State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Monitoring Plan

for

West Lake Boudreaux Shoreline Protection and Marsh Creation (TE-46)

State Project Number TE-46
Priority Project List 11

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Terrebonne Parish

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The Coastal Protection and Restoration Authority (CPRA) and the United States Department of Interior/Fish and Wildlife Service (FWS) agree to carry out the terms of this Monitoring Plan (hereinafter referred to as the "Plan") of the accepted, completed project features in accordance with the Cost Sharing Agreement DNR No. 2511-02-19 dated April 3, 2002. The FWS will be included as part of the Plan as a reviewing federal sponsor.

The project features covered by this plan are inclusive of and are identified as the West Lake Boudreaux Shoreline protection and Marsh Creation Project (TE-46). The intention of the provisions of this plan is to monitor the project using standardized data collection techniques and to analyze that data to determine whether the project is achieving the anticipated benefits. Reports will be generated and recommendations made to adaptively manage the project. There are no requirements that this project function to any standard beyond the economic life, except that it is not left as a hazard to navigation or a detriment to the environment.

Construction of the West Lake Boudreaux Shoreline Protection and Marsh Creation Project was authorized by Section 303(a) of Title III Public Law 101-646, the Coastal Wetlands Planning and Protection Restoration Act (CWPPRA) enacted on November 29, 1990 as amended. This project was approved on the eleventh (11^{th}) Priority Project List.

1. PROJECT DESCRIPTION, PURPOSE, GOALS, and FEATURES

Description

The West Lake Boudreaux Shoreline Protection and Marsh Creation (TE-46) project area is located in the Terrebonne Basin on the western rim of Lake Boudreaux in Terrebonne Parish, LA (Figure 1). It encompasses 1,177 acres (476 ha) including 250 acres (101 ha) of intermediate marsh and 927 acres (375 ha) of open water habitat. It is bounded on the east by Lake Boudreaux, on the north by a private canal adjacent to Bayou Butler, on the west by Bayou Grand Caillou, and on the south by an unnamed drainage canal.

The (TE-46) project area is on the Teche Ridge, a feature of the Terrebonne delta plain which is a result of landforms produced by the Teche-Mississippi delta cycle 4500 to 3500 years ago (Gagliano and Wicker 2002) (Figure 1). Lake Boudreaux was created as a result of fault events between the early to mid 1800's when the area's fresh marshes and swamps reached maximum development and the marsh was continuous and unbroken. A severe flood in 1903 prompted the construction of a dam across the head of Bayou Lafourche at Donaldsonville (completed in 1904), effectively cutting off all sediment flow from the Mississippi River. Since the turn of the 20th century a combination of natural and anthropogenic alterations within the Terrebonne delta plain has contributed to its deterioration (Gagliano and Wicker 2002).

The western shoreline of Lake Boudreaux has experienced erosion and high marsh loss rates due to factors such as exposure to wind-generated wave energy,

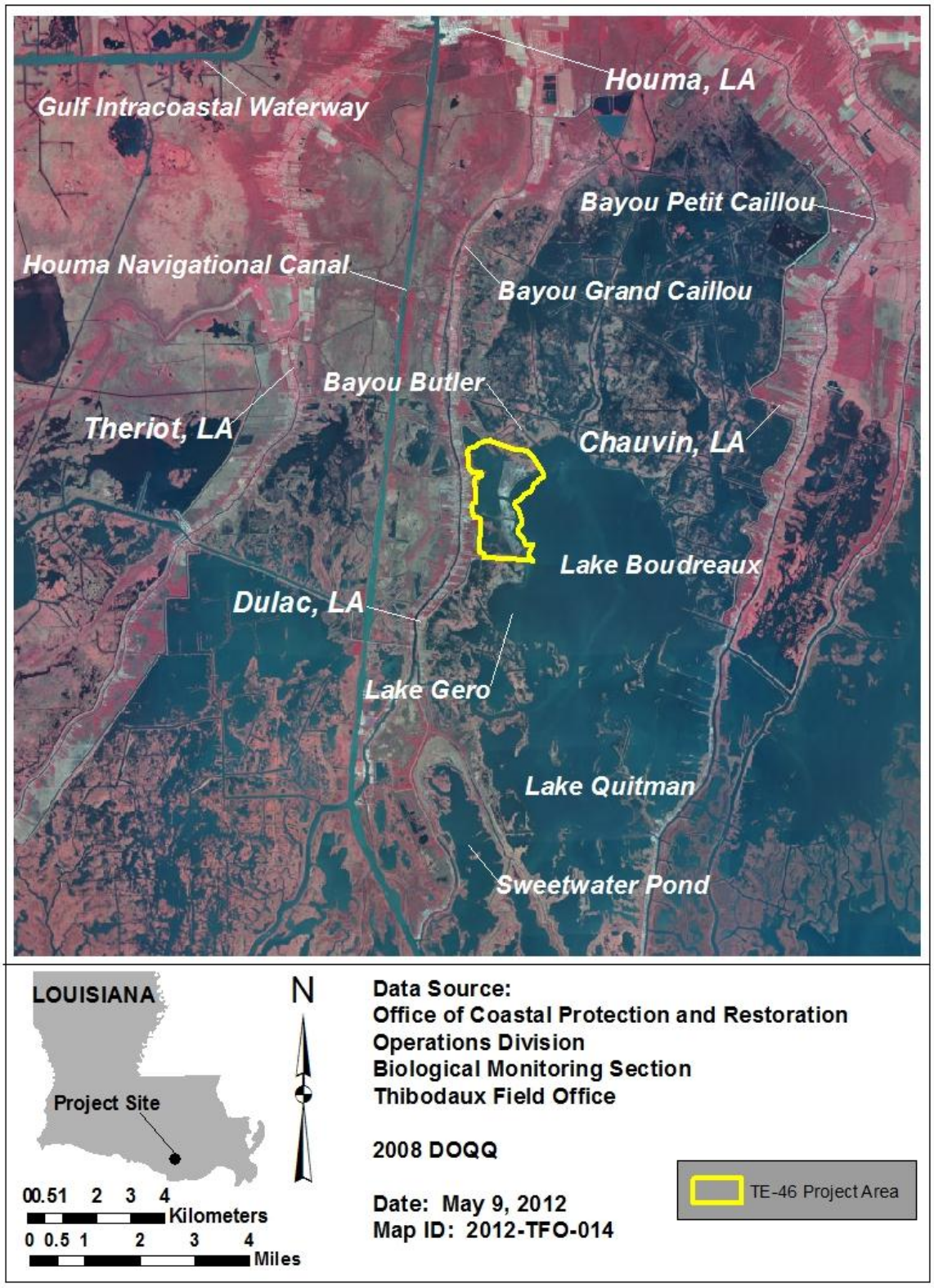

Figure 1. Location map for the West Lake Boudreaux Shoreline Protection and Marsh Creation (TE-46) project.

subsidence, turbidity detrimental to submerged aquatic vegetation (SAV) populations, and saltwater intrusion (USFWS 2005a). The United States Geological Survey (USGS) has estimated that between 1983 and 1990 interior marsh loss rates in the Lake Boudreaux area were approximately 3.68 % (USGS 2001). An analysis of shoreline erosion rates by the USGS using 2001 through 2004 aerial photography indicates shoreline erosion rates ranged from 10 ft per year (3 m per year) along the southwest shoreline to 91 ft per year (27.7 m per year) along the northwest shoreline, with a total weighted average shoreline erosion rate of 42 ft per year (12.8 m per year) (USFWS 2005b). Additionally, based upon a 2004 survey by Professional Engineering and Surveying Company, Inc. (PENSCO) as much as 600 ft (182.88 m) of shoreline erosion has occurred since the baseline aerial photo utilized for the project plan was taken on February 4, 1998 (Hill and Brass 2005). Concerns are that the erosion will convert the productive shallow, open water areas behind the eroding shoreline to a less productive open lake habitat and the interior marsh and adjacent infrastructure will be compromised.

The project involves the construction of a foreshore rock dike on the -1.0 ft (-0.30 m) NAVD88 contour along the western shoreline of Lake Boudreaux in three sections (northern, central, and southern) with a combined linear distance of 14,207 ft (4,330 m) in order to reduce shoreline erosion rates. Construction would also involve the dredging of sediments from a Lake Boudreaux borrow site into three contained open water areas behind the foreshore dike segments at an initial average elevation of + 3.2 ft (0.97 m) NAVD88 with an expected settlement to + 0.98 ft (0.30 m) NAVD88 by year 20 post-construction. This will create approximately 220 acres (89 ha) of intermediate marsh habitat, which in turn will provide a reduction in erosion rates to already existing interior marshes to the west of the constructed features.

Purpose:

The project's purpose is to reduce erosion of the west Lake Boudreaux shoreline, which in turn will protect interior low salinity marshes and aquatic grass beds from the high wave energy and turbidity found in Lake Boudreaux; it will create emergent marsh along the southwestern shoreline of Lake Boudreaux and at interior marsh sites through the deposition of material dredged from the Lake bottom.

Goals:

The specific project goals are:

1. To stop shoreline erosion along approximately 14,207 linear ft (4,330 m) of the western shoreline of Lake Boudreaux over the 20-year project life.
2. To initially create 220 acres (89 ha) of marsh by the completion of project construction with intertidal marsh developing after year 3 of the project's life.
3. To reduce erosion rates by 50%, from 3.68% per year to 1.84% per year, in the created and nourished marsh over the 20-year project life.
4. To reduce erosion rates by 25%, from 3.68% per year to 2.76% per year, in the non-directly affected marsh over the 20-year project life.

Features:
The as-built principal project features include (Figure 2): 1) 12,447 linear feet (3,794 m) of foreshore rock dike constructed to an elevation of +3.5 feet NAVD88 (vertical tolerance of +0.5 feet) in three separate segments (North, Central and South), 2) 220 acres (89 ha) of marsh creation areas in three segments using material dredged from Lake Boudreaux, 3) 24,553 linear feet (7,484 m) of earthen containment dike around the three marsh creation areas to be partially degraded three years post-construction, 4) one 75 foot (23 m) long earthen plug located in the northern portion of the project area, 5) one 150 foot (46 m) long x 75 foot (23 m) wide rock riprap choke-down section in the shoreline gap between the northern and central marsh creation area shorelines, 6) two spoil gaps or "fish dips" in the central section of the project area.

Project construction began on July 4, 2007, and was completed on Oct 30, 2009. Project life is estimated to be 20 years. Annual project inspections are planned.

2. ITEMS REQUIRING MONITORING

The Coast-wide Reference Monitoring System (CRMS) - *Wetlands* is a network of 392 monitoring sites distributed throughout the coastal zone of Louisiana. Hydrographic, vertical accretion, elevation change, vegetation, soils, and aerial photography data are collected at each CRMS site. There are no CRMS monitoring stations located within the TE-46 project area. However, CRMS0390 and CRMS0392 are located approximately three miles due north of the project area (Figure 3). Data from these sites may be used to characterize conditions in the vicinity of the project area, and land loss data may be used for comparison to the land loss within the project area.

Project-specific monitoring for TE-46 includes 42 long-term vegetation monitoring stations randomly selected and established in the fall of 2012 along 14 east-west transects and divided amongst the three marsh creation areas (Figure 4). These stations will allow for comparison to the aforementioned CRMS stations outside the project area. CRMS methods are described in detail in Folse et al. (2008, revised 2012). Additionally, CRMS coastwide flights will be utilized to estimate project-specific shoreline change rates and to document land/water changes over time.

The following monitoring strategies will provide the information necessary to evaluate the specific project goals**.**

A. Vegetation - Vegetation sampling will be conducted at each of the 42 long-term project-specific monitoring stations and will follow the Braun-Blanquet methodology (Mueller-Dombois and Ellenberg 1974). The stations will consist of 42 randomly selected replicate 2m x 2m plots located along 14 east-west transects divided amongst the three marsh creation areas. Sampling will occur in year 3 (2012), year 11 (2020), and year 19 (2028). Additionally, vegetation sampling at CRMS sites will also utilize the Braun-Blanquet methodology and will consist of

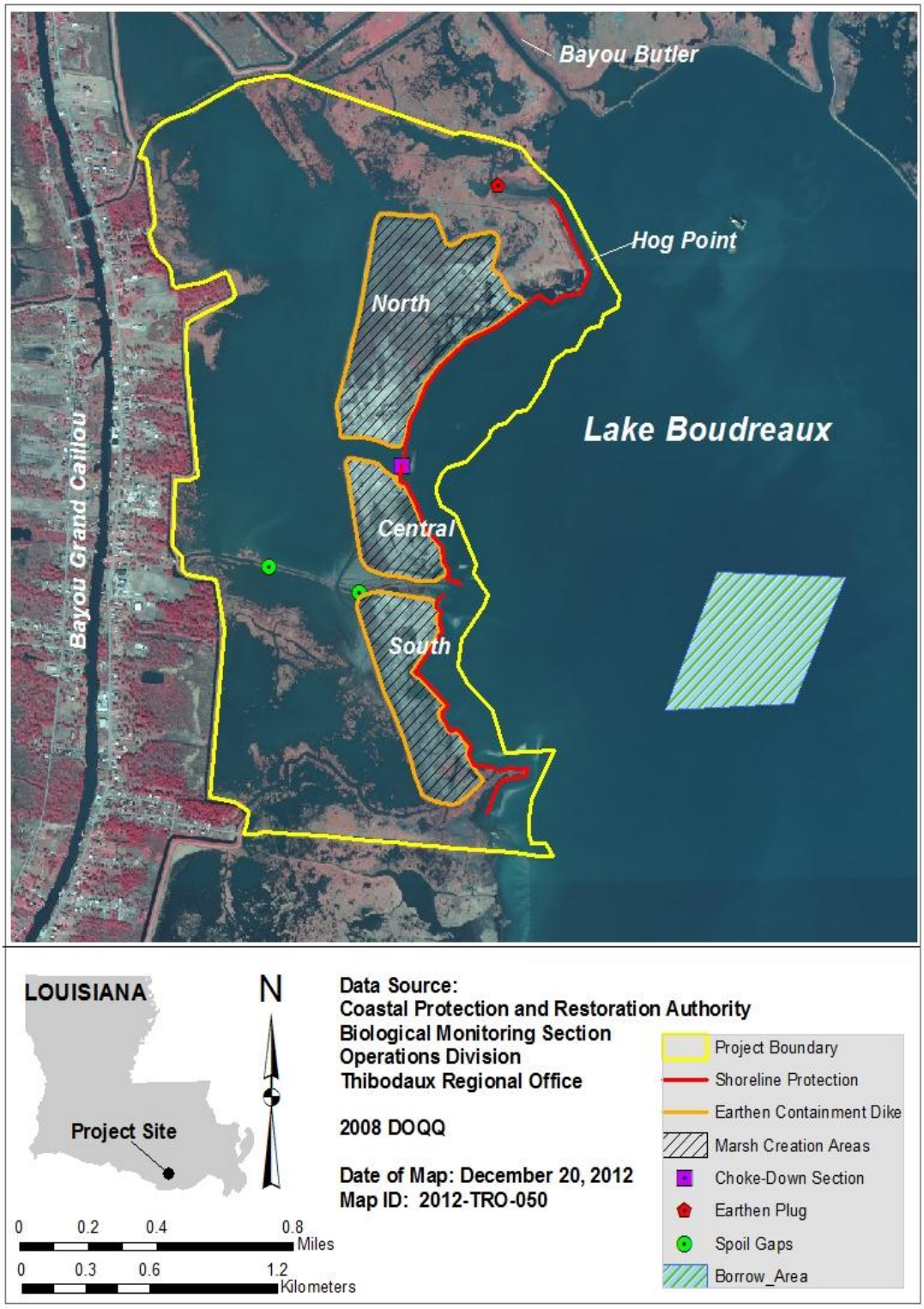

Figure 2. As-built project features located in the West Lake Boudreaux Shoreline Protection and Marsh Creation (TE-46) project area.

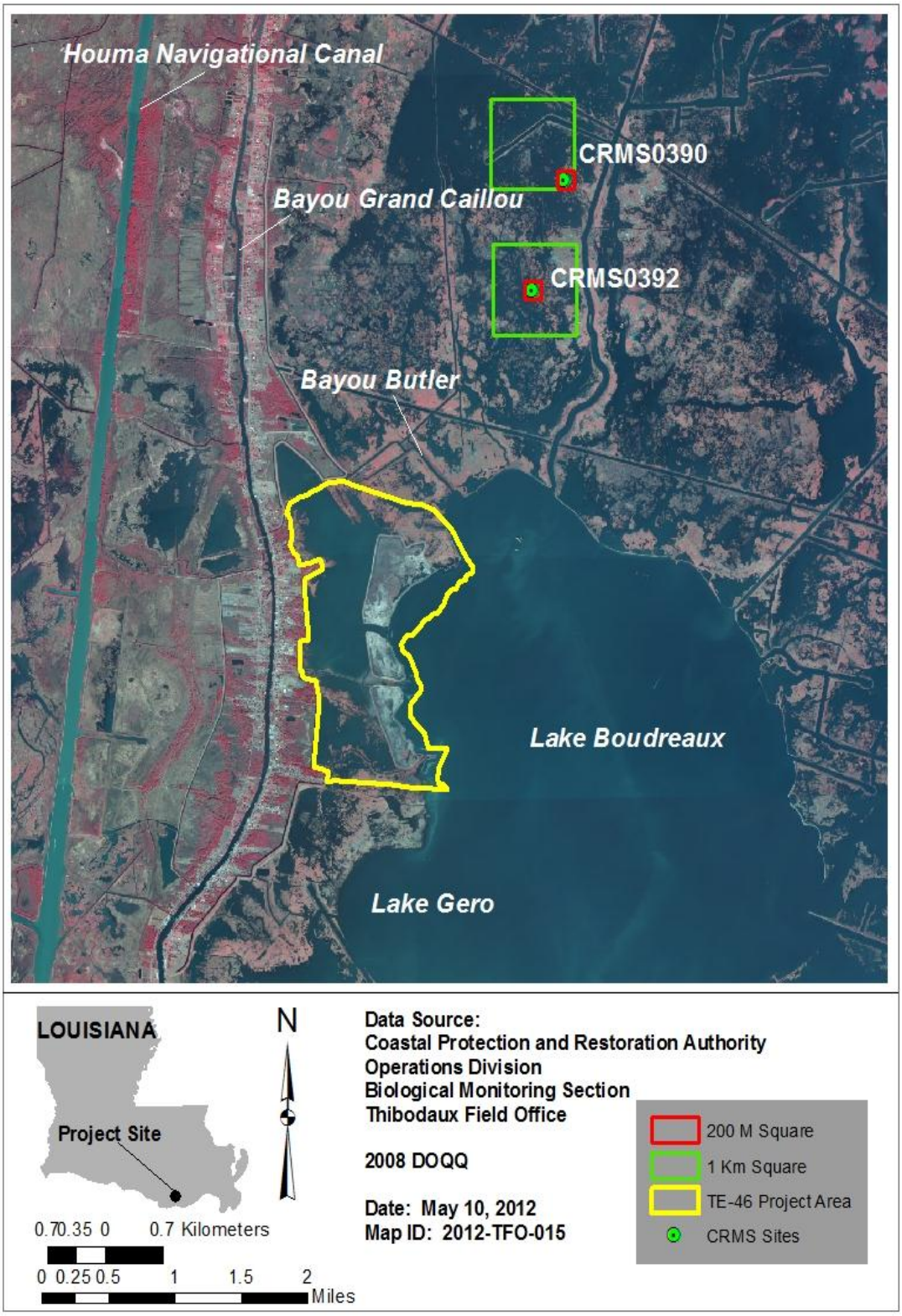

Figure 3. Location map for nearby CRMS monitoring sites north of the TE-46 project area.

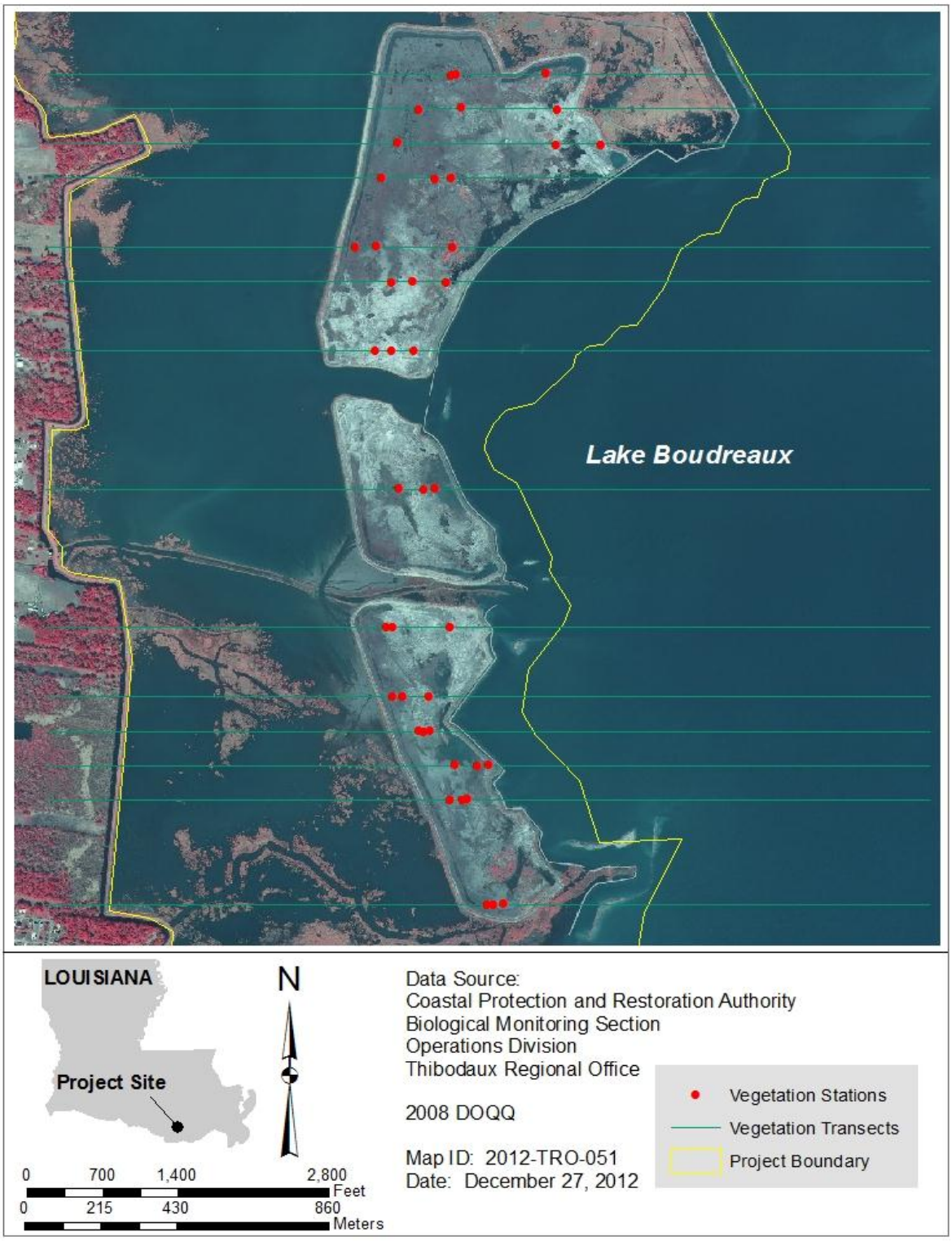

Figure 4. Project-specific vegetation monitoring stations for West Lake Boudreaux Shoreline Protection and Marsh Creation (TE-46) project.

ten replicate 2m x 2m stations located within a 200m x 200m square of each CRMS site. CRMS vegetation data will be collected annually in late summer.

B. Aerial photography - In order to evaluate land/water ratios in the project area, land/water data will be obtained from digital imagery (Z/I Imaging digital mapping camera) with a 1-meter resolution. The photography will be georectified using standard operating procedures described in Steyer et al. (1995, revised 2000), and land/water ratios will be determined. Aerial photography will be captured using CRMS coastwide flights for year 3 (2012), year 11 (2020), and year 19 (2028).

C. Shoreline Change – Shoreline erosion rates will be calculated using georectified CRMS photography and the Digital Shoreline Analysis System (DSAS) (Thieler et al. 2003). Shoreline positions will be determined by digitizing aerial photographs as per the Steyer et al. (1995) method, which defines shoreline position as the edge of the live emergent vegetation. Aerial photography will be captured using CRMS coastwide flights for year 3 (2012), year 11 (2020), and year 19 (2028).

D. Salinity - Salinity readings will be recorded hourly using continuous recorders located at each CRMS site. Discrete porewater salinity will be collected when sondes are serviced and during vegetation monitoring.

E. Water Level - Water level readings will be recorded hourly at each CRMS site to determine frequency, depth, and duration of flooding.

F. Soil Properties - Soil cores will be collected at a 10 year interval at each CRMS site. The first cores were extracted upon site establishment in 2006. Analysis of soil properties will include soil pH, salinity (EC), bulk density, moisture, percent organic matter, wet/dry volume and texture (Particle Size Distribution) analysis.

G. Sediment Elevation - Rod Surface Elevation Tables (RSET) will be used to measure changes in sediment elevation over time relative to a fixed datum at each CRMS site. Data will be collected biannually in the spring and fall.

H. Surface Accretion - Accretion plots will be used to measure surface accretion (i.e. sediment deposition) near the RSET station at each CRMS site. Vertical accretion is to be used in conjunction with the RSET to provide information on below ground processes that influence surface elevation change. Data will be collected semi-annually in spring and fall.

3. MONITORING BUDGET

The cost associated with project-specific monitoring variables outlined in Section 2 of this plan for the twenty (20) year project life is included and summarized in Attachment 1. Funding for monitoring was approved by the CWPPRA task force on October 12, 2011.

4. RESPONSIBILITIES

A. CPRA will:

1. Coordinate and oversee all scientific data collection.

2. Ensure that all data goes through quality control procedures and is entered into the public database.

3. Analyze the data and report on the status of the project after data collection events. Should the data indicate that the project is not meeting the goals and objectives, adaptive management recommendations will be made to improve the response.

4. Review the monitoring plan and budget annually with the USFWS to determine that the data being collected adequately evaluates the project.

B. USFWS will:

1. Review the monitoring plan and budget annually with the CPRA to determine that the data being collected adequately evaluates the project.

References

Folse, T. M., J. L. West, M. K. Hymel, J. P. Troutman, L. A. Sharp D. Weifenbach, T. McGinnis, and L. B. Rodrigue. 2008. A Standard Operating Procedures Manual for the Coast-wide Reference Monitoring System-Wetlands: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Office of Coastal Protection and Restoration. Baton Rogue, LA. 191pp.

Gagliano, S. M. and K. M. Wicker. April, 2002. Geological Characterization of Potential Receiving areas for the Central and Eastern Terrebonne Basin Freshwater Delivery Project. DNR Contract No. 2509-01-02. Report prepared for Louisiana Department of Natural Resources. Baton Rouge, LA. 57 pp. plus appendices.

Hill, S. and A. Y. Brass. 2005. Ecological Review: West Lake Boudreaux Shoreline Protection and Marsh Creation. Louisiana Department of Natural Resources. Baton Rouge, LA. 19 pp.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. J. Wiley and Sons, New York, NY. 547 pp.

Steyer, G. D., R. C. Raynie, D. L. Stellar, D. Fuller, and E. Swenson. 1995, (revised 2000). Quality Management Plan for Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp.

Thieler, E. R., and D. Martin, and A. Ergul 2003. The Digital Shoreline Analysis System, Version 2.0: Shoreline Change Measurement Software Extension for ArcView: USGS U.S. Geological Survey Open-File Report 03-076.

United States Fish and Wildlife Service (USFWS). 2005a. West Lake Boudreaux Shoreline Protection and Marsh Creation (TE-46) - Project Information Sheet. Prepared for the Louisiana Department of Natural Resources. Baton Rouge, Louisiana. 2 pp.

United States Fish and Wildlife Service (USFWS). 2005b. West Lake Boudreaux ShorelineProtection and Marsh Creation Project: Wetland Value Assessment Project Information Sheet. October 31, 2005. 6 pp.

USGS National Wetland Research Center Coastal Restoration Field Station and Louisiana Department of Natural Resources. 2001. West Lake Boudreaux Shoreline Protection Project (TE-CW-2). Habitat Analysis.

Attachment 1
Project Monitoring Budget

Project Name	West Lake Boudreaux Shore Protection and Marsh Creation												5									
Infl. Rate	2.60%		Sondes to Install		0			Monitoring Budget	$196,587													
Price Level	2010		Feldspar Sites		0																	
Round Trip Mileage		200	SET Installation		0																	
		Expended																				
	Rates	Dollars	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Daily Rate Items																						
Base Field Equipment	$ 56.18				5								5								5	
Camera	$ 25.00				5								5								5	
Handheld GPS	$ 17.00				5								5								5	
Differential GPS	$ 220.00				5								5								5	
Air Boat Rental	$ 1,050.00				5								5								5	
Four Man Crew	$ 1,800.00				5								5								5	
Data Processing & QA	$ 450.00				5								5								5	
Vehicle	$ 0.51				400								400								400	
Annual Rate Items																						
Misc. Supplies	$ 400.00				1								1								1	
Comprehensive Report	$ 12,000.00					1								1								1
Aerial Photography	$ 19,096.25				1								1								1	
		Expended																				
	Rates	Dollars	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Daily Rate Items																						
Base Field Equipment					$ 296								$ 363								$ 446	
Camera					$ 132								$ 162									
Handheld GPS					$ 89								$ 110								$ 135	
Differential GPS					$ 1,158								$ 1,422								$ 1,746	
Air Boat Rental					$ 5,527								$ 6,786								$ 8,333	
Four Man Crew					$ 9,474								$ 11,634								$ 14,285	
Data Processing & QA					$ 2,369								$ 2,908								$ 3,571	
Vehicle					$ 215								$ 264								$ 324	
Annual Rate Items																						
Misc. Supplies					$ 421								$ 517								$ 385	
Comprehensive Report						$ 12,961								$ 15,915								$ 19,543
Aerial Photography					$ 20,102								$ 24,684								$ 30,311	
Total		$ -	$ -	$ -	$ 39,782	$ 12,961	$ -	$ -	$ -	$ -	$ -	$ -	$ 48,850	$ 15,915	$ -	$ -	$ -	$ -	$ -	$ -	$ 59,537	$ 19,543
Projected - Running Total		$ -	$ -	$ -	$ 39,782	$ 52,742	$ 52,742	$ 52,742	$ 52,742	$ 52,742	$ 52,742	$ 52,742	$ 101,592	$ 117,507	$ 117,507	$ 117,507	$ 117,507	$ 117,507	$ 117,507	$ 117,507	$ 177,044	$ 196,587