State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Humble Canal Hydrologic Restoration

State Project Number ME-11
Priority Project List 8

August 2003
Cameron Parish

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MONITORING PLAN

PROJECT NO. ME-11 (PME-15)
HUMBLE CANAL HYDROLOGIC RESTORATION

ORIGINAL DATE: October 26, 2000
REVISED DATE: August 14, 2003, January 2, 2014

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. The recommendations for modifying this Monitoring Plan are the result of a joint meeting with DNR, USGS, and the federal sponsor. Based on this review, it was recommended that the recorder in the Mermentau River be maintained, but the recorder in the project interior be replaced by a recorder at CRMS624, and an additional project-specific "CRMS" station be added near station ME11-25R. After 2003, vegetation sampling will be conducted through CRMS, and SAV sampling will be discontinued. These changes have been incorporated into this revised Monitoring Plan in the Monitoring Elements section.

Project Description

The Humble Canal Hydrologic Restoration Project (ME-11) encompasses 4,030 acres (1228.34 ha) in Cameron Parish, Louisiana . The project is bounded by the Little Chenier Ridge to the south, the Mermentau River to the east, oilfield canals on the west, and an east-west trenaisse and an oilfield canal along the north (figure 1). The marsh is classified as a fresh marsh with 74 percent of the project area being marsh and 26 percent open water, based on the Louisiana Department of Natural Resource's GIS data for 1988–90. Dominant emergent vegetation in the project area includes *Spartina patens* (marshhay cordgrass), *Paspalum vaginatum* (seashore paspalum), and *Panicum hemitomon* (paille fine). Submerged aquatic vegetation (SAV) in the project area include *Potamogeton pectinatus* (sago pondweed), *Ceratophyllum demersum* (coontail), *Myriophyllum spicatum* (Eurasian watermilfoil), *Najas guadalupensis* (southern naiad), and *Vallisneria americana* (water celery), (United States Department of Agriculture, Natural Resources Conservation Service [USDA/NRCS] 2000).

The soils found in the project area have been recently mapped as Allemands muck, Clovelly muck, Larose muck, Bancker muck, Aquents frequently flooded, Peveto fine sand Hackberry loamy fine sand and Hackberry-Mermentau complex (USDA/SCS 1995). Most of the soils within the project area are classified as muck and are associated with brackish or freshwater marsh. The Aquents

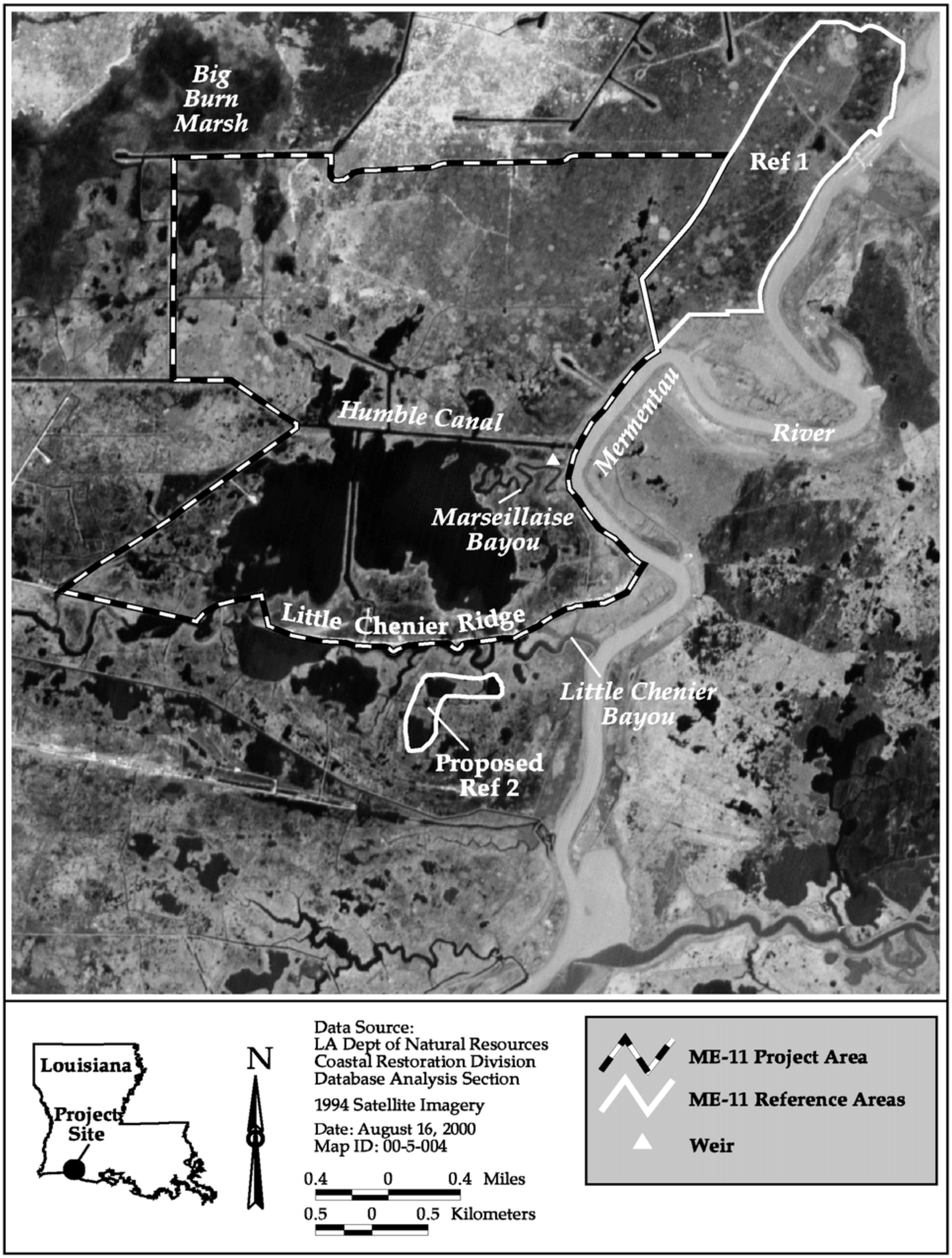

Figure 1. Humble Canal Hydrologic Restoration Project (ME-11 [PME-15]) map showing project and reference boundaries and project feature locations.

frequently flooded are hydraulically excavated soils that occur along the Mermentau River. The Peveto, Hackberry, and Hackberry-Mermentau are on the Little Ridge that comprises the southern boundary of the project.

Although no conclusive data exist, wetland loss and marsh deterioration in the Mermentau Basin estuary are suspected from numerous factors, primarily excessive water levels within the Lake Sub-Basin. Other suspected factors include relative sea level rise, hurricanes, shoreline erosion, herbivory, hydrologic alterations and direct loss (USDA/NRCS 1997). Land loss data compiled by Dunbar et al. (1990) indicate that from 1932 to 1990, about 826 acres (334.26 ha) of land were converted to open water in the Humble Canal project area. Britsch (1998) showed that between 1932 and 1956, the average land loss rate within the project area was relatively low at approximately 0.2 percent or 8 acres (3.24 ha) per year. Most of the land loss in the project area occurred during 1956 and 1972 when the loss rate increased to approximately 1.98 percent or 80 acres (32.37 ha) per year. The loss rate declined between 1974 and 1983 to 0.15 percent or 6 acres (2.43 ha) per year, and again between 1983 and 1990 to 0.11 percent or 4.4 acres (1.78 ha) per year (USDA/NRCS 2000).

Historically, floods occurring in spring inundated wetlands with fresh water. As water levels receded, salt water could slowly move into the basin through meandering bayous, especially during periods of low rainfall in late summer and early fall. The basin once functioned as a nursery for a variety of marine species that favor a low salinity environment. Projects initiated by various interests have disrupted the basin’s natural processes. Extended periods of high water in the upper basin and saltwater intrusion in the lower basin have imposed physiological stresses on vegetated wetlands resulting in their conversion to open water (USDA/NRCS 1997). However, the vegetation in the project area was classified as freshwater marsh in 1968 (Chabreck et al. 1968), and vegetation maps produced in the last three decades still classify the project area as a freshwater marsh (Chabreck and Linscombe 1978,1988,1998).

The Humble Canal and its laterals were constructed for mineral exploration during the early 1950's and increased water exchange between the Mermentau River and the eastern end of Big Burn Marsh. Dredging of the Mermentau River in 1952 and construction of the Mermentau River to the Gulf of Mexico Navigation Channel in 1978 provided greater commercial use of the Mermentau River Basin. But as with other deepwater shipping channels along Louisiana’s fragile coast, one environmental consequence has been increased northward migration and intrusion of saltwater, and the deterioration of fresh water wetlands. In the south eastern portion of the project is a 24 inch open pipe allowing water flow into the project area. This also may be affecting salinity within the project.

<u>Project Features</u>

1. Install three 48 in culverts with variable crest weir inlets and flapgated outlets in an oilfield access canal north of Marseillaise Bayou.

2. Enlarge conveyance channel between structure location and Humble Canal.

Project Objectives

1. Improve removal of excess water without permitting saline water into the freshwater marsh of the project area.

Specific Goals

1. Increase present (yr 2000) land to water ratio.

2. Maintain mean water levels in the project area between 6 in below and 2 in above marsh level.

3. Maintain mean monthly salinity (0–3 ppt) in the project area after construction and prevent salinities from exceeding 7 ppt.

4. Increase or maintain the occurrence and cover of fresh marsh vegetation species in the project area.

5. Increase frequency of occurrence of submerged aquatic vegetation (SAV) in 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.

The proposed reference area (# 1), immediately east of the project area, will be used in the evaluation of emergent vegetation. The project and proposed reference are classified as a fresh marsh (Chabreck and Linscombe 1998). Soils in the northern portion of the project, where emergent vegetation will be evaluated are an Allemand and Larose muck. Soils in the reference are also an Allemand and Larose muck (USDA/SCS 1995). Aerial photographs for determining land to water ratios will be taken for both project and reference areas. A proposed reference area (#2) located south of Little Chenier Bayou will be used for evaluation of submerged aquatic vegetation. This area, like the locations chosen in the project area is classified as a fresh marsh (Chabreck and Linscombe 1998).

A reference location for the water level monitoring was chosen in the Mermentau River. Monitoring of water levels in the project area and reference location will allow us to compare the project area with natural conditions in the Mermentau River. Comparison of data from the project and reference location should be adequate for evaluating the influence of water level on project area vegetation.

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 Limitations

A suitable paired- reference area is not available for water level and salinity continuous recorder data collection. Due to budget constraints, only two continuous recorders will be used for the water level data collection. This will create an environment where psuedo-replication will occur when data are analyzed.

Monitoring Elements

1. Aerial Photography — To document land to open-water ratios and land change rates, color-infrared aerial photography (1:12,000 scale) will be obtained in 2000 as an as-built, and post-construction during 2005, and 2017. The photography will be processed by National Wetlands Research Center (NWRC) personnel using standard operating procedures documented in Steyer et al. (1995) for determining land-to-water ratios and corresponding acreage through GIS analysis.

2. Water level — Water level will be monitored at least monthly at 2 staff gauges located on the variable-crest weir. In addition, one continuous data recorder and staff gauge will be deployed in the project area and one continuous data recorder and staff gauge will be deployed in the Mermentau River (figure 2). Continuous data recorders will document hourly water level until year 2020.

   Based on the CRMS review, the station in the Mermentau River will be maintained, however, the station in project interior will be replaced by CRMS624 in the northern project area, and an additional station with the CRMS parameters will be added to the southern project area near station ME11-35.

3. Salinity — Salinities will be monitored at least monthly at permanent discrete sampling stations within the project area. In addition, continuous data recorders will be deployed to record salinity at 1 location in the project area and at 1 location in the Mermentau River (figure 2). Following a site visit to establish permanent sampling stations, a sampling station map will be prepared and added to this monitoring plan. Additional discrete and continuous data recorder stations may be established within the project and reference areas as data becomes available and a power analysis can be performed. Salinity data will be used to characterize the spatial variation in salinity throughout the project area, and to determine if project area salinity is being maintained within the target range. Salinity will be monitored in 2000 (pre-construction) and in 2000–2020 (post-construction).

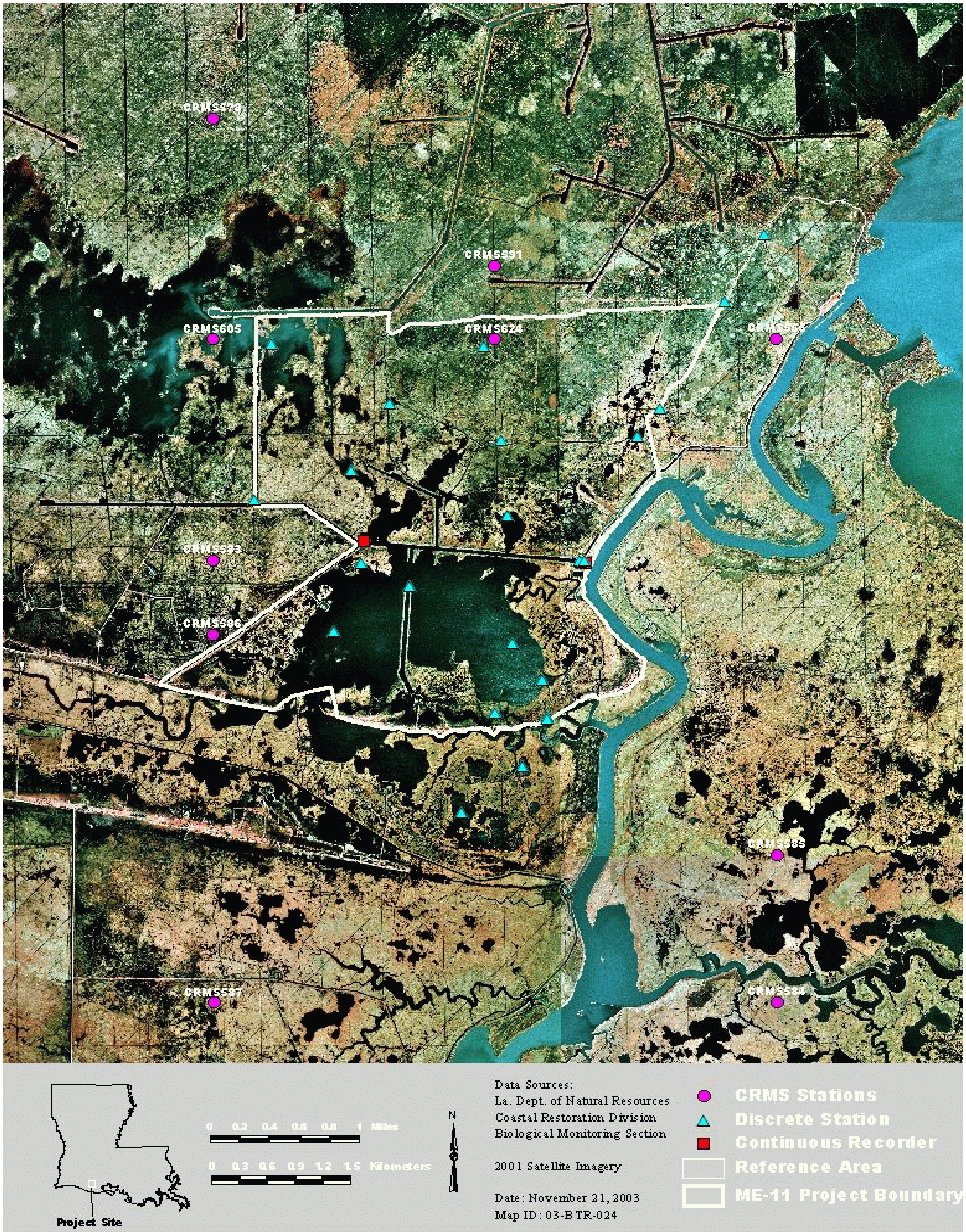

Figure 2. Monitoring station locations for the continuous recorder and discreet data collection for the ME-11 Humble Canal Hydrologic Restoration project and reference areas.

Based on the CRMS review, the station in the Mermentau River will be maintained, however, the recorder station in project interior will be replaced by CRMS624 in the northern project area, and an additional station with the CRMS parameters will be added to the southern project area near station ME11-35. Discrete sampling will be discontinued after 2003.

4. Emergent Vegetation

To document the condition of the emergent vegetation in the project area over the life of the project, vegetation will be monitored at sampling stations (figure 3) established systematically in the project and reference area using a modified Braun Blanquet sampling method as outlined in Steyer et al. (1995). Four north-south transects will be established uniformly across the project area. Sampling stations will be established uniformly along each transect line to obtain an even distribution of sampling stations throughout the project area. Two north-south transects will be delineated across reference area # 1 to establish the sampling stations. Percent cover, dominant plant heights, and species composition will be documented in 2.0 m^2 sampling plots marked with 2 corner poles to allow for revisiting the sites over time. Descriptive observations of submergent vegetation will be noted during monitoring of emergent vegetation. Vegetation will be evaluated at the sampling sites in the fall of 2000 (as built) and in the fall of 2003.

Based on the CRMS review, the vegetation sampling originally scheduled for 2006, 2009, 2012, and 2015 was discontinued and replaced by vegetation sampling at the CRMS stations. In addition, vegetation sampling will be supplemented by periodic Chabreck and Linscombe data which will be collected at approximately 6 locations within the project area.

4. SAV

The effect of the project on SAV abundance will be determined by comparing SAV abundance before and after project construction in the project and reference areas. Three permanent locations will be sampled in the project area, and three in a reference area (figure 4). Frequency will be determined on two transects in each pond; there will be at least 20 stations per transect. Frequency will be determined by methods described in Chabreck and Hoffpauir (1962) and Nyman and Chabreck (1995) except that the stations will be as short as possible because the ideal area of a station is a point (Mueller-Dombois and Ellenberg 1974:69-80). When water clarity permits, cover and species abundance will also be estimated visually on each transect. SAV will be monitored in the fall of 2000 (as built) and in the fall of 2003.

Based on the CRMS review, the SAV sampling originally scheduled for 2006, 2009, 2012, and 2015 was eliminated.

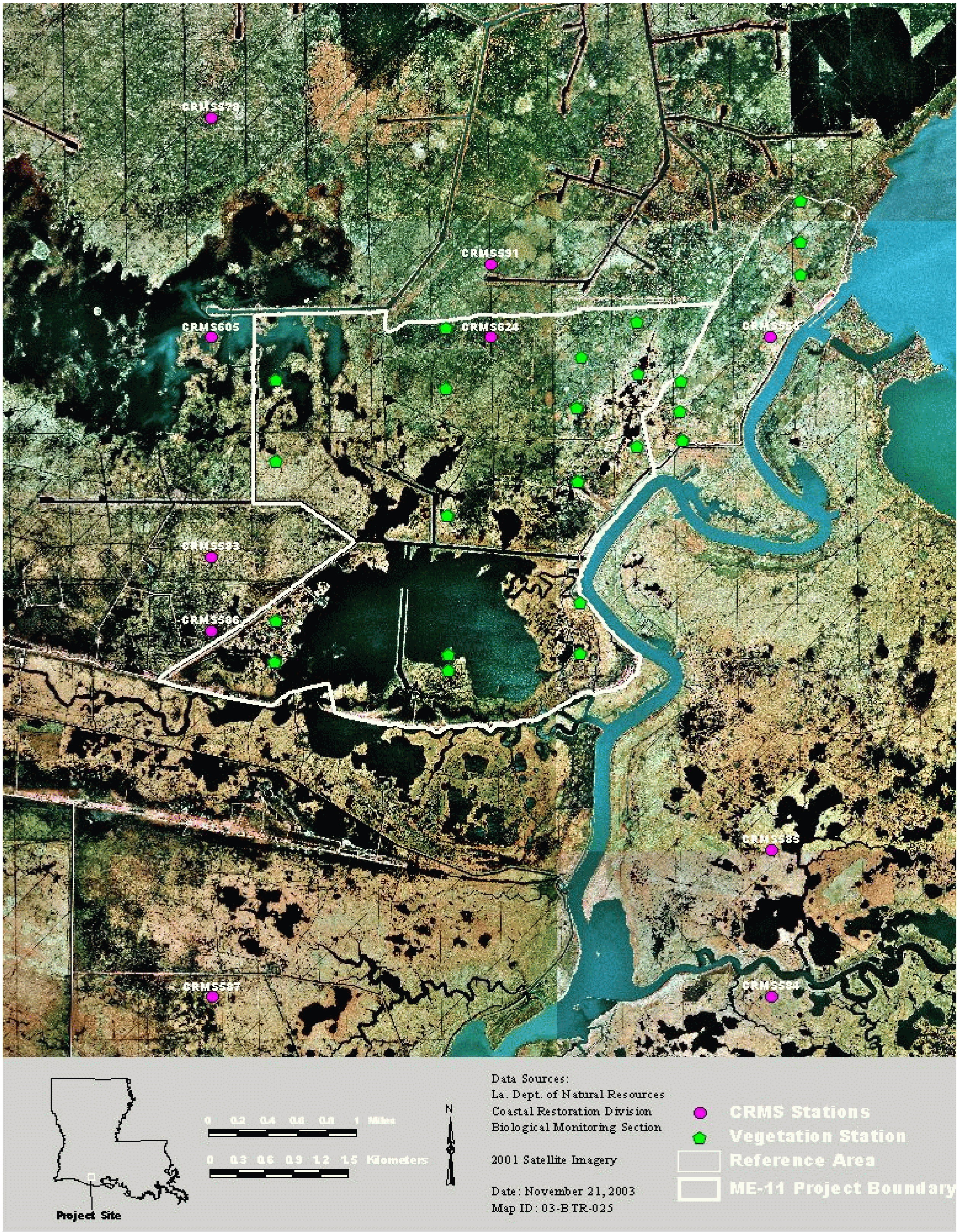

Figure 3. Vegetation monitoring stations and transect lines for the Humble Canal Hydrologic Restoration project and reference area.

Figure 4. Locations for the SAV monitoring stations and transect lines for the Humble Canal Hydrologic Restoration project and reference area.

Anticipated Statistical Analyses and Hypotheses

The following describes statistical tests that will be used to analyze data collected for each monitoring element included in this monitoring plan to evaluate accomplishment of the project goals. The numbers to the left correspond to the monitoring elements described above. These are followed by statements of the project goals, and the hypotheses that will be used in the evaluation.

1. Aerial Photography: 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: Increase present (yr 2000) land to water ratio.

2. Maintaining Target Water Level: Because there is no way to determine the marsh elevation from the reference recorder in the Mermentau River, we can only estimate the number of days water levels fall within the target range. We will use Chi-square tests (Conover 1980) to determine differences between the proportion of days within that target range pre- and post-construction if adequate preconstruction data are collected.

   Goal: Maintain mean water levels in the project area between 6 in below and 2 in above marsh level.

   Hypothesis:

   H_o: Proportion of sampling time where water level is within target range will not be significantly higher after construction than before.

   H_a: Proportion of sampling time where water level is within target range will be significantly higher after construction than before.

3. Salinity: To determine if salinities are maintained in the project area, we will use ANOVA to compare mean salinity in the project and reference areas both pre- and post-construction if adequate preconstruction data are collected from discrete stations. To determine if salinity is maintained with the target range we will estimate the proportion of data points that fall within that range and use Chi-square tests to compare those proportions in project and reference areas.

   Goal: Maintain mean monthly salinity (0–3 ppt) in the project area after construction and prevent salinities from exceeding 7 ppt.

   Hypothesis 1:

   H_0: Mean monthly salinity within the project area after construction will not be significantly lower than mean salinities in the reference area after construction.

H_a: Mean monthly salinity within the project area after construction will be significantly lower than mean salinity in the reference area after construction.

Hypothesis 2:

H_0: Proportion of salinity data points within 0-3 ppt in the project area will not be significantly higher than at the reference recorder after construction.

H_a: Proportion of salinity data points within 0-3 ppt in the project area will be significantly higher than at the reference recorder after construction.

4. Emergent Vegetation: To determine if frequency of occurrence and cover of fresh marsh vegetation has been maintained or increased, we will use ANOVA to compare those variables between project and reference areas for the 7 sampling periods.

Goal: Increase or maintain the occurrence and cover of fresh marsh vegetation species in the project area.

Hypothesis:

H_0: Percent occurrence and mean coverage of fresh marsh vegetative species within the project area after construction will not be significantly greater than the occurrence of fresh marsh vegetative species in the reference area after construction.

H_a: Percent occurrence and mean coverage of fresh marsh vegetative species within the project area after construction will be significantly greater than the occurrence of fresh marsh vegetative species in the reference area after construction.

5. SAV: The primary analyses for detecting project impacts on SAV will be an analyses of variance with area (project vs. reference) and time (pre-construction vs. post-construction) as fixed effects and ponds and transects within ponds as random effects. The project will be assumed to have impacted SAV if SAV changes over differently between the project and reference areas. If such differences occur, then there will be a statistically significant interaction between time and area.

Goal: Increase the frequency of SAV.

Hypothesis:

H_o: Mean SAV occurrence will change similarly in the project and reference areas after construction.

H_a: Mean SAV occurrence will change differently in the project and reference areas after 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, LDNR, LSU, etc.).

Notes

1)	Implementation Schedule:	Start Construction	November 2000
		End Construction	December 2000
2)	NRCS Point of Contact:	Marty Floyd	(318) 473-7690
3)	DNR Project Manager:	Pat Landry	(337) 482-0680
	DNR Monitoring Manager:	Christine Thibodeaux	(337) 482-0655

4) The primary land to water gains were anticipated to be obtained from the DNR/NWRC/SWCC vegetation plantings

5) The twenty-year monitoring plan development and implementation budget for this project is $674,821. Pursuant to the CRMS review, it was authorized by the Task Force to maintain $624,815 with the project, and utilize $50,006 to support CRMS. A progress report will be available in 2001. 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.

6) In the southeastern portion of the project area is a 24-in pipe that could allow water flow from Little Chenier Bayou into the project area. The pipe has a flap/cover to control water flow into the project. This structure has been vandalized on several occasions in which the flap/cover has been non functional at certain times. In early April, 2000, water entering the project area had a measured salinity of 21 ppt. If this pipe is not managed for low salinity input, it will compromise efforts to assess the effect of project features on salinity in the project area.

7) If additional funds are available, an additional continuous recorder will be placed in the southeastern portion of the project area to evaluate the effect of the water control structure on Little Chenier Bayou on salinity and water level.

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