State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Marsh Island Hydrologic Restoration

State Project Number TV-14
Priority Project List 6

August 2003
Iberia Parish

Prepared by:

Troy Barrilleaux, Monitoring Section (CRD)
LDNR/Coastal Restoration and Management

MONITORING PLAN

PROJECT NO. TV-14
MARSH ISLAND HYDROLOGIC RESTORATION

ORIGINAL DATE: January 21, 2000
REVISED DATE: August 14, 2003

Preface

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System (CRMS-*Wetlands*) for CWPPRA, updates were made to this Monitoring Plan to merge it with CRMS to provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. The implementation plan included review of monitoring efforts on currently constructed projects for opportunities to 1) determine if current monitoring stations could be replaced by CRMS stations, 2) determine if monitoring could be reduced to evaluate only the primary objectives of each project and 3) determine whether monitoring should be reduced or stopped because project success had been demonstrated or unresolved issues compromised our ability to actually evaluate project effectiveness. As a the result of a joint meeting with DNR, USGS, and the federal sponsor, the recommendations for this Monitoring Plan were to stop hydrologic monitoring after 5 years post-construction in 2006 (since all of the structures are passive and not operated), however maintain the aerial photography and the SAV sampling as originally planned. In addition, the satellite imagery collected through CRMS should be used to evaluate changes in land and water areas within the project area. These recommendations have been incorporated into the Monitoring Elements section.

Project Description

The Marsh Island Hydrologic Restoration Project is located in Iberia Parish approximately six miles south of Cypremort Point. The project area encompasses approximately 6,697 acres of wetlands on the northeast tip of Marsh Island east of Bayou Blanc (figure 1). It comprises 5,034 acres of brackish marsh and 1,663 acres of open water, based on the Louisiana Department of Natural Resource's GIS data for 1984. Common plant species found in the project area include *Juncus roemerianus* (needlegrass rush), *Spartina patens* (saltmeadow cordgrass), *Scirpus maritimus* (saltmarsh bulrush), *Scirpus americanus* (bulrush), *Spartina alterniflora* (saltmarsh cordgrass), and *Vigna luteola* (marsh cowpea) (USCOE 1994).

Between 1930 and the present, the hydrology of Marsh Island has changed due to tidal influenced erosion, subsidence, and oil and gas exploration (Brown and Root 1992). Currently, numerous conduits allow rapid water exchange between the interior marshes and the adjacent bays. Historically, water exchange between these two areas occurred as sheet flow from three major bayous, Bayou Blanc, Bayou Hawkins and Oyster Bayou (USCOE 1994). Another significant hydrological alteration is "Dynamite Cut", located in the south end of the reference area. It was excavated prior to the 1930's with dynamite to connect East Branch Oyster Bayou with Bayou Blanc and was created to provide trappers access for the control of muskrat populations. Dynamite Cut also allows increased tidal exchange and may have contributed to a gradual increase in salinity in

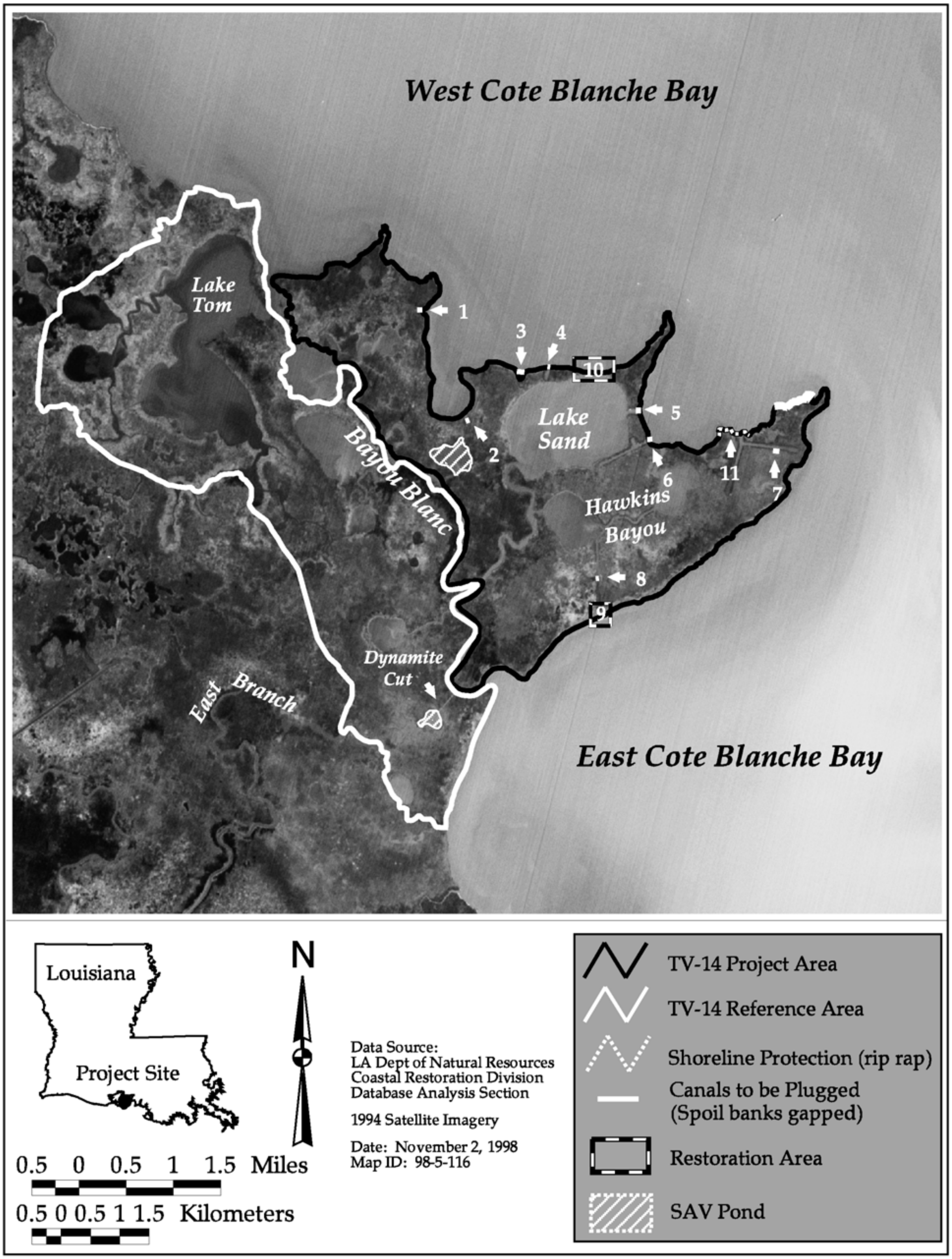

Figure 1. Marsh Island Hydrologic Restoration (TV-14) project area, reference area, and project features.

the surrounding interior marshes (Orton 1959). In the late 1950's, Dynamite Cut was plugged at Bayou Blanc to restore the original hydrology to the surrounding area. However, the plug at Dynamite Cut has since eroded and exchange into Bayou Blanc is again unrestricted.

Several oil field canals were constructed to facilitate oil and gas exploration in the project area during the 1950's. Much of this exploration took place in the vicinity of Lake Sand. Spoil deposited along these canals while dredging initially formed continuous banks which disrupted surface water flow and created ponding in the interior marshes (Brown and Root 1992). Surface water flow is important to wetland vegetation because it is the main pathway through which nutrients and sediments are delivered, whereas ponding generally decreases wetland productivity (Mitsch and Gosselink 1993).

Recent deterioration and subsidence of the spoil banks deposited in the 1950's have resulted in cuts in the spoil banks that have become conduits for rapid tidal exchanges between the surrounding bays and the interior marshes. These rapid exchanges have resulted in tidal scouring and the loss of marsh vegetation through erosion and subsidence (USCOE 1994). Lake Sand and a number of interior lakes also supported a significant amount of submerged aquatic vegetation (SAV). Today these lakes are almost devoid of SAV, presumably due to the effects of increased tidal exchange and increased turbidity (USCOE 1994). Erosion has also lead to the deterioration of the northeast end of Marsh Island and the north rim of Lake Sand, leaving exposed a highly organic brackish marsh.

The primary objectives of the project are to stabilize the northeastern shoreline of Marsh Island, including the northern shoreline of Lake Sand and to plug nine oil field access canals to help restore the historical hydrology of the project area. Approximately 2,000 ft (610.0 m) of rock breakwater will be used to stabilize the northeastern shoreline and 3,000 ft (914.4 m) of rock breakwater will be used to reconstruct the north shore of Lake Sand. Oil field canals will be plugged using low level rock dikes and earthen closures. Expected benefits of the project features are a reduction in the water exchange between the interior marshes and East and West Cote Blanche Bays. Minimizing rapid water exchange is expected to decrease the rate of marsh loss in the project area, encourage the colonization of SAV in shallow open water areas and reduce the erosion rate of the northeast shoreline.

Project Features

Project features (Figure 1) include:

1. Canal 1 (O&M Feature Only).
   Low level earthen closure. Crown height +3.0' MLG crown width 5' w/lv on 3h side slopes; 165 linear feet. Average elevation at base of closure 0.0' MLG.
2. Canal 2
   Earthen closure at rear of canal. Crown height +5.0' MLG. Crown width 5' w/lv on 3h side slopes; 50 linear feet. Average elevation at base of closure -6.0' MLG.

3. Canal 3

Low level rock/limestone breach repair feature at canal entrance w/reinforcement geotextile at base. Average stone size 125 lbs. Maximum stone size 250 lbs. Crown width 5' w/lv on 2h side slopes; 150 linear feet. Average elevation at base of closure -2.5' MLG. Crown height +4.0' MLG

4. Canal 4

    Low level rock/limestone breach repair feature at canal entrance w/reinforcement geotextile at base. Average stone size 125 lbs. Maximum stone size 250 lbs. Crown width 5' w/lv on 2h side slopes; 125 linear feet. Average elevation at base of closure -1.5' MLG. Crown height +4.0' MLG

5. Canal 5

    Sheetpile and Armor Stone Plug. Top of sheetpile and stone +5.0'MLG. Tip of sheetpile at elevation -35' MLG, 22' below existing channel bottom (mudline). Rock protection at base of sheetpile constructed to -7.0' MLG; w/lv on 2h side slopes; 15' crown width; 195 linear feet. Limestone dike (armor stone); 5' crown width w/lv on 2h side slopes; 175 linear feet. Average stone size 250 lbs. Maximum stone size 600 lbs. Average elevation at base of dike -2.0' MLG. Geotextile Reinforcement/Separator at base.

6. Canal 6

    Earthen closure w/Separator Filter Fabric and 3' Armor cover (Floodside face + 75% Crown width). Construct earthen core to +2.0'MLG. Crown width 5' w/lv on 2h side slopes. Average stone size 125 lbs. Maximum stone size 250 lbs. Average elevation at base of closure -3.0' MLG

7. Canal 7

    Earthen closure along south side of canal adjacent to open water area (+/- 150 linear feet). Avg. elevation at base of closure -2.5 MLG. Feature to be constructed by EXXON/WL&F.

8. Canal 9

    Low level earthen closure built to + 3.0' MLG. Crown width 5' w/lv on 3h side slope; 165 linear feet. Average elevation at base of dike -1.5' MLG.

9. Canal 9 Foreshore protection

    Rock at rear of Canal 9 along existing rim adjacent to the Gulf of Mexico. Rock design consistent with Lake Sand Closure (see below).

10. Lake Sand Closure

    Armor Stone 3000 linear feet; Outer 1000' segments of closure construct to elevation + 5.0' MLG. Inner 1000' to + 4.0' MLG for overtopping of stone. Average elevation at base of closure -1.5' MLG. Crown width 5.0' with levee on 2h side slope(s). Average stone size 250 lbs. Maximum stone size 600 lbs. Geotextile Seperator/ Reinforcement at base.

11. Shoreline Protection

    Armor stone 5.0' crown width with levee on 2h side slopes. Crown height +4.0' MLG. Average stone size 250 lbs. Maximum stone size 600 lbs. Average elevation at base of dike -3.5' MLG. Geotextile Reinforcement/Separator at base.

Project Objectives

1. Restore the hydrology of the project area by repairing breaches and plugging oil field canals.

2. Restore the north shoreline of Lake Sand.

3. Protect emergent marsh in the project area by reducing erosion along the northeast shoreline of Marsh Island.

4. Encourage colonization of submersed aquatic vegetation.

Specific Goals

1. Reduce water level variability in the project area.

2. Decrease the rate of marsh loss in the project area.

3. Reduce erosion rate of the northeast shoreline of Marsh Island.

4. Increase the occurrence of submerged aquatic vegetation in Lake Sand and in shallow open water within the project area.

Reference Area

Reference areas will be used to help separate project effects from spatial and temporal variability. Monitoring of both the project and reference areas provide a means to achieve statistically valid comparisons, and is therefore, the most effective way to evaluate project effectiveness. The main criteria for selecting reference areas are similarities in soil type, vegetation community, and hydrology of the project area.

Two reference areas, have been proposed to evaluate project effectiveness. The proposed reference area one (REF 1), immediately west of the project area, will be used in the evaluation of marsh to open-water ratios, SAV abundance, and water level fluctuations (figure 1). The project area and REF 1 are classified as brackish marsh (Chabreck and Linscombe 1988). Soils in the northern portion of both areas are of the Lafitte soil series while soils in the southern portions are of the Scatlake association (SCS 1978). Hydrology is similar in both areas. Specifically, both areas are exposed to Vermilion Bay on the north and the Gulf of Mexico on the south. To evaluate the shoreline protection feature located on the northeast shoreline of Marsh Island an additional reference area, REF 2, is proposed adjacent to the project shoreline, but not influenced by the rip

mapped and used to compare shoreline erosion/growth rates in the project area and in REF 2.

4) Submersed Aquatic Vegetation- SAV will be monitored using the rake method (Chabreck and Hoffpauir 1962). Restoration of the Lake Sand shoreline is expected to influence SAV primarily in Lake Sand, while canal plugs and spoil bank repair work is expected to influence SAV primarily in other shallow open water areas. Separate tests will therefore be used to evaluate SAV in Lake Sand and SAV in shallow open water areas. The frequency of occurrence of SAV in Lake Sand will be compared to the frequency of occurrence of SAV in Lake Tom found in REF 1. Three parallel transects will be established and separated by a distance approximately equal to one-fourth the pond width. Each transect will have a minimum of twenty-five equally spaced sampling stations. At each station, aquatic vegetation will be sampled by dragging a garden rake on the pond bottom for one second. The presence of vegetation will be recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/25 x 100). When vegetation is present, the species present will be recorded in order to determine the frequencies of individual species (Nyman and Chabreck 1996). In shallow open water areas, three small ponds in the project area will be compared to three small ponds in REF 1. Two parallel transects, separated by a distance approximately equal to one-third the pond width will be established in each pond and investigated using similar sampling techniques as discussed above. Ancillary salinity data, collected with continuous data recorders and monthly discrete samples, will be evaluated in concert with the statistical analysis to aid in the interpretation of SAV data. SAV will be monitored prior to construction in 1999, and post construction years 2002, 2004, 2006, 2009, 2012, 2013, and 2016.

<u>Anticipated Statistical Analyses and Hypotheses</u>

The following describes hypotheses associated with specific monitoring elements. Data will be analyzed, testing these hypotheses with appropriate parametric or non-parametric methods to evaluate the project goals.

1) <u>Aerial Photography:</u> Descriptive and summary statistics on historical data (for 1956, 1978, and 1988) and data from color-infrared aerial photography collected pre- and post construction will be used, along with GIS interpretations of these data sets, to evaluate marsh to open water ratios and changes in the rate of marsh loss/gain in the project area.

Goal: Reduce the rate of marsh loss in the project area.

2) Water level variation:

Goal: Reduce water level variability within the project area.

Hypothesis[1]:

H_o^1: Annual water level variability within the project area post-construction will not be significantly lower than annual water level variability within the reference area post-construction.

H_a^1: Annual water level variability within the project area post-construction will be significantly lower than annual water level variability within the reference area post-construction.

Hypothesis[2]:

H_o^2: Annual water level variability within the project area after project implementation will not be significantly less than annual water level variability before project implementation.

H_a^2: Annual water level variability within the project area after project implementation will be significantly less than annual water level variability before project implementation.

3) Shoreline Change: Descriptive and summary statistics will be used to compare measured rates of shoreline change in the project and reference area between successive years. Also, historical values for the area as well as data available from other surveys (i.e.,USACE, USFWS, LDNR, LSU) will be gathered to document and allow for appropriate parametric and/or non parametric statistical analysis of long-term shoreline movement.

Goal: Reduce erosion rate along the selected northeast shoreline of Marsh Island.

Shoreline erosion within the project area post-construction will be less than shoreline erosion within the reference area post-construction.

4) SAV:

Goal: Increase the occurrence of SAV in Lake Sand. Increase the occurrence of SAV in shallow open water within the project area.

Hypothesis[1]:

H_o^1: Frequency of occurrence of SAV will not differ among sites [Lake Sand (project) and Lake Tom(reference)] and sampling periods (pre and post construction).

H_a^1: Frequency of occurrence of SAV will differ among sites [Lake Sand (project) and Lake Tom(reference)] and sampling periods (pre and post construction).

Hypothesis[2]:

H_o^2: Frequency of occurrence of SAV within the interior ponds inside the project area will not differ among sites (project and reference) and sampling periods (pre and post construction).

H_a^2: Frequency of occurrence of SAV within the interior ponds inside the project area will not differ among sites (project and reference) and sampling periods (pre and post construction).

Note: Available ecological data, including both descriptive and quantitative data, will be evaluated in concert with the statistical analysis to aid in determination of overall project success. This includes ancillary data collected in the monitoring project but not used directly in statistical analysis, as well as data available from other sources (USACE, USFWS, DNR, LSU, etc.).

Notes

1)	Implementation Schedule:	Start Construction	July 25, 2001
		End Construction	December 12, 2001
2)	USCOE Point of Contact:	Chris Monnerjahn	(504) 862-2415
3)	DNR Project Manager:	Herb Juneau	(337) 482-0684
	DNR Monitoring Manager:	Troy Barrilleaux	(337) 482-0657

4) The twenty-year monitoring plan development and implementation budget for this project is $673,747. Pursuant to the CRMS review, it was authorized by the Task Force to maintain $420,056 with the project, and utilize $253,691 to support CRMS. Periodic comprehensive

reports on coastal restoration efforts in the Teche-Vermilion hydrologic basin will describe the status and effectiveness of the project as well as cumulative effects of restoration projects in the basin.

5) References:

Brown & Root Inc. 1992. Marsh Island Canal Backfilling and Sediment Fencing Iberia Parish. Feasibility study prepared for Louisiana Department of Natural Resources Coastal Restoration Division 37 pp.

Chabreck, R.H. and C.M. Hoffpauir. 1962. The use of weirs in coastal marsh management in coastal Louisiana. Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commissioner 16:103-112.

Chabreck, R.H. and R.G. Linscombe. 1988. Vegetative type map of the Louisiana coastal marshes. Louisiana Wildlife and Fisheries Commission, Baton Rouge, LA.

Mitsch, W. J. and J.G. Gosselink. 1993. Wetlands. 2nd Edition, Van Nostrand Reinhold, New York, NY, USA.

Nyman, J.A. and R.H. Chabreck. 1996. Some effects of 30 years of weir management on coastal marsh aquatic vegetation and implications to waterfowl management. Gulf of Mexico Science 14:16-25.

Orton, E.W. 1959. A geological study of Marsh Island, Iberia Parish, Louisiana. Tech. Report, Louisiana Wildlife and Fisheries Commission.

SCS. 1978. Soil survey of Iberia Parish, Louisiana. U.S. Department of Agriculture (USDA), Soil Conservation Service. 67+ pp.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller, and E. Swensen. 1995. 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.

USCOE. 1994. Wetland Value Assessment for Marsh Island Canal Plugging, Shoreline Stabilization and Marsh Restoration (T/V-14). United States Department of the Interior, Army Corps of Engineers. 5pp.

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