State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Pecan Island Terracing

State Project Number ME-14
Priority Project List 7

August 2003
Vermilion Parish

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LDNR/Coastal Restoration and Management

MONITORING PLAN

PROJECT NO. ME-14 (XME-22) PECAN ISLAND TERRACING

ORIGINAL DATE: November 27, 2001
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, this Monitoring Plan was reviewed to facilitate merging 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 maintain it in its current form. Consequently, no changes were made as a result of the CRMS review.

Project Description

The Pecan Island Terracing (ME-14) project is located five miles north of the Gulf of Mexico just south of Pecan Island and Hwy 82 in the Lakes Sub-basin of the Mermentau Basin, Vermilion Parish, Louisiana (figure 1). The total project area comprises approximately 3,550 acres (1,436.6 ha) of brackish marsh and open water (Louisiana Department of Natural Resources [LDNR 1998]). Area 1 is primarily open water and was formerly pasture land of approximately 1,950 acres (789.1 ha). Area 2 consists of approximately 1,600 acres (647.5 ha) of brackish marsh and open water (LDNR 1997).

Habitat analysis in 1956 classified Area 1 as 99.1 % fresh marsh and 0.9 % water and Area 2 as 89.7 % fresh marsh and 10.3 % water. The marshland in Area 1 was converted in the late 1950's to a dry pasture area by constructing continuous dikes around the perimeter and draining the interior. By 1978, Area 1 was classified as 93.4 % pasture, 0.5 % water, 0.2 % fresh marsh, and 1% intermediate marsh with Area 2 being 16 % intermediate marsh, 14.3 % brackish marsh, and 69.4 % open water. Deterioration and loss of the perimeter levees between 1978 and 1988 has converted the entire area into a shallow, open water lake with some sporadic small islands. The analysis performed from1988 through 1990 indicated that Area 1 had converted to 98 % water with only 1. 6 percent of the land left and it being brackish marsh. Additionally, Area 2 had converted to 68.2 % water and 31.7 % brackish marsh (United States Geological Survey [USGS] 2001).

Soils in the northern portion of Area 1 are Bancker muck with the southern portion being Clovelly muck. Area 2 consists solely of Clovelly muck. Bancker muck is very poorly drained, very fluid, mineral soil. Natural vegetation on a Bancker muck may consist of mainly *Spartina patens*

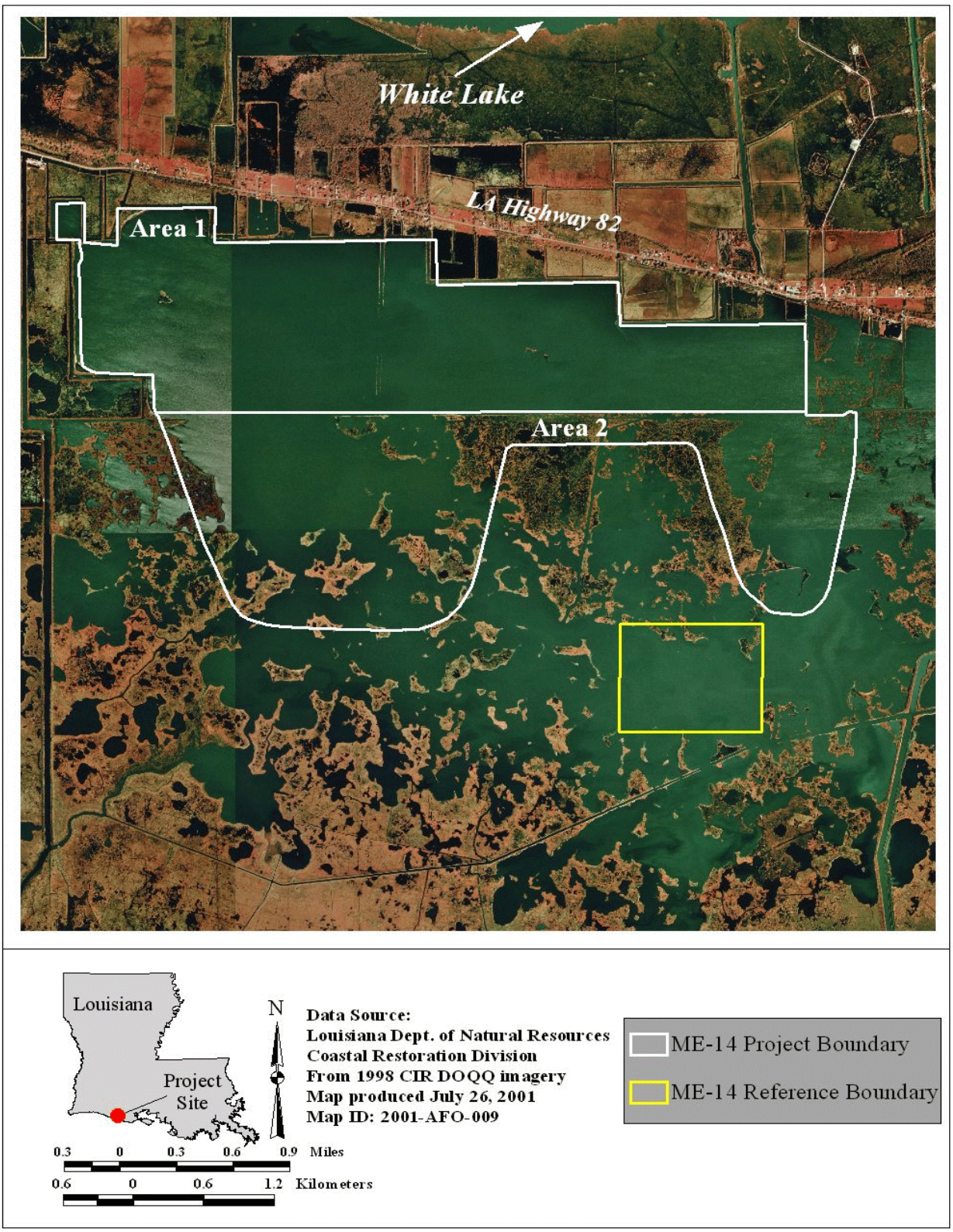

Figure 1. Pecan Island Terracing (ME-14) project and reference area showing LA Hwy. 82 and White Lake.

(marshhay cordgrass) (USDA 1996). Other common plants are *Juncus roemarianus* (needlegrass rush), *Paspalum vaginatum* (seashore paspalum), *Phragmites australis* (common reed), *Schoenoplectus robustus* (sturdy bulrush), *Schoenoplectus americanus* (chairmakers bulrush), *Spartina alterniflora* (saltmarsh cordgrass), and *Distichlis spicata* (inland saltgrass). Aquatic vegetation may consist of *Ruppia maritima* (widgeongrass) and *Eleocharis parvula* (dwarf spikerush). Clovelly muck is very poorly drained, very fluid and organic soil. Natural vegetation on a Clovelly muck may consist of mainly *S. patens*. Other common plants that may occur are *J. roemarianus*, *S. robustus*, *S. americanus* and *P. vaginatum*. Aquatic vegetation may be *R. maritima* and *E. parvula*.

The Pecan Island Terrace (ME-14) project is expected to create approximately 100 acres (40.5 ha) of marsh initially and is anticipating 300 acres (121.4 ha) be created/restored over the 20 year life of the project. It is anticipated that this project will also enhance the project area by increasing the amount of submersed aquatic vegetation (SAV) from 1 to 50% in Area 1 and 5 to 15% in Area 2 (LDNR 1997). The proposed project features consist of constructing 172,000 linear feet of terraces in 500 ft sections with a 50 ft break between each terrace, creating approximately 344 terraces (figure 2). Terraces will run east to west in a staggered gap formation (figure 3). The terraces will be constructed by depositing borrow material with a 40 ft-wide berm to make a terrace with 4:1 side slopes and a top width of 10 ft. Initial constructed elevation is expected to be 3.75 ft NAVD 88 which in 5 years should have a final settled elevation approximately 1 ft above marsh elevation. The dredged material will be deposited such that the terrace's side slopes will be 4:1 or conform to the natural angle of repose for the bottom soil. Breaks will be constructed to permit water to move in and out of the interior, which will facilitate the settling of suspended soil particles (figure 3). *Spartina alterniflora* (smooth cordgrass) plugs will be planted every five linear feet on both sides of terrace.

Objective

1. This project will convert areas of open water in Area 1 back to vegetated marsh through the construction of earthen terraces and vegetative plantings.

Goals

1. Increase land to water ratios by constructing approximately 100 acres (41.3 ha) of earthen terraces in Area 1.
2. Increase land to water ratios by creating over 300 acres (121.4 ha) of land within Areas 1 and 2 over 20 years after construction.
3. Increase percent cover of SAV in remaining open water areas to 50% in Area 1 and to 15% in Area 2.
4. Establish emergent vegetated marsh on planted terraces.

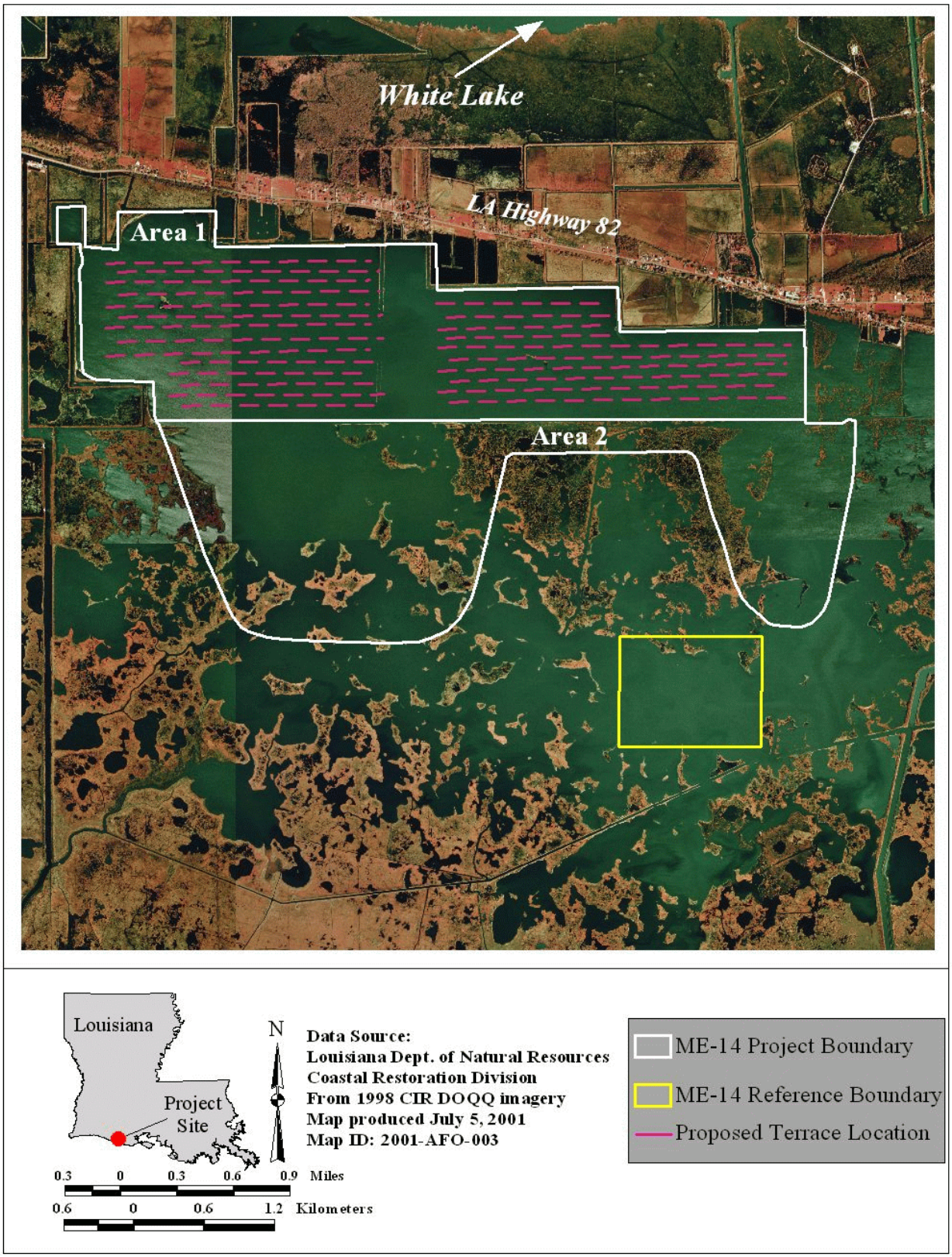

Figure 2. Pecan Island Terracing (ME-14) project and reference area showing approximate location of terraces.

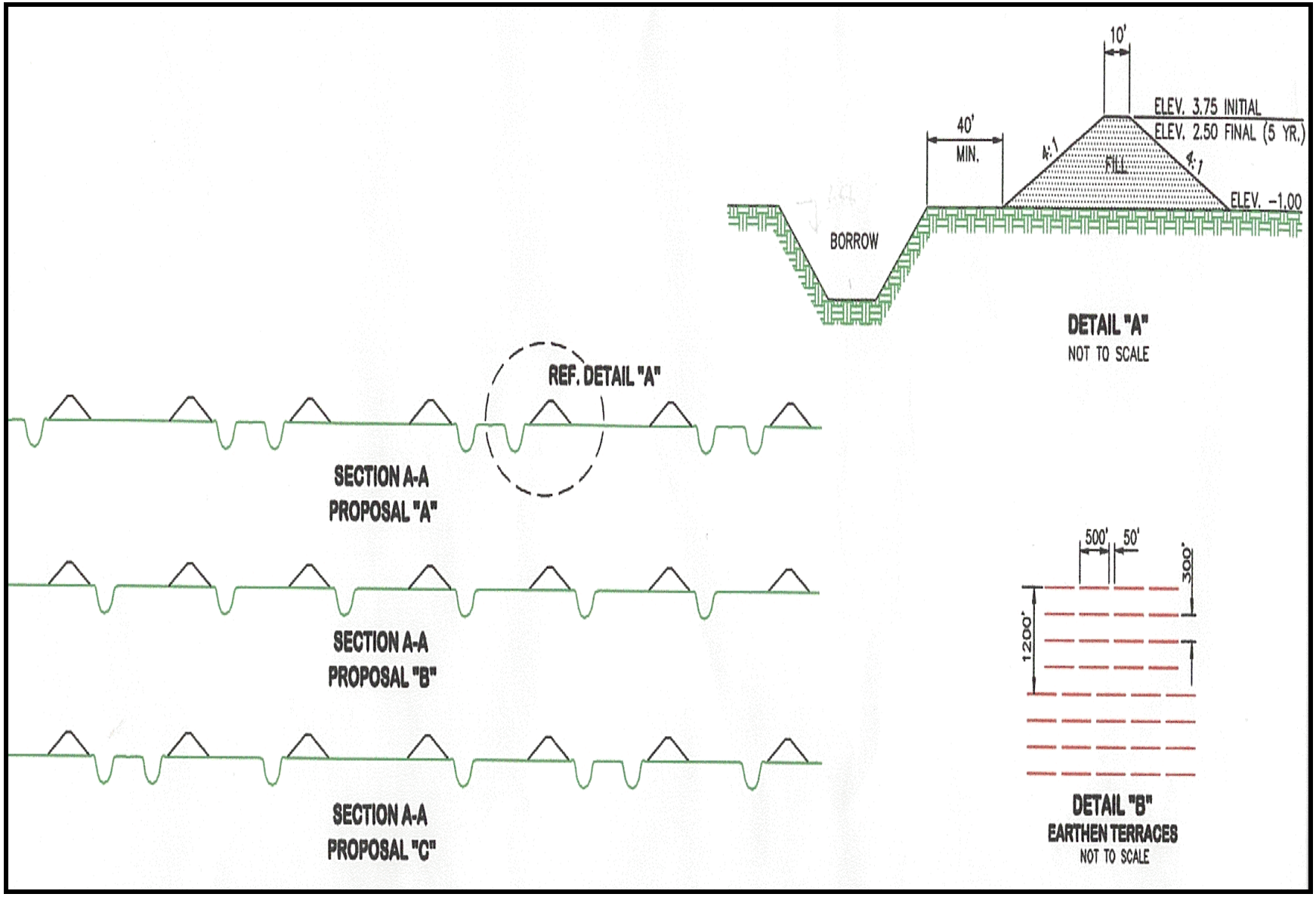

Figure 3. Cross section of proposed terraces for Pecan Island Terracing (ME-14) project (figure adapted from preliminary design proposal by Aucoin & Associates, Inc., Eunice, LA.)

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Reference Area

Monitoring on both project and reference areas will provide 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, and proximity to the project area. A proposed monitoring site located south of the project area was chosen based upon the aforementioned criteria. This area will be used as a reference for the aerial photography and SAV (figure 4).

Fifteen randomly selected terraces will remain unplanted to serve as a reference and to assess vascular plant colonization independent of the plantings. Although natural regeneration is not part of this project design, it may provide a learning environment on establishing emergent vegetation on terraces and whether or not vegetation plantings are actually necessary. Natural regeneration, if successful, makes use of plants originally adapted to grow in this area and encourages, through natural selection, plants which can best cope with the new environment produced by the creation of the new marsh in the form of terraces.

CRMS will provide a pool of reference sites within the same basin and across the coast to evaluate project effects. At a minimum, every project will benefit from basin-level satellite imagery and land:water analysis every 3 years, and supplemental vegetation data collected through the periodic Chabreck and Linscombe surveys. Other CRMS parameters which may serve as reference include Surface Elevation Table (SET) data, accretion (measured with feldspar), hourly water level and salinity, and vegetation sampling. A number of CRMS stations are available for each habitat type within each hydrologic basin to supplement project-specific reference area limitations.

Monitoring Elements

1. Aerial Photography — To document land to open-water ratios and marsh loss/gain rates in Area 1 and Area 2, color infrared aerial photographs (1:12,000) will be obtained in 2001 (pre-construction), 2004, and 2017. Habitat mapping is not required. However, imagery will be delineated to classify all land in the project and reference areas as either (1) preexisting wetlands, (2) vegetated and non-vegetated terraces, and (3) non-terrace, newly developed wetlands (i.e., those that develop in open water areas between the terraces or adjacent to the preexisting perimeter levees).

2. Emergent Vegetation — The condition of the emergent and planted vegetation on the terraces over the life of the project, will be monitored at sampling stations established systematically on 15 of the total planted terraces and the 15 unplanted terraces using a modified Braun Blanquet sampling method as outlined in Steyer et al. (1995). Transects will be established uniformly across selected terraces and unplanted reference terraces. Three sampling stations will be established uniformly along each transect to obtain an even distribution of sampling stations along

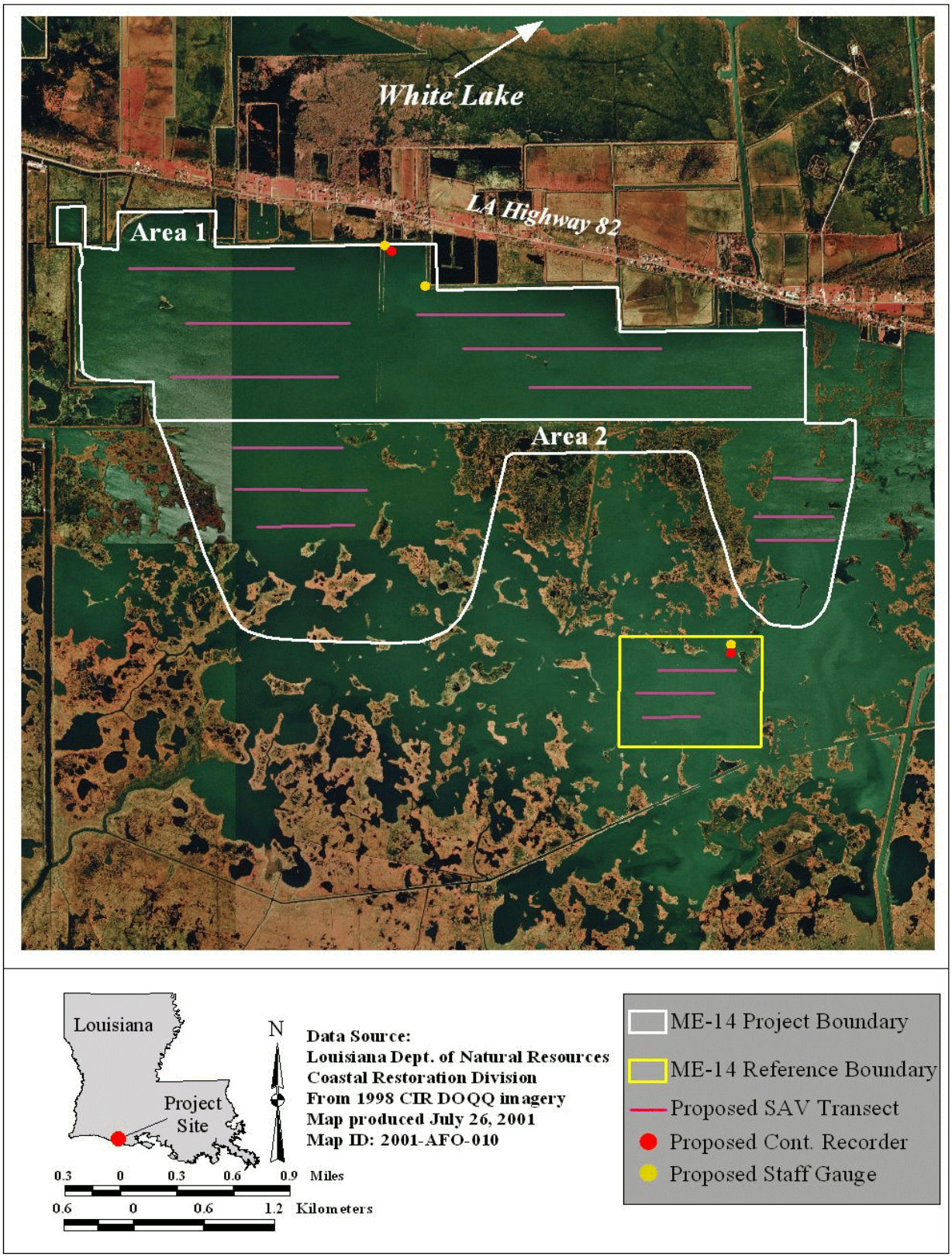

Figure 4. Pecan Island Terracing (ME-14) project and reference area proposed locations of SAV transects, continuous recorders and staff gauges.

the terraces. Three transects will be established across each selected terrace; one beginning at the east end of the terrace, the second being in the center of the terrace and a third at the west end of the terrace. At each station, percent cover, dominant plant heights, and species composition will be documented in a 4 m^2 sample area. Each plot will be marked with 2 corner poles to allow for revisiting the sites over time. Vegetation will be evaluated at the sampling sites in the fall of 2003 (as built) and in the spring of 2005, 2010,and 2018. Two continuous recorders will be established; one in the project area and one in the reference area. Staff gauges will be associated with a bench mark surveyed to the North American Vertical Datum of 1988 (NAVD 88) to tie water levels to a known datum. Water level and salinity data will be collected for only a period of one year prior to the years emergent vegetation is monitored. Water level data will be used to document environmental conditions that may have an effect on emergent and planted vegetation. Following a site visit to establish permanent sampling stations, a sampling station map will be prepared and added to this monitoring plan.

3. SAV

To document changes in the frequency of occurrence of submersed aquatic vegetation (SAV), a modification of the rake method will be employed (Chabreck and Hoffpauir 1962). The project and reference area will be monitored along 15 transect: 6 transects on the east side of the project, 6 transects on the west side of the project and 3 in the reference area. Each transect will have a minimum of 20 sampling stations. At each station, aquatic vegetation will be sampled by dragging a garden rake on the pond bottom for about one second. The presence of vegetation will be recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/number of stations 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). SAV abundance will be sampled in the spring of 2001 (pre-construction), and in 2005, 2010, and 2018. Two continuous data recorders will be deployed to record salinity and water level at one location in the project area and at one location in the reference area (figure 4). Continuous data recorders will document hourly salinity and water level for one year prior to the years SAV is collected with the exception of 2001 (pre-construction). Salinity data will be used to document environmental conditions that may have an effect on SAV occurrence.

Anticipated Statistical Tests and Hypotheses

The following hypotheses correspond with the monitoring elements and will be used to evaluate the specific goals established to assess project effectiveness:

1) Aerial Photography: Descriptive and summary statistics on historical data (1956, 1978, 1988) and data from aerial photography and GIS interpretation collected during pre- and post-project implementation will be used to evaluate marsh to open water ratios and marsh loss rates.

   Goal: 1. Increase land to water ratios by constructing approximately 100 acres (41.3 ha) of earthen terraces in Area 1.
   2. Increase land to water ratios by creating over 300 acres (121.4 ha) of land within Areas 1 and 2 over 20 years after construction.

2) Emergent Vegetation: To determine whether marsh vegetation has been established, descriptive and summary statistics will be utilized to characterize vegetation colonization on the planted terraces. In addition, we will use ANOVA to compare % occurrence and % cover of vegetative species between planted and unplanted terrace areas for the 4 sampling periods to evaluate the effectiveness of the vegetation plantings.

   Goal: Establish emergent vegetated marsh on planted terraces.
   Determine effectiveness of planting vegetation relative to natural regeneration to establish vegetation on terraces.

   Hypothesis:

   H_o: Mean % occurrence and mean % cover of marsh vegetative species on planted terraces after construction will not be significantly greater than mean % occurrence and mean % cover on unplanted terraces.

   H_a: Mean % occurrence and mean % cover of marsh vegetative species on planted terraces after construction will be significantly greater than mean % occurrence and mean % cover of marsh vegetative species on unplanted terraces after construction.

3) SAV: To determine project impacts on SAV we will use ANOVA to compare % occurrence between project and reference areas over the 4 sampling periods. The project will be assumed to have impacted SAV if it changes differently between the project and reference areas as indicated by a significant interaction. We also use a 90% confidence interval for our estimate of % SAV occurrence to determine if the project has met the 50% target.

Goal: Increase percent cover of SAV in remaining open water areas to 50% in Area 1 and to 15% in Area 2.

Hypothesis 1: Area 1 and Area 2

H_o: Mean % occurrence of SAV will be the same in the project and reference areas after construction.

H_a: Mean % occurrence of SAV will be higher in the project vs reference area after construction.

Hypothesis 2: Area 1

H_o: Mean % occurrence of SAV in the project area will be less than 50% after construction.

H_a: Mean % occurrence of SAV in the project area will be 50% or greater after construction.

Hypothesis 3: Area 2

H_o: Mean % occurrence of SAV in project area will be less than 15% after construction.

H_a: Mean % occurrence of SAV in project area will be 15% or greater after construction.

Notes

1)	Implementation Schedule:	Start Construction	December 18, 2002
		End Construction	September 2003
2)	NMFS Point of Contact:	Joy Merino	(337) 482-5915
3)	DNR Project Manager:	Melvin J. Guidry	(337) 893-3643
	DNR Monitoring Manager:	Christine Thibodeaux	(337) 893-3643

4) The twenty-year monitoring plan development and implementation budget for this project is $151,536. Periodic comprehensive reports on coastal restoration efforts in the Mermentau hydrologic basin will describe the status and effectiveness of the project as well as cumulative effects of restoration projects in the basin.

5) Historical discrete (1992-95) and recorder data (1993-96) is available from Pecan Island Freshwater Introduction (ME-01a) and may be used in the comprehensive reports.

6)

7) References

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 Commissioners 16:103-112.

Louisiana Department of Natural Resources 1998. Summary of Priority Projects List 1-7. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

Louisiana Department of Natural Resources 1997. Candidate Project Fact Sheet. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

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.

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

U. S. Department of Agriculture, Natural Resources Conservation Service 1996. Soil survey of Vermilion Parish, Louisiana. Publication No. 1996!405!693/20014/NRCS. Washington, D.C.: U.S. Government Printing Office. 183 pp, 98 maps. Scale 1:20,000.

U.S. Department of the Interior, U.S. Geological Survey. 2001. Habitat Analyses Map ID 2001-4-481. Lafayette, Louisiana: National Wetlands Research Center.