terrace (marshside) (Table 2).

High variability of terrace area remaining among the 12 terraces in 2010 (marshside: 5-101% of terrace area remaining; lakeside: 6-48% of terrace area remaing) was attributable to the vegetative cover of Roseau cane. Overall, percent of remaining terrace area and percent cover of Roseau cane was positively related ($r = 0.54$, $p = 0.0710$); this relationship was much stronger among the marshside terraces ($r = 0.82$, $p = 0.0451$). Upon construction, Roseau cane was planted on three lakeside terraces for an independent project under a cooperative agreement between the Natural Resources Conservation Service and the LSU Agricultural Center; unfortunately, the report is not published. Roseau cane on the experimental terraces and in other thick stands on other terraces and along the Collicon Lake shoreline is notable in recent aerial imagery (figure 7 and picture 1). After observing the prolific nature of the Roseau cane, an attempt to plant it on remaining terraces was made in March 2009; however, water levels were too high and available terrace area was too scarce for a successful planting. Another attempt was not made to plant the terraces.

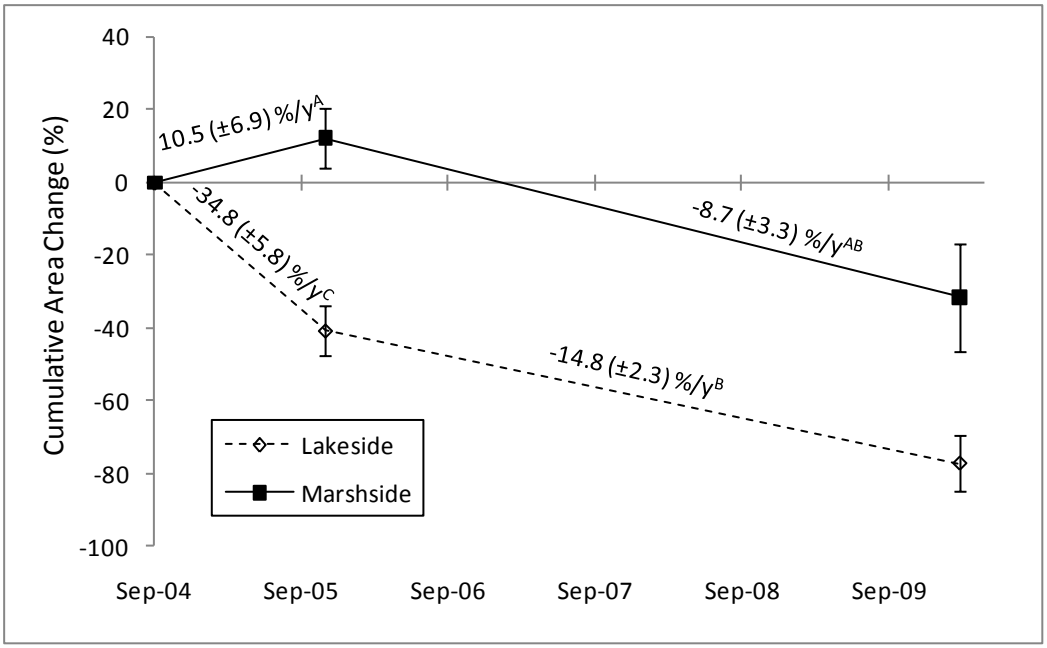
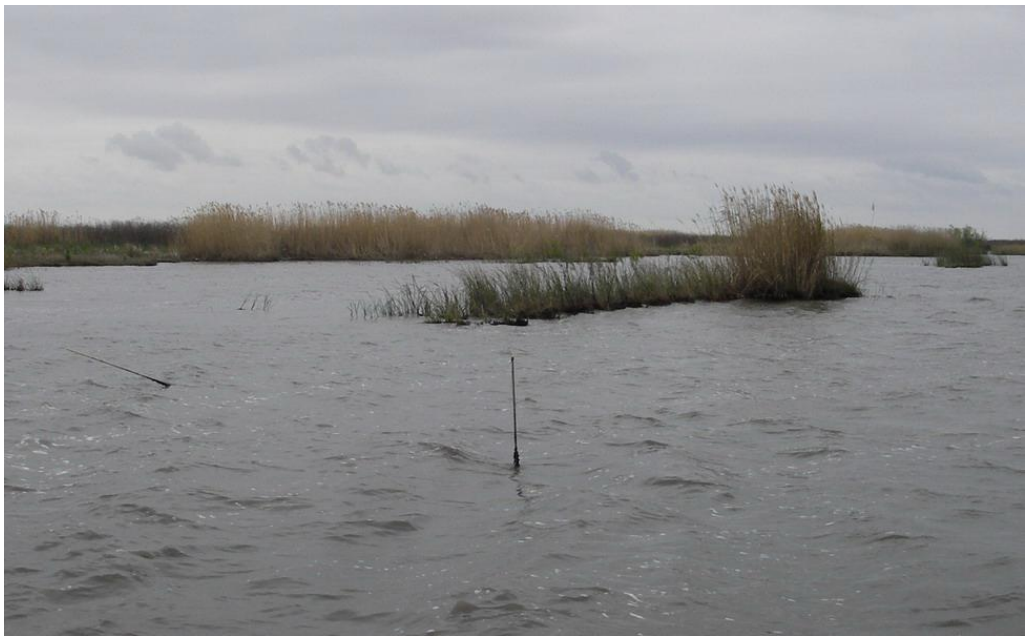


Figure 6. Terrace areas were determined for the Collicon Lake terraces for September 2004 (as-built), November 2005, and March 2010. Cumulative percent change in area since construction was calculated and plotted (means±SE). Rates of percent change (values over lines) interactions were compared for terrace location (lakeside and marshside) by time intervals (2004-2005 and 2005-2010); exclusively different superscript letters indicate significant difference.



Picture 2. Many terraces have eroded since construction, especially the lakeside terraces (e.g. LS42) which were intended to be sacrificial and buffer the marshside terraces. Note the cane poles that mark the original corners of the terrace. Picture was taken on March 24, 2010.

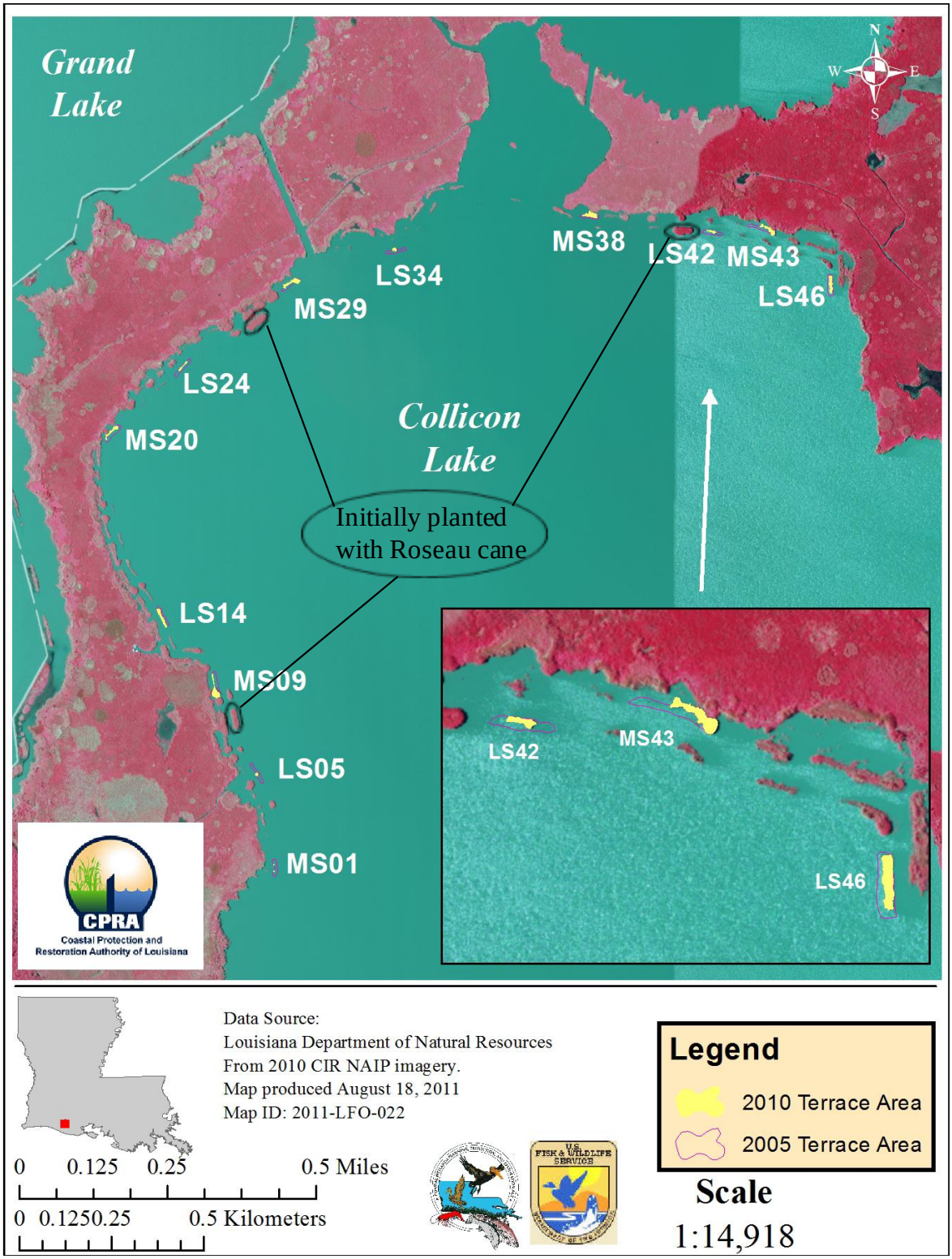


Figure 7. 2005-2010 land change anlaysis of ME-19 terraces along Collicon Lake used for vegetation analysis indicates that marshside (MS, 9 %/y) and lakeside (LS, 15 %/y) terraces have lost area. From construction (September 2004) to 2010, MS terrace area decreased by 32% while lakeside LS terrace area decreased by 77%.

Table 1. Analysis of Variance (ANOVA) results from full factorial analyses of terrace position (marshside, MS; lakeside, LS) and time (2004, 2005, 2010) effects for species richness and percent total cover of terrace vegetation at ME-19. Significant differences are set at α=0.05.

		Species Richness			Percent Vegetative Cover		
Effect	df	F-Ratio	p-value	Post Test	F-Ratio	p-value	Post Test
Position	1	4.4978	0.0426	MS > LS	0.0787	0.7809	NA
Time	2	5.2354	0.0114	'10 > '05	73.2476	<.0001	'10 > '04, '05
Position × Time	2	0.9545	0.3968	NA	0.0759	0.9271	NA

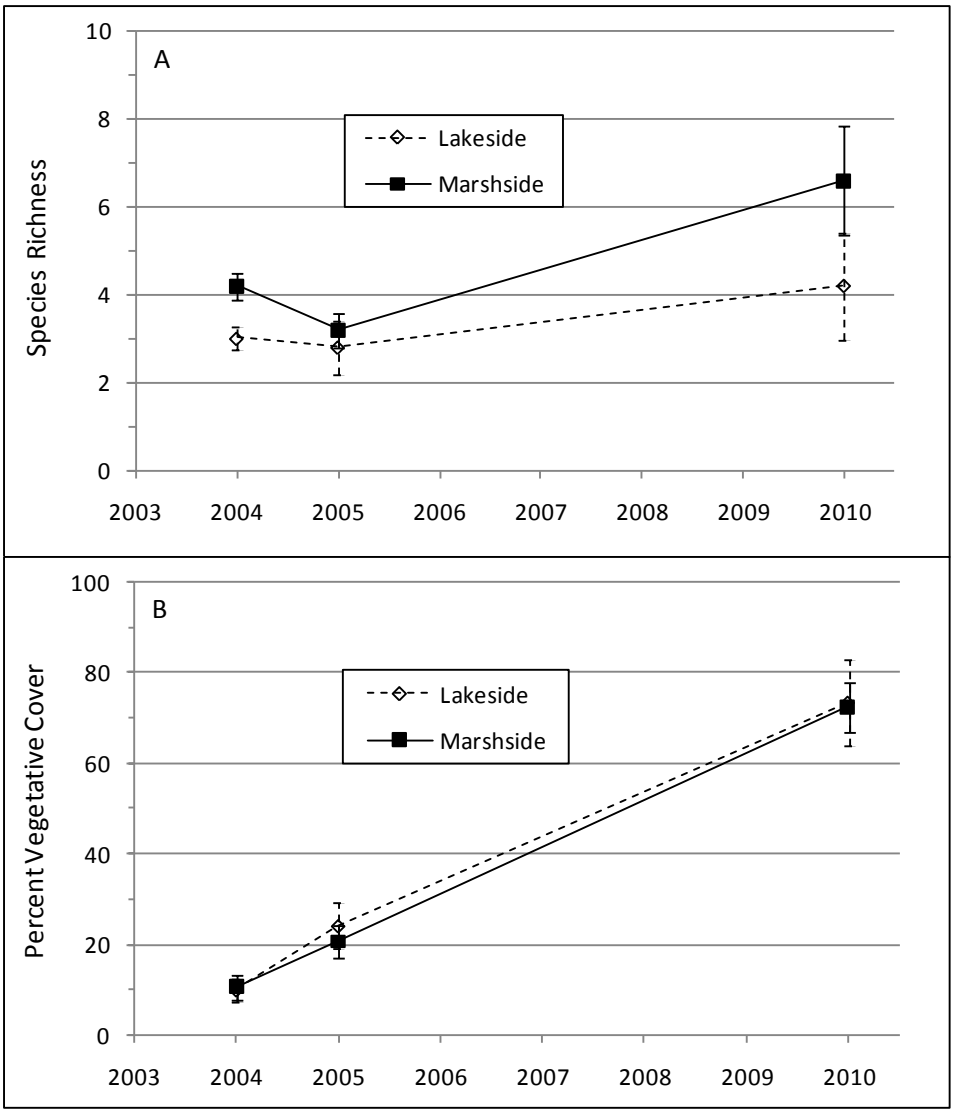


Figure 8. Species richness (A) and percent vegetative cover (B) over time collected on terraces along Lake Collicon in ME-19. Values are means and standard errors of 6 terraces.

Table 2. Vegetation observed on lakeside and marshside terraces along Collicon Lake over time in ME-19 project area. Values are the mean percent of terraces on which the species was observed (% Occ) and percent area coverage (% Cov).

	Year	2004				2005				2010			
	Terrace Position	Marshside		Lakeside		Marshside		Lakeside		Marshside		Lakeside	
Scientific Name	Common Name	% Occ	% Cov	% Occ	% Cov	% Occ	% Cov	% Occ	% Cov	% Occ	% Cov	% Occ	% Cov
Zizaniopsis miliacea (Michx.) Doell & Aschers.	giant cutgrass	100	4.9	100	3.5	83.3	21.7	100	40.5	83.3	38.5	66.7	38.8
Paspalum vaginatum Sw.	seashore paspalum	100	4.9	83.3	4	100	10.9	66.7	14.2	83.3	8.2	66.7	10
Echinochloa crus-galli (L.) Beauv.	barnyard grass	100	8.7	100	9.8					16.7	0.5		
Phragmites australis (Cav.) Trin. ex Steud.	Roseau cane							16.7	3	83.3	26.9	100	40.8
Salix nigra Marsh.	black willow					50	3.4	66.7	3.3	50	3	50	3.7
Sagittaria lancifolia L.	bulltongue arrowhead					16.7	1			50	1.3	33.3	1.1
Alternanthera philoxeroides (Mart.) Griseb.	alligator weed	33.3	0.4			16.7	0.5			33.3	0.8		
Echinochloa walteri (Pursh) Heller	coast cockspur grass	33.3	5.3	16.7	21.5								
Sesbania drummondii (Rydb.) Cory	poison bean	16.7				33.3	5	16.7		33.3	1.1	16.7	0.1
Cyperus odoratus L.	fragrant flatsedge	16.7	0.1										
Eclipta prostrata L.	false daisy	16.7	0.1										
Eleocharis R. Br.	spike rush									16.7	0.5		
Iva frutescens L.	Jesuit's bark											16.7	0.1
Juncus effusus L.	common rush									16.7	1		
Ludwigia peploides (Kunth) Raven	floating primrose-willow					16.7	0.5			16.7	0.1		
Mikania scandens (L.) Willd.	climbing hempvine									16.7	1	16.7	7
Sagittaria latifolia Willd.	broadleaf arrowhead									16.7	0.1		
Schoenoplectus californicus (C.A. Mey.) Palla	California bulrush									16.7	15		
Sesbania herbacea (P. Mill.) McVaugh	bigpod sesbania							16.7				16.7	0.1
Sesbania Scop.	river hemp											16.7	1
Solidago sempervirens L.	seaside goldenrod									16.7	0.5		
Typha L.	cattail											16.7	2
	Total Species Richness	8		4		7		6		15		11	

V. Conclusions

a. Project Effectiveness

The Grand/White Lake Land Bridge Protection project (ME-19) is on track to achieve the main objective to prevent the coalescence of Grand, Collicon, and Round Lakes within the 20 year project life (2003-2023). The width of the land bridge between the foreshore dikes along Grand Lake and the terraces along Collicon Lake/plantings along Round Lake has broadened slightly since project construction although land loss is still occurring within the ME-19 project area because of interior marsh loss. Towards the specific project goals:

1. A quarter of the way through the project life, shoreline change rates behind both project structures were significantly better than their reference shorelines. The foreshore rock dike has not only stopped erosion but has gained land along the southeastern shoreline of Grand Lake, and the earthen terraces have significantly reduced erosion on the northern and western shorelines of Collicon Lake.
2. A total of 17 acres of emergent marsh along the southeastern shoreline of Grand Lake and 10 acres of emergent marsh along the northern and western shorelines of Collicon Lake is not anticipated to be created by the end of the project (2023) based on land creation rates through 2010. Grand Lake shoreline gained 6.4 acres (1.2 acres of shoreline and the 5.2 acres of dredge material islands). Collicon Lake has gained 5.66 acres but is decreasing when accounting for terrace area change and shoreline erosion rates.
3. The goal of reducing erosion along the southern shoreline of Round Lake by 50 % has not been directly monitored. Anecdotally, the same species planted along the southern shoreline of Round Lake in 2004 were still present in 2011. Also, the Collicon Lake shoreline is expanding along the narrow land bridge adjacent to the southwestern shoreline of Round Lake.

The vegetation on the remaining terraces has matured such that the increased coverage by vegetation and species richness overall is beginning to resemble the marsh on the land bridge.

b. Recommended Improvements

Armoring the lakeside slope of terraces along Collicon Lake should be considered to prevent future shoreline erosion.

c. Lessons Learned

Although the lakeside terraces were initially effective at buffering the marshside terraces, the high rate of lakeside terrace loss has made the marshside terraces vulnerable. The wind fetch across Collicon Lake from all directions is large enough to allow for the sizeable wave generation that has degraded the earthen terraces. In terms of vegetation used as armor, *Phragmites australis* (Roseau cane) has been effective in maintaining terraces thus far; however, high water-levels will not allow for a successful planting event.

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APPENDIX A
(Inspection Photographs)

Appendix A
(Inspection Photographs)

Photo 1, Typical rock dike.

Photo 2, Rock foreshore dike.

Photo 3, Earthen terraces.

Photo 4, Earthen terraces

APPENDIX B
(Three Year Budget Projection)

Appendix B
(Three Year Budget Projection)
GRAND-WHITE LAKES LANDBRIDGE/ ME-19 / PPL 10
Three-Year Operations & Maintenance Budgets 07/01/2011 - 06/30/2014

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Mel Guidry*	*USFWS*	*Mel Guidry*

	2011/2012 (-7)	2012/2013 (-8)	2013/2014 (-9)
Maintenance Inspection	$ 6,086.00	$ 6,269.00	$ 6,457.00
Structure Operation			
State Administration		$ -	$ -
Federal Administration		$ -	$ -
Maintenance/Rehabilitation			

11/12 Description:

E&D	
Construction	
Construction Oversight	
Sub Total - Maint. And Rehab.	$ -

12/13 Description

E&D		$ -
Construction		$ -
Construction Oversight		$ -
	Sub Total - Maint. And Rehab.	$ -

13/14 Description:

E&D			$ -
Construction			$ -
Construction Oversight			$ -
		Sub Total - Maint. And Rehab.	$ -

	2011/2012 (-7)	2012/2013 (-8)	2013/2014 (-9)
Total O&M Budgets	$ 6,086.00	$ 6,269.00	$ 6,457.00

O &M Budget (3 yr Total)	**$ 18,812.00**
Unexpended O & M Budget	**$ 1,084,206.00**
Remaining O & M Budget (Projected)	**$ 1,065,394.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2011 - 06/30/2012

GRAND-WHITE LAKES LANDBRIDGE / PROJECT NO. ME-19 / PPL NO. 10

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,086.00	**$6,086.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:	Repair bank erosion at Grand Bayou & Mangrove structures, replace composite marine timber at Mangrove boat guide.				
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Bank Paving	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD		$0.00	$0.00
Navigation Aid		EACH		$0.00	$0.00
Signage		EACH		$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
Vegetative Plantings		EACH	0	$10.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,086.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2012 - 06/30/2013

GRAND-WHITE LAKES LANDBRIDGE / PROJECT NO. ME-19 / PPL NO. 10

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,269.00	**$6,269.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:				
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Repair bank erosion at Grand Bayou & Mangrove structures, replace composite marine timber at Mangrove boat guide.

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Bank Paving	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD		$0.00	$0.00
Navigation Aid		EACH		$0.00	$0.00
Signage		EACH		$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
Vegetative Plantings		EACH	0	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,269.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2013 - 06/30/2014

GRAND-WHITE LAKES LANDBRIDGE / PROJECT NO. ME-19 / PPL NO. 10

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,457.00	**$6,457.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:				
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Repair bank erosion at Grand Bayou & Mangrove structures, replace composite marine timber at Mangrove boat guide.

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Bank Paving	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD		$0.00	$0.00
Navigation Aid		EACH		$0.00	$0.00
Signage		EACH		$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
Vegetative Plantings		EACH	0	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,457.00**

APPENDIX C
(Field Inspection Notes)

Appendix C
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:ME-19 Grand-White Lake Landbridge

Date of Inspection: June 15, 2007 Time: 10:00 am

Structure No.

Inspector(s):Mel Guidry, Stan Aucoin (LDNR), Darryl Clark (USFWS)
Chad Courville & Ted Johanon (Miami Corp)

Structure Description: Rock Dike and Earthen Terraces

Water Level Inside: Outside: _____

Type of Inspection: Annual

Weather Conditions: Sunny and mild

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill) Rock Dike	Good			1 & 2	Rock dike is in very good shape.
Earthen Terraces	Fair			3 & 4	Terraces will require vegetative planting.

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?