Coastal Protection and Restoration Authority of Louisiana

State of Louisiana
Office of Coastal Protection and Restoration
Operations Division

Monitoring Plan

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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MONITORING PLAN

CWPPRA PROJECT NO. ME-19 (PME-18)
GRAND-WHITE LAKE LAND BRIDGE PROTECTION

Original: August 7, 2003
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Project Description

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 Cameron Parish, Louisiana. The project area, located in the Mermentau Basin (CWPPRA n.d.), includes shoreline along a portion of the southeast Grand Lake shoreline, the northern half of Collicon Lake shoreline, and Round Lake (figure 1). In 1990, 29% of the project area was classified as fresh marsh, 71% as open water, and less than 1% as bottomland shrub/scrub (United States Geological Survey/National Wetlands Research Center [USGS/NWRC] 1988/90). 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 would be lost and the entire project area will 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.

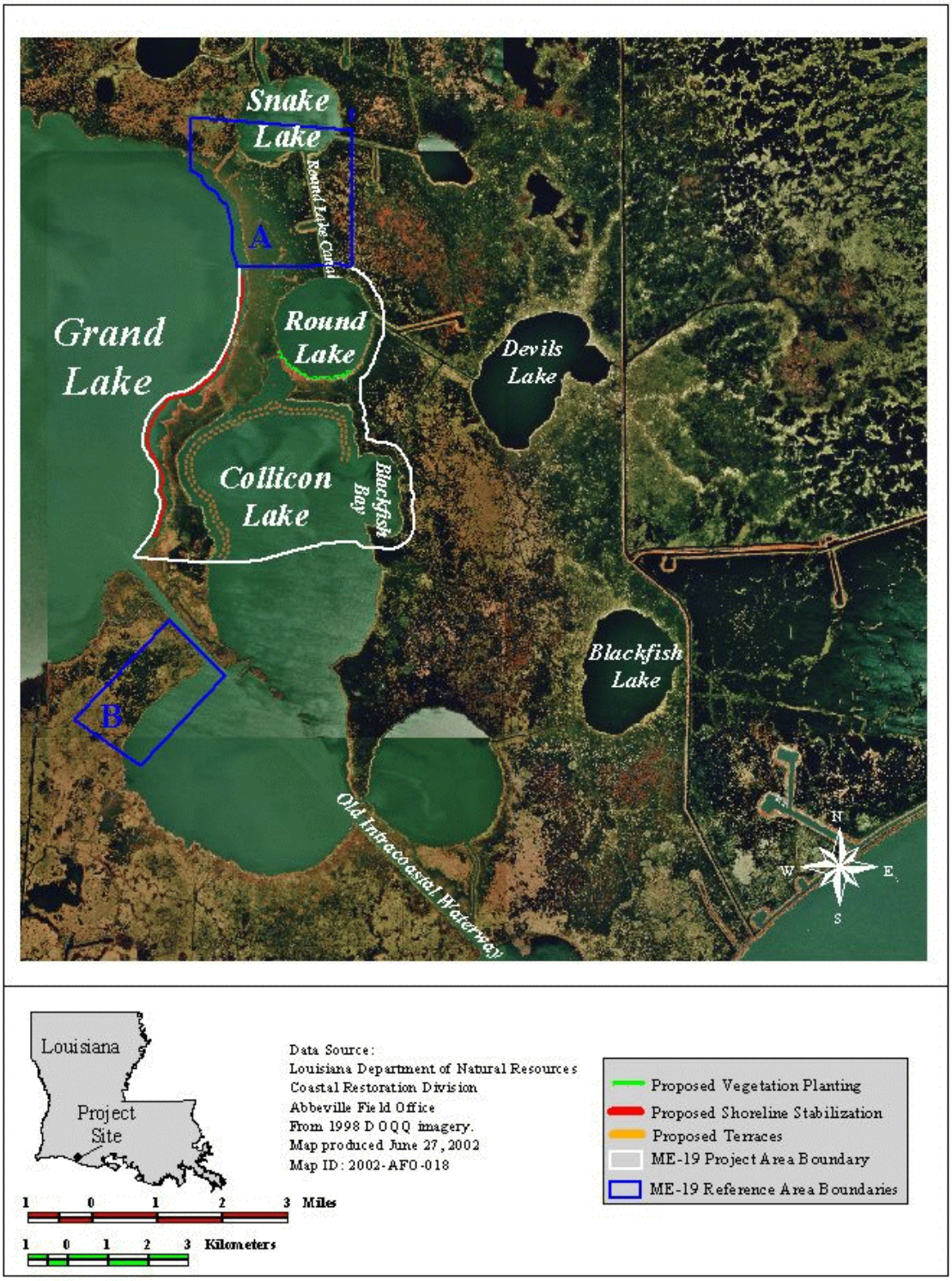

Figure 1. Site map of Grand-White Lake Land Bridge Protection project (ME-19) showing location and project features.

Project Goals and Objectives/Coast 2050 Strategies Addressed

CWPPRA projects are reviewed prior to authorization of construction funds for compatibility of project goals with those in Coast 2050 (LCWCRTF and WCRA 1998), and for the probability that proposed restoration strategies will accomplish those goals.

Project Goal:

The goal of this project is to prevent the coalescence of Grand and Collicon lakes by:

a. Stopping erosion along the southeastern shoreline of Grand Lake and the north and western shorelines of Collicon Lake over the 20 year project life.
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 north and western shorelines of Collicon Lake over the 20 year project life.
c. Reducing erosion along the southern shoreline of Round Lake by 50 % over the 20 year project life.

Project Strategies:

1) Retain separation of Grand and Collicon Lakes by an isthmus of marsh greater than 500 ft (152.4 m) wide by construction of approximately 12,000 feet (3,657.6 m) of shoreline protection along the southeastern shore of Grand Lake. Create marsh between the foreshore dike and the Grand Lake shoreline by using spoil material from dredging of access channel and accretion of sediments from periodic wave overwash.

2) Create or restore 32 acres (12.95 ha) of fresh marsh by constructing earthen terraces and subsequent accretion of sediments between the northern and western Collicon Lake shoreline, the first row of terraces and between terrace rows.

3) Reduce shoreline erosion along southern Round Lake through planting of 4,000 ft (1,219.2 m) of vegetation.

Project Features

The proposed project features, specifically shoreline protection and terracing, were identified by the Region 4, Regional Planning Team, as part of Coast 2050, as strategies that will directly benefit the Grand-White Lake Land Bridge Mapping Unit (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority [LCWCRTF & WCRA] 1999; Belhadjali et al. 2002).

Unit 1 - Grand Lake Shoreline Stabilization

Unit 1 includes installation and maintenance of approximately 12,000 feet of hard shoreline stabilization material lakeward of, and parallel to, the present Grand Lake southeastern shoreline. Additional fresh marsh was created in open water behind the hard shoreline stabilization material from access channel sediment dredged during construction. More specifically, construction in this unit includes the following items.

1. Excavation of a barge access canal (7 ft/2.13 m deep by 70-80 ft/21.34-24.38 m wide) 40 ft (12.19 m) lakeward of and parallel to, the foreshore dike.

2. Placement of approximately 12,000 ft (3,657.6 m) of limestone rock as a foreshore dike150-250 ft (45.72-76.2 m) lakeward of the shoreline, with 25 ft (7.62 m) gaps every 700-1,000 ft (213.36-304.8 m). The rock (+2.5 ft NAVD 88) was be placed on geotextile fabric to a height of 1 ft (0.30 m) above average water level along the minus 1-2 ft depth contour. The foreshore dike had an initial height of 4 ft (2.5-3 feet NAVD 88), a 3 ft wide crown, a 29 ft (8.84 m) or less base width, and 3:1 side slopes. The 4 ft (1.22 m) initial height includes allowance for a maximum 2 ft (0.61 m) water depth, 1 ft (0.3 m) of subsidence, and 1 ft or less of freeboard above mean water level. Shoreline stabilization extends from 1,000 ft (304.8 m) north of the Old GIWW to a point even with the north shore of Round Lake. The gaps left in the foreshore dike and marsh creation area will provide for water exchange and fish access.

3. Use of the access canal dredge material to created additional marsh behind the foreshore dike (Clark and Dubois 2002).

Unit 2 - Collicon Lake Terraces

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

1. Construction of two rows of 200 ft (60.96 m) long terrace segments (approximately 112 segments), with 50 ft (15.24 m) gaps between each segment. Total length is 25,000 ft/7,620 m (2 rows, each 10,000 ft/3,048 m long) plus 5,000 ft/1,524 m (approximately 2,500 ft/762 m in each row) of 50 ft (15.24 m) long gaps between terraces.

2. Planting of terrace tops with three rows of 4-inch diameter containers of *Paspalum vaginatum* (seashore paspalum) planted on 5 ft (1.52 m) centers. The crowns (8 feet wide for inner terraces and 10 feet wide for outer terraces) and slopes (3:1) of the terraces were seeded with a mixture of *Echinochloa esculenta* (Japanese millet) and *Panicum ramosum*

(brown top millet), as a temporary erosion control measure pending establishment of native species. Terrace side slopes were planted with gallon containers of *Zizaniopis miliacea* (giant cutgrass) in one row on 5 ft (1.52 m) centers. The side slope facing Collicon Lake has two rows on 5 ft (1.52 m) centers.

3. Vegetation planting along the southern shoreline of Round Lake include planting one or two rows of gallon containers of *Z. miliacea* (giant cutgrass) and *Scheonoplectus californicus* (bulrush) on 5 ft (1.52 m) centers for a total distance of 4,000 ft (1,219.2 m).

Monitoring Goals

Priorities:

The Grand-White Lake Landbridge Protection project is classified as a shoreline protection project. However, the Wetland Value Assessment, Draft Environmental Assessment, and other documents state that the project is also expected to create marsh by constructing terraces and increase the frequency and occurrence of SAV within the shallow open water areas of the project. There are insufficient resources for an evaluation of all anticipated project benefits, and the primary purpose of this project is reducing or reversing the erosive loss of marsh between Grand and Collicon Lakes. Therefore, monitoring efforts will focus on evaluating project effects on land/water ratios, shoreline change, and vegetation planting success on the terraces. SAV and structural integrity of the rock dike and terraces will only be monitored via visual inspections by the Operations Section of OCPR (formerly, Engineering and Monitoring Sections of LDNR-CRD) during annual Operations & Maintenance inspections (engineers) and shoreline and vegetation surveys (scientists). Changes in shoreline at the south end of Round Lake will be evident from aerial photography, but no specific monitoring of those plantings is anticipated. Any variation from expected results will be documented and evaluated.

Specific Monitoring Goals:

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.
4) Evaluate changes in elevation and landscape integrity due to the accumulation and erosion of sediments in land bridge areas.

Reference Area:

Monitoring on both project and reference area provides a means to achieve statistically valid comparisons, and is therefore the most effective means of evaluating project effectiveness. The main criteria for selecting a reference area are similarities in vegetative community, soil type, and

hydrology, similarities in shoreline erosion rates, and proximity to the project area.

Two proposed reference locations were chosen for evaluating and comparing changes in shoreline based on the aforementioned criteria. Reference site A is located north of Round Lake and includes the southern portion of Snake Lake (figure 1). Shoreline change along this stretch of the eastern edge of Grand Lake will be compared to that along the project area where the proposed foreshore dike in Unit 1 will be constructed. Land/water ratios in Reference site A and the project area also will be compared. Reference site B is located south of the Old GIWW on the south western portion of Collicon Lake (figure 1) and will be used to compare changes in shoreline erosion of the north western shore of Collicon Lake where the terraces will be constructed.

Monitoring Strategies

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

1. Aerial Photography — To evaluate the extent of wetland loss or gain adjacent to project features, near-vertical, color-infrared aerial photography (1:12,000 scale) were obtained in project and reference areas in November 2004 (as built for terraces) and will be obtained in 2014 (post construction). The photography will be georectified, mosaicked, and land/water ratios determined using standard operating procedures described in Steyer et al. (1995, revised 2000).

2. Shoreline Survey — To document annual shoreline movement, differential GPS (dGPS) will be used to map the shoreline in both the project and reference areas as described in Steyer et al. (1995). Shoreline data behind the foreshore dike and its reference area were collected in November 2003 (as built) and August 2006 (post construction). Shoreline data behind the earthen terraces and its reference area were collected in October 2004 (as built). Post construction shoreline data behind the foreshore dike and terraces were collected in October 2008 and will be collected late summer/fall 2013 and 2021.

3. Terrace Vegetation — The condition of the natural emergent, seeded, and planted vegetation on the terraces over the life of the project, will be monitored at 10% of the total planted terraces using a modified Braun-Blanquet sampling method as outlined in Steyer et al. (1995). Of the 12 terraces, 6 are lakeside terraces and 6 are marshside terraces. Four sampling stations were established on selected terraces consisting of a station on the inner and outer slope and 2 stations on the crown to include both high and low energy environments. At each station, percent cover, dominant plant heights, and species composition were

documented in a 4 m^2 sample area. 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 the most of the terraces (especially the lakeside terraces) had eroded to the point that many of the permanent vegetation stations did not exist.

3.a. Terrace Vegetation

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 using the modified Braun-Blanquet sampling method (Steyer et al. 1995) over the entire terrace rather than permanent vegetation stations. Vegetation sampling was evaluated in March 2010 and is scheduled to coincide with shoreline mapping in 2013 and 2021. Previous vegetation data (2004 and 2005) collected from permanent vegetation stations will be combined to describe each terrace and compared to future vegetation data collected at the terrace level. Future and previous vegetative assessments will be compared to planted specifications (2004) to describe vegetative cover and species composition change over time.

4. Terrace Area

Vegetated portions of the terraces will be mapped to compliment the terrace vegetation evaluation and track the condition of the terraces over time. The twelve terraces used for vegetation evaluation will be mapped using differential GPS (Steyer et al. 1995) as conducted for shoreline mapping. Differentially corrected GPS (dGPS) data was collected in March 2010 and are scheduled to coincide with shoreline mapping in 2013 and 2021, concurrent with vegetation assessments. Terrace areas obtained from dGPS mapping will be compared to terrace areas obtained from digitization of the as-built aerial photography taken in November 2004 to calculate and describe changes over time.

5. Elevation

In order to monitor elevation changes due to the movement of sediment over time, elevation profiles of the project and reference sites (e.g., between Grand Lake and Collicon Lake, Grand Lake and Round Lake, Round Lake and Collicon Lake, and Grand Lake and Snake Lake) will be generated using GIS (three dimensional topographic grids). Three transect lines will be established at each

location and elevations will be recorded at 10 ft (3.05 m) intervals starting 50 ft (15.24 m) lakeward of each project feature to the existing shoreline, and at 100 ft (30.48 m) intervals across the existing land bridge, and at any significant change in elevation within those intervals. Elevations will be tied to the North American Vertical Datum of 1988 (NAVD 88). Elevation surveys were scheduled for 2004 (as-built), 2006, and 2013 concurrent with the shoreline surveys and Operation and Maintenance (O&M) surveys. The analysis of these profile data would be beneficial in evaluating the rate of gain or loss of wetland acreage and the volumetric amount of retention of the shoreline sediments during post-construction years. See Note 5 (below).

Anticipated Analyses and Hypotheses

The following describes comparisons, hypotheses, and statistical tests, if applicable, used to evaluate each of the Monitoring goals and thus effectiveness of the project.

1. Aerial Photography: Descriptive and summary statistics from color-infared aerial photography collected pre- and post-construction will be used to estimate land/water ratios and calculate wetland loss/gain. Wetland loss/gain rates from pre- to post-construction will be compared between project and reference areas.

   Goal: 1) Evaluate changes in Land:Water ratios.

2. Shoreline Survey: Shoreline erosion rates will be calculated over time from pre- to post-construction to compare project and reference areas.

   Goal: 2) Evaluate rate of erosion along the eastern shoreline of Grand Lake and western shoreline of Collicon Lake.

3. Terrace Vegetation: Determine if planted marsh vegetation established and maintained or increased from 2004 to 2005, we used ANOVA to compare % occurrence and % cover of vegetation species.

   Goal: 3) Evaluate establishment of emergent vegetation on planted terraces.

   Hypotheses:

   H_o: Mean % occurrence and mean % cover of marsh vegetation species on planted terraces after construction was not significantly different in 2005 than

in 2004.

H_a: Mean % occurrence and mean % cover of marsh vegetation species on planted terraces after construction was significantly different in 2005 than in 2004.

3.a. Terrace Vegetation: To determine the condition of vegetation on the terraces, we will compare % vegetated area, % cover of vegetation species, and species richness to the as-built specification over time and position of the terrace (lakeside versus marshside).

Goals: 3.a.) Evaluate the condition of emergent vegetation on planted terraces.

Hypotheses:

H_o: Mean % vegetated area, % cover, and species richness of marsh vegetation species on planted terraces after construction will not significantly change over time and by position of the terrace.

H_a: Mean % vegetated area, % cover, and species richness of marsh vegetation species on planted terraces after construction will significantly change over time and by position of the terrace.

4. Terrace Area: To determine the changes in terrace area, we will compare digitally mapped areas over time and by position of the terrace (lakeside versus marshside).

Goals: 4) Evaluate changes in area of terraces.

Hypotheses:

H_o: The area of the terraces after construction will not significantly change over time and by position of the terrace.

H_a: The area of the terraces after construction will significantly change over time and by position of the terrace.

5. In order to evaluate the accumulation (or erosion) of sediments between project features and the existing vegetated shoreline, data will be collected using a three dimensional GIS grid, and a volumetric difference of the sediments will be evaluated between years 2003 (being start of project), 2006, and 2013. Sediment volume will be compared between project and reference sites between years 2003 and 2006, 2006 and 2013, and 2003 and 2013.

Goal: 5) Evaluate changes in elevation and landscape integrity due to the accumulation and erosion of sediments in land bridge areas.

Notes

1.	Implementation:	Start Construction:	
		Phase I (rock)	July 2003
		Phase II (terraces)	March 2004
		End Construction:	
		Phase I (rock)	November 2003
		Phase II (terraces)	August 2004
2.	USFWS Project Manager:	Darryl Clark	(337) 291-3111
3.	OCPR Project Manager:	Andrew Beall	(225) 342-1952
	OCPR Construction/O&M Manager:	Melvin Guidry	(337) 482-0682
	OCPR Design Engineer:	Amanda Phillips	(225) 219-0380
	OCPR Biological Monitoring Manager:	Maggie Hawkins	(337) 482-0657

4. The twenty year monitoring plan development and implementation budget for this project is $186,403. Comprehensive reports are scheduled for every three years beginning in 2005 or when critical data is available and will be combined with the annual Operations and Maintenance Report. These reports will describe the status and effectiveness of the project.

5. Presently, there are insufficient funds to monitor elevation profiles. However, should funds become available over the twenty year project life span this monitoring element will be addressed.

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