State of Louisiana
Department of Natural Resources
Coastal Restoration Division and
Coastal Engineering Division

2004 Operations, Maintenance, and Monitoring Report

for

Pecan Island Terracing

State Project Number ME-14
Priority Project List 7

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Vermilion Parish

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I. Introduction

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 3,753 acres (1,519 ha) of brackish marsh and open water. Area 1 is primarily open water and was formerly pasture land of approximately 1,938 acres (784 ha). Area 2 consists of 1,715 acres (694 ha) of brackish marsh and open water.

The project area was initially classified as fresh marshland. 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 comprised of 16 % intermediate marsh, 14.3 % brackish marsh, and 69.4 % open water. Deterioration and loss of the perimeter levees between 1978 and 1988 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 1.6 % brackish marsh. Additionally, Area 2 had converted to 68.2 % water and 31.7 % brackish marsh.

Soils in the northern portion of Area 1 are Bancker muck with Clovelly muck in the southern part of that area. Area 2 consists solely of Clovelly muck. Bancker muck is very poorly drained, very fluid, mineral soil while Clovelly muck is very poorly drained, very fluid and organic soil. The dominant natural vegetation on both soils is *Spartina patens* (marshhay cordgrass). Other common plants include *Juncus roemarianus* (needlegrass rush), *Paspalum vaginatum* (seashore paspalum), *Phragmites australis* (common reed), *Scirpus robustus* (saltmarsh bulrush), *Scirpus pungens* (three-corner grass), *Spartina alterniflora* (saltmarsh cordgrass), and *Distichlis spicata* (seashore saltgrass). Aquatic vegetation historically consisted of *Ruppia maritima* (widgeongrass) and *Eleocharis parvula* (dwarf spikesedge).

The project features include construction of 197,000 linear feet (60,046 m) of terraces in 500 ft (152.4 m) sections with a 50 ft (15.24 m) break between each terrace, creating approximately 344 terraces (figure 2). Terraces run east to west in a staggered gap formation (figure 3). The terraces were constructed by depositing borrow material with a 40 ft (12.19 m) berm for a terrace with 4:1 side slopes and a top width of 10 ft (3.04 m). Initial constructed elevation was approximately 3.75 ft (1.14 m) NAVD88 which in 5 years should have a final settled elevation approximately 1 ft above marsh elevation. The dredged material was deposited such that the terrace's side slopes were 4:1 to conform to the natural angle of repose for the bottom soil. Breaks were constructed to permit water to move in and out of the interior, which may facilitate the settling of suspended soil particles (figure 3). *Spartina alterniflora* (smooth cordgrass) plugs were planted every five linear feet on both sides of terrace.

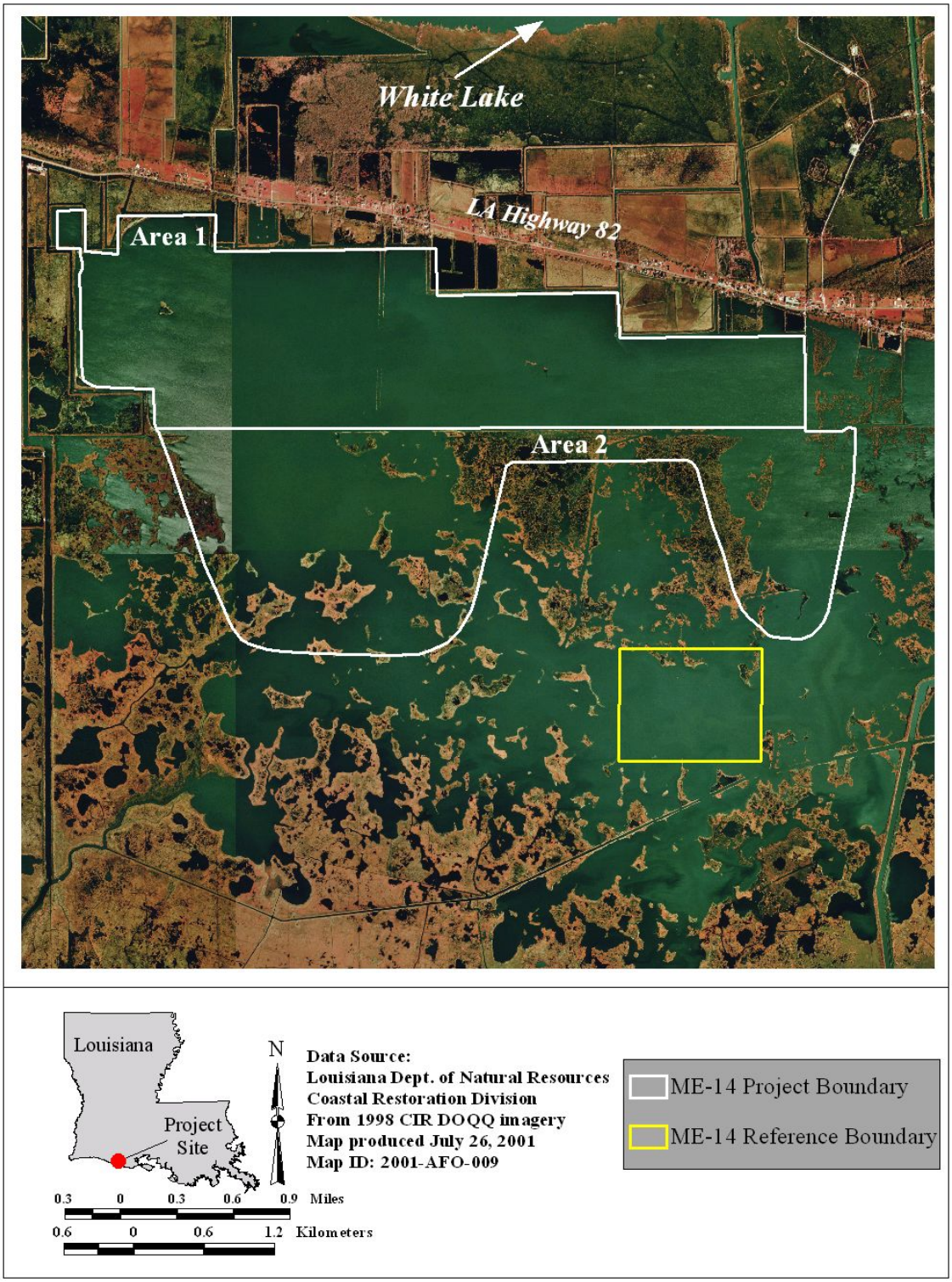


Figure 1. Pecan Island Terracing (ME-14) project and reference area boundaries**.**

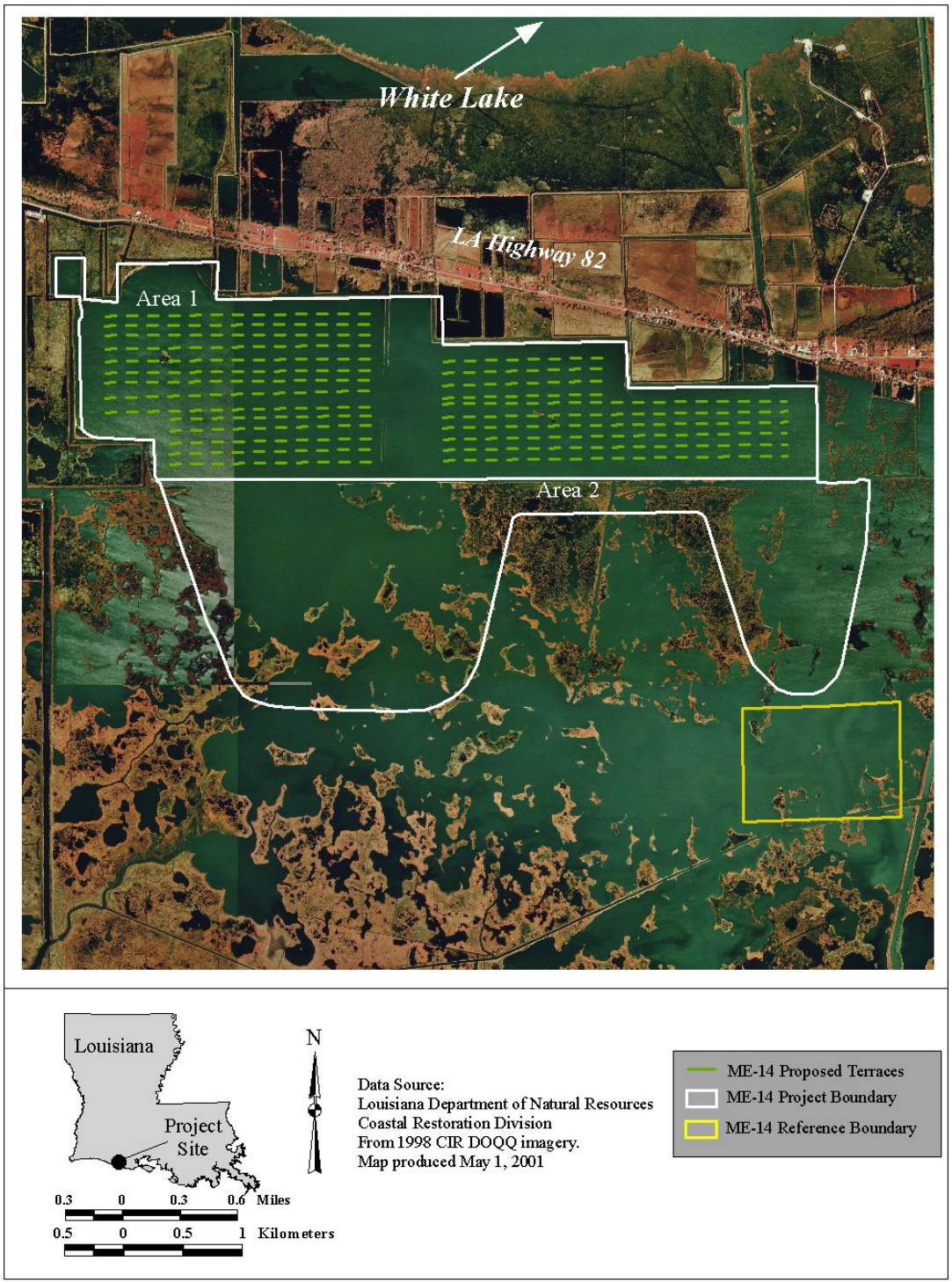


Figure 2. Pecan Island Terracing (ME-14) location of terraces.

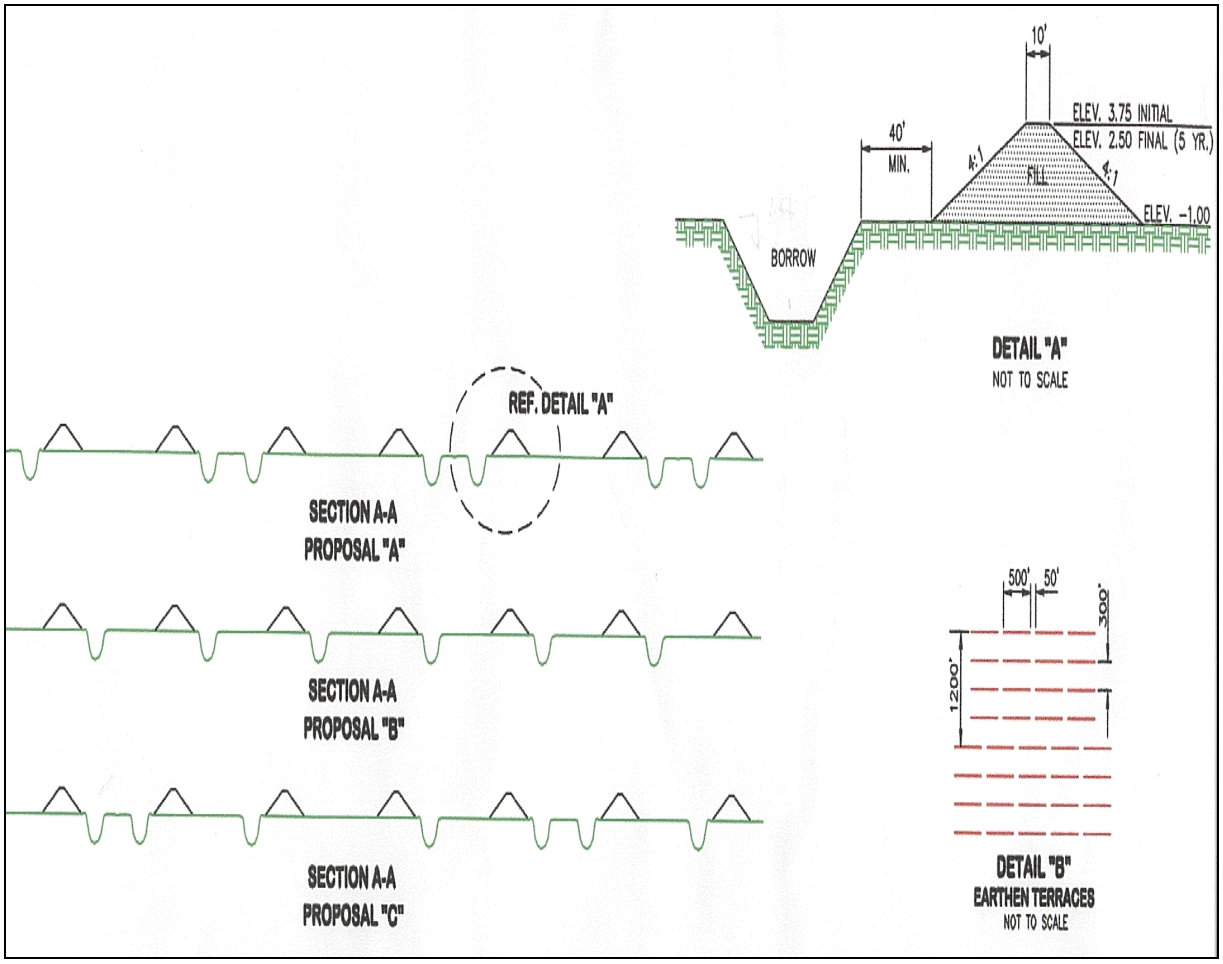


Figure 3. Pecan Island Terracing (ME-14) schematic of terraces.

II. Maintenance Activity

a. Project Feature Inspection Procedures

Since construction was recently completed, no inspection has been performed.

b. Inspection Results

Since construction was recently completed, no inspection has been performed.

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

Since construction was recently completed, no inspection has been performed.

ii. Programmatic/ Routine Repairs

Since construction was recently completed, no inspection has been performed.

III. Operation Activity

a. Operation Plan

There are no active operations associated with this project.

b. Actual Operations

There are no active operations associated with this project.

IV. Monitoring Activity

a. Monitoring Goals

The objective of the Pecan Island Terracing Project is to convert areas of open water in Area 1 to vegetated marsh through the construction of earthen terraces and vegetation plantings.

The following goals will contribute to the evaluation of the above objective:

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 15% in Area 2.

4. Establish emergent vegetated marsh on planted terraces.

b. Monitoring Elements

Aerial Photography:
To document land to open-water ratios and marsh loss/gain rates in Area 1 and Area 2, near-vertical color infrared aerial photographs (1:12,000) were obtained in 2001 prior to construction, and will be obtained in 2004, and 2017. 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). The original photographs were checked for flight accuracy, color correctness, and clarity and were subsequently archived. Aerial photographs were scanned, mosaicked, and georectified by USGS/NWRC personnel according to standard operating procedures.

Emergent Vegetation:
The condition of the emergent and planted vegetation on the terraces was 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. Transects were established uniformly across selected terraces and unplanted reference terraces. Three sampling stations were established uniformly along each transect to obtain an even distribution of sampling stations along the terraces. Three transects were established across the 500 ft terraces, and one transect was established across the 120 ft terraces and also on the 250 ft terrace. On the 500 ft terraces the first transect was established at the east end of the

terrace, the second in the center of the terrace and a third at the west end of the terrace. At each station, percent cover, dominant plant height, and species composition were documented in a 4 m^2 sample area. Each plot was marked with 2 corner poles to allow for revisiting the sites over time. Vegetation was evaluated at the sampling sites in the spring of 2003 (as built) and will be evaluated in the spring of 2005, 2010, and 2017. Two continuous recorders were established; one in the project area and one in the reference area. Staff gauges were associated with a bench mark surveyed to the North American Vertical Datum of 1988 (NAVD88) to tie water levels to a known datum. Water level and salinity data were collected for one year prior to emergent vegetation sampling in 2003 and will be collected one year prior to future years that emergent vegetation is monitored. Water level data was used to document environmental conditions that may have an effect on emergent and planted vegetation.

Submerged Aquatic Vegetation (SAV):

To document changes in the frequency of occurrence of submerged aquatic vegetation, a modification of the rake method was employed. The project and reference area were 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 had a minimum of 20 sampling stations. At each station, aquatic vegetation was sampled by dragging a garden rake on the pond bottom for about one second. The presence of vegetation was recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/number of stations x 100). When vegetation was present, the species present were recorded in order to determine the frequencies of individual species. SAV abundance was sampled in the spring of 2001 (pre-construction), and will be sampled in 2005, 2010, and 2017. Continuous data recorders will document hourly salinity and water level for one year prior to the years that 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.

IV. Monitoring Activity

c. Preliminary Monitoring Results and Discussion

Aerial Photography

Aerial photography analysis indicated that on December 18, 2001 (pre-construction) project Area 1 is comprised of 46 acres (19 ha) of land and 1,892 acres (766 ha) of water with a land to water ratio of 2.4 % land and 97.6 % water. Project Area 2 has 395 acres (160 ha) of land and 1,320 acres (534 ha) of water with a land to water ratio of 23 % land to 77 % water. The reference area consists of 322 acres (130 ha) with 28 acres (11 ha) of land and 294 acres (119 ha) of water. The land to water ratio in the reference area are 8.7 % land to 91.3 % water.

Emergent Vegetation

Hourly salinity and water level data have been collected at the following continuous recorder stations for one year prior to vegetation monitoring:

Station	Data collection period
ME14-01	9/9/2002 – 12/3/2003
ME14-02R	9/9/2002 – 12/3/2003

*Marsh elevation for the two recorders is an estimated value taken from an earlier state project ME-01 Pecan Island Control Structures.

Percent cover in the plots sampled on the terraces planted with *Spartina alterniflora* was 0.53 % and on the unplanted terraces was 0.36 %. Colonization of vegetation was predominantly composed of *S. alterniflora* on the planted terraces only. *S. alterniflora* did not occur on any of the unplanted terraces sampled. Colonization of dominant vegetation independent of the planted vegetation was *Paspalum vaginatum* on both planted and unplanted terraces. Daily mean salinity in the project area at station ME14-01 ranged from 0.69 ppt on December 14, 2002 to 6.7 ppt on November 17, 2003. In the reference area at station ME14-02R daily mean salinity ranged from 1.2 ppt on December 30, 2002 to 7.5 ppt on September 2, 2003.

Submerged Aquatic Vegetation:

Species of submerged aquatic vegetation consisted of one unknown alga. Salinity and water level data were not collected at the time of sampling. Lack of SAV may be attributed to the long fetch associated with the large body of shallow open water, high water levels or extremes in salinity variability. Also, wind driven waves may increase turbidity due to re-suspension of unconsolidated bottom sediments.

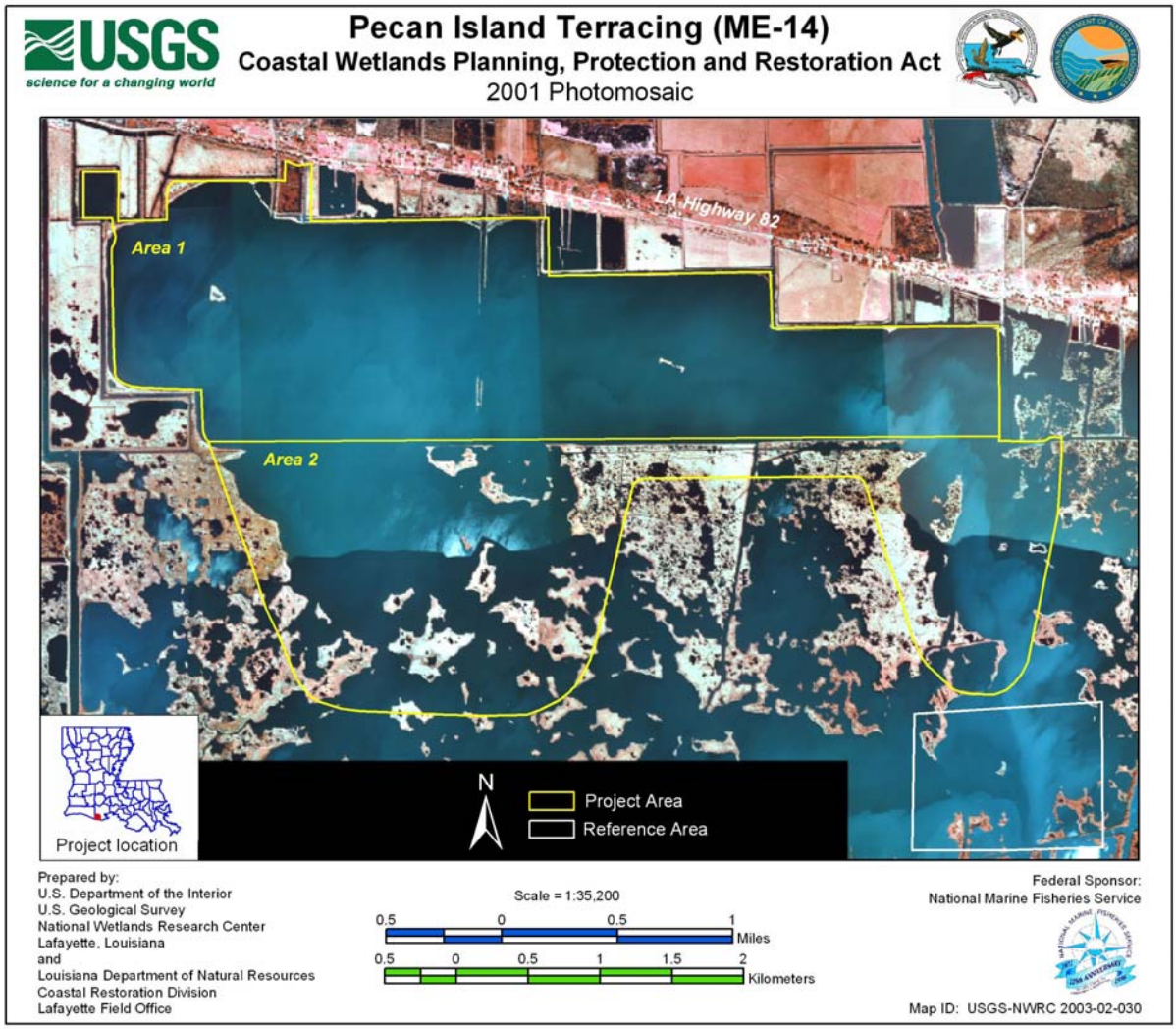


Figure 4. Pecan Island Terracing (ME-14) GIS photomosaic of the project and reference area.

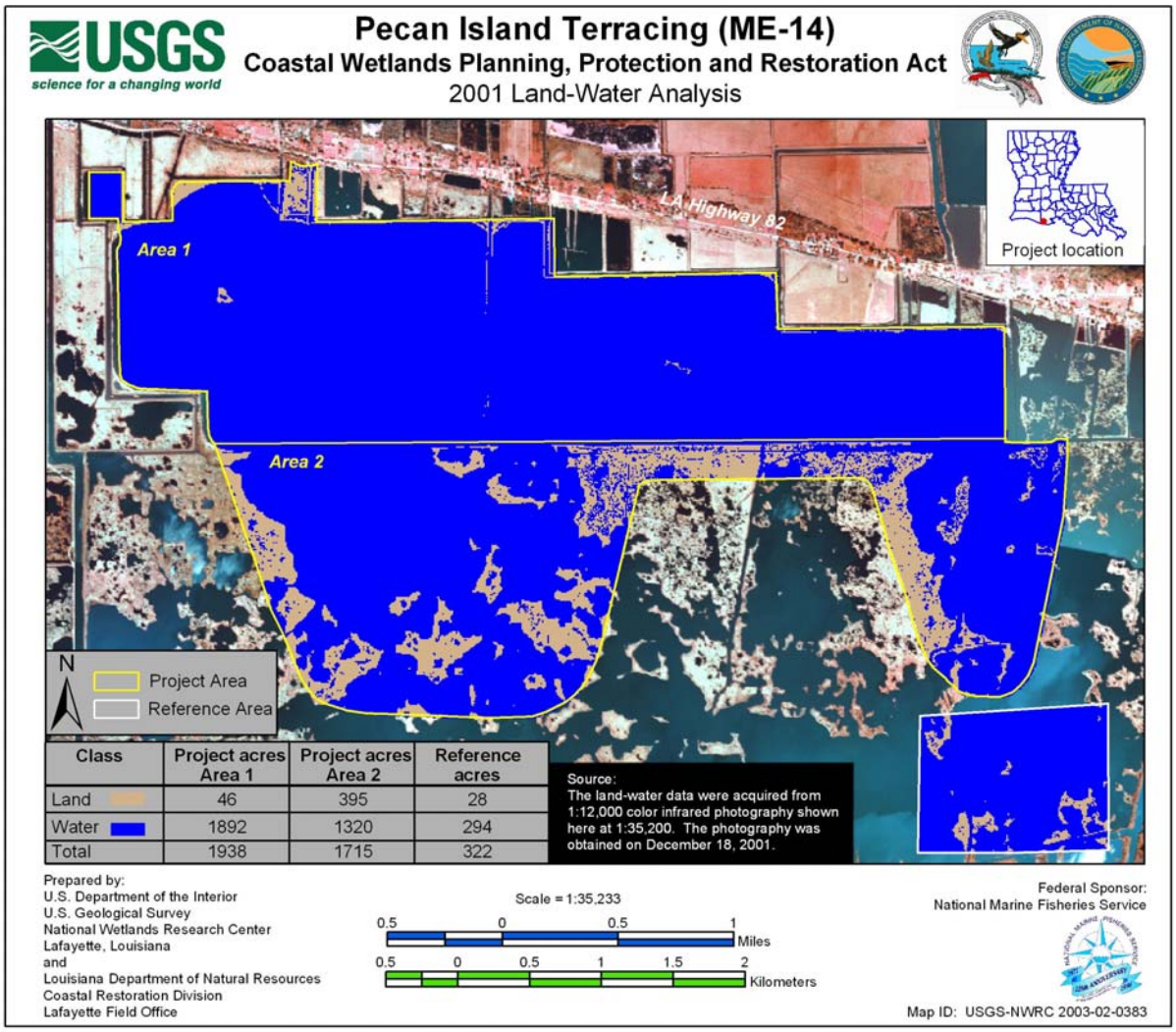


Figure 5. Pecan Island Terracing (ME-14) GIS Land/Water analysis of the project and reference area.

Pecan Island Terracing (ME-14)

Project Station ME14-01 (9/9/02 - 12/3/03)
Salinity and Water Level Data

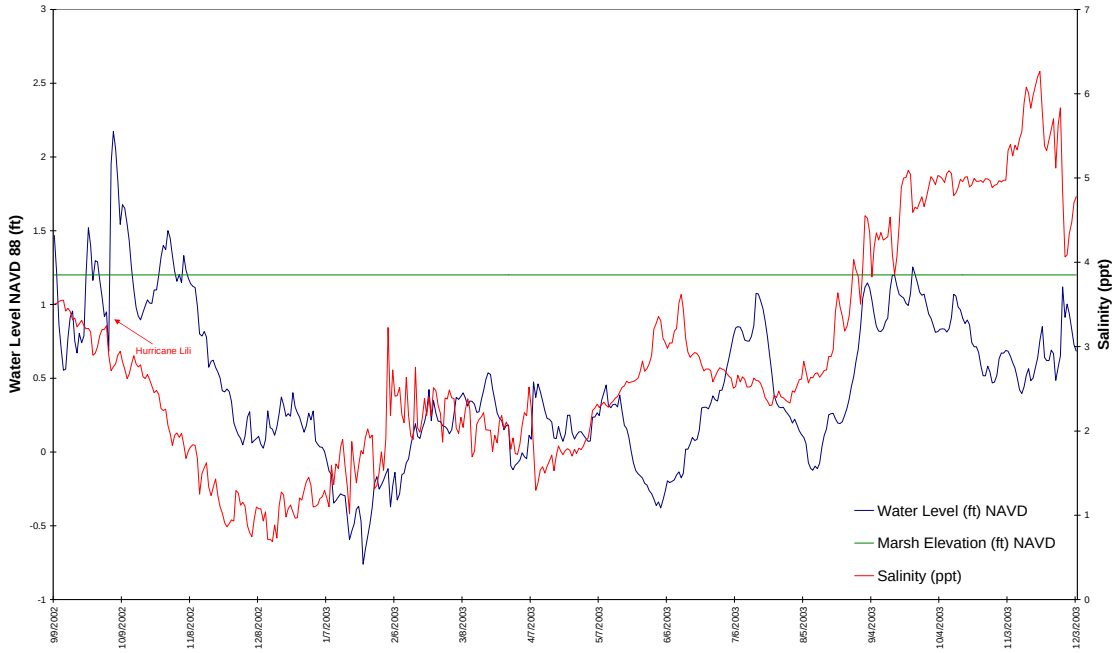


Figure 6. Daily mean salinity and water level at Station ME14-01 in the Pecan Island Project area during 2002 and 2003. A water level reading above the marsh elevation line signifies that the marsh is flooded.

Pecan Island Terracing (ME-14)

Project Station ME14-02R (9/9/02 - 12/3/03)
Salinity and Water Level Data

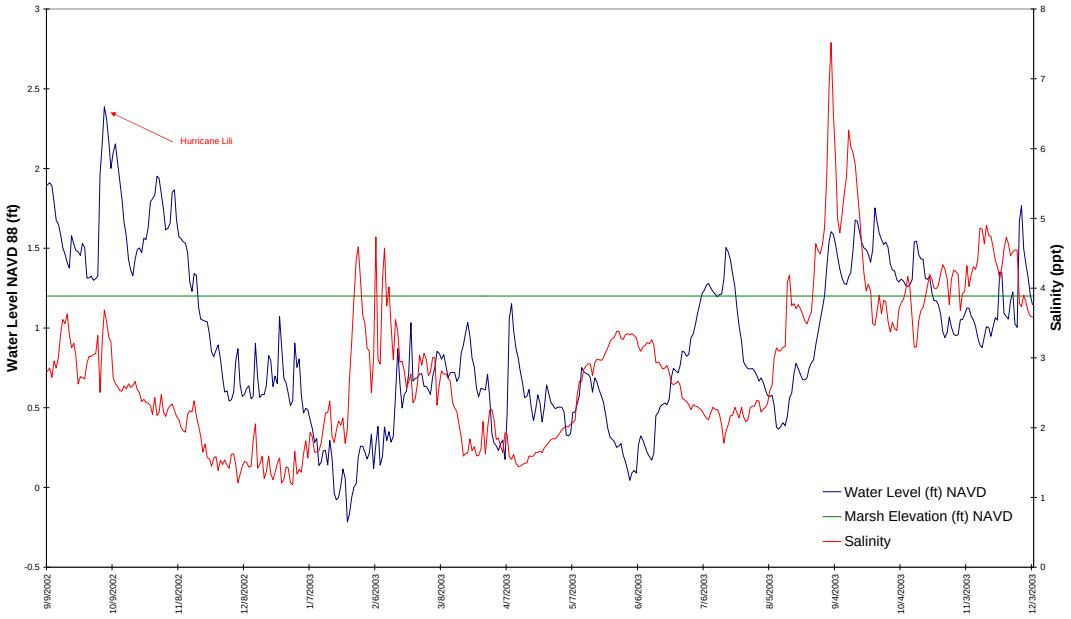
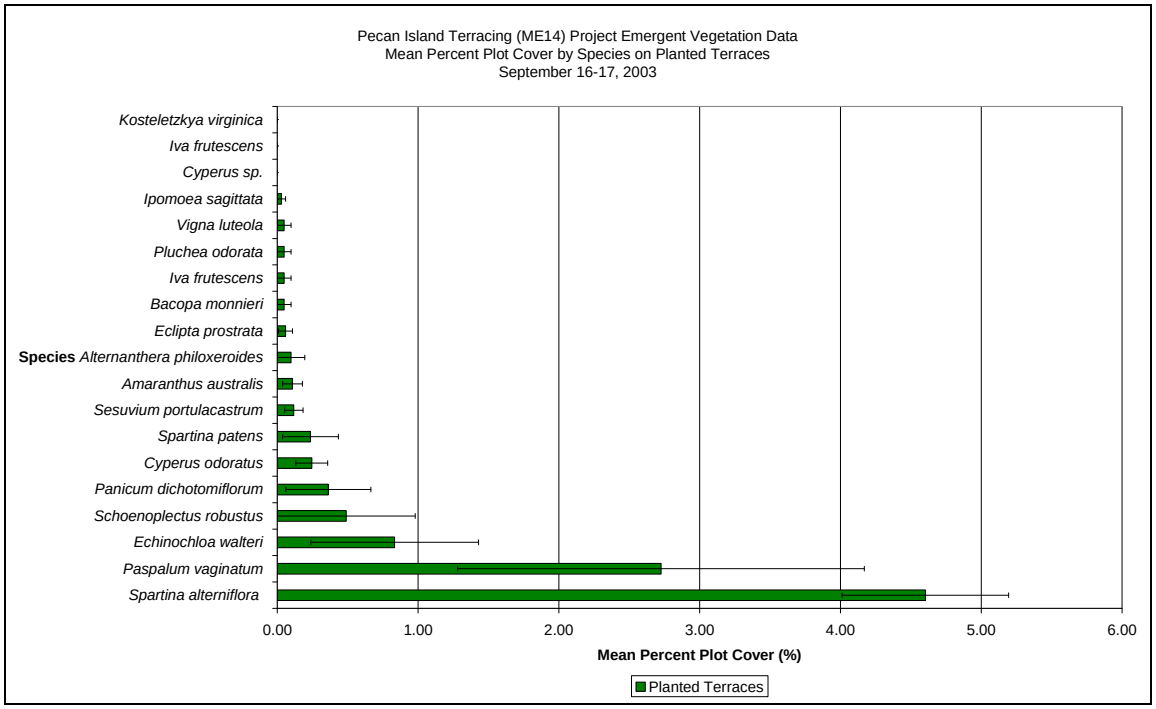


Figure 7. Daily mean salinity and water level at station ME14-02R in the Pecan Island Project area during 2002 and 2003. A water level reading above the marsh elevation line signifies that the marsh is flooded.



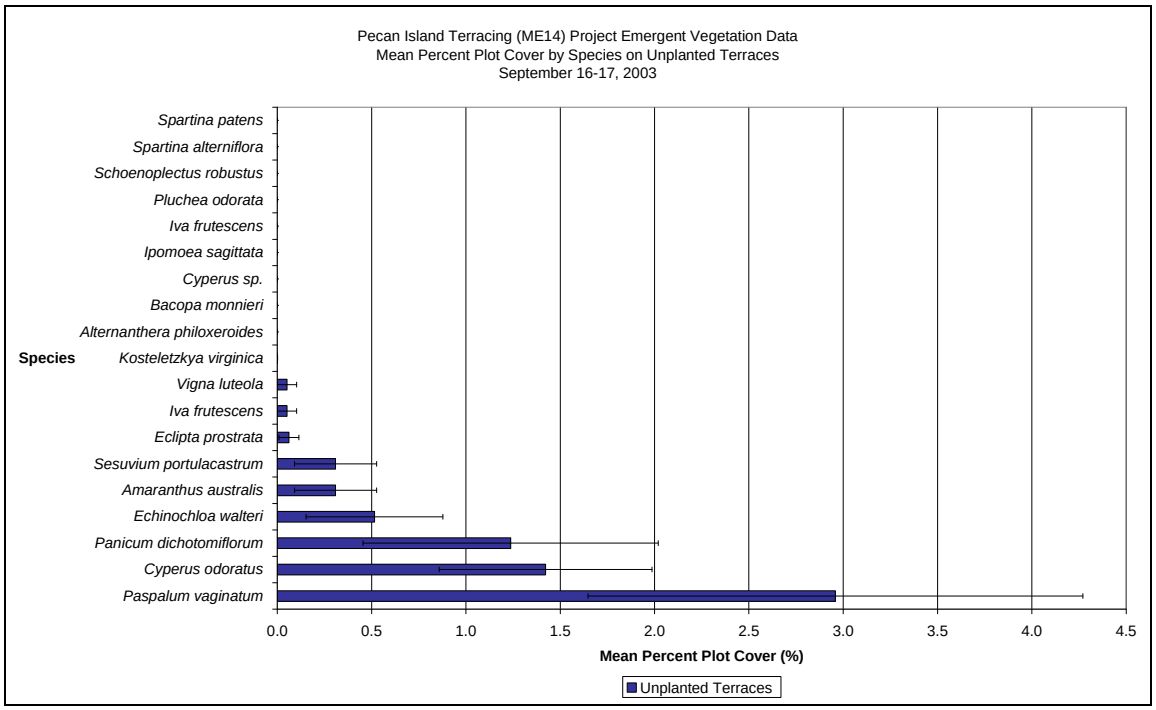


Figure 8. Mean % cover of selected species across al 4m^2 plots within the ME14 project area on the planted and reference unplanted terraces.

Pecan Island Terracing (ME-14)

Emergent Vegetation Data

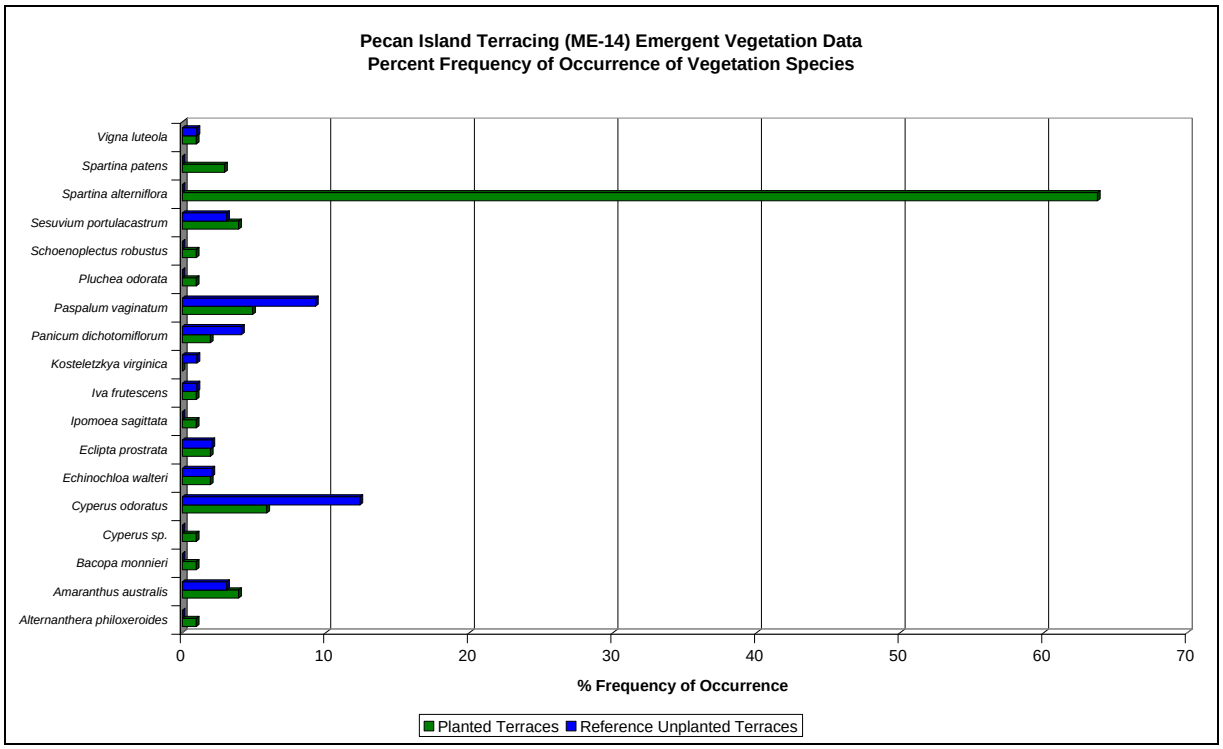


Figure 9. Pecan Island Terracing (ME-14) % frequency of occurrence of emergent vegetation by species on terrace planted with *Spartina alterniflora* vs. unplanted terraces.

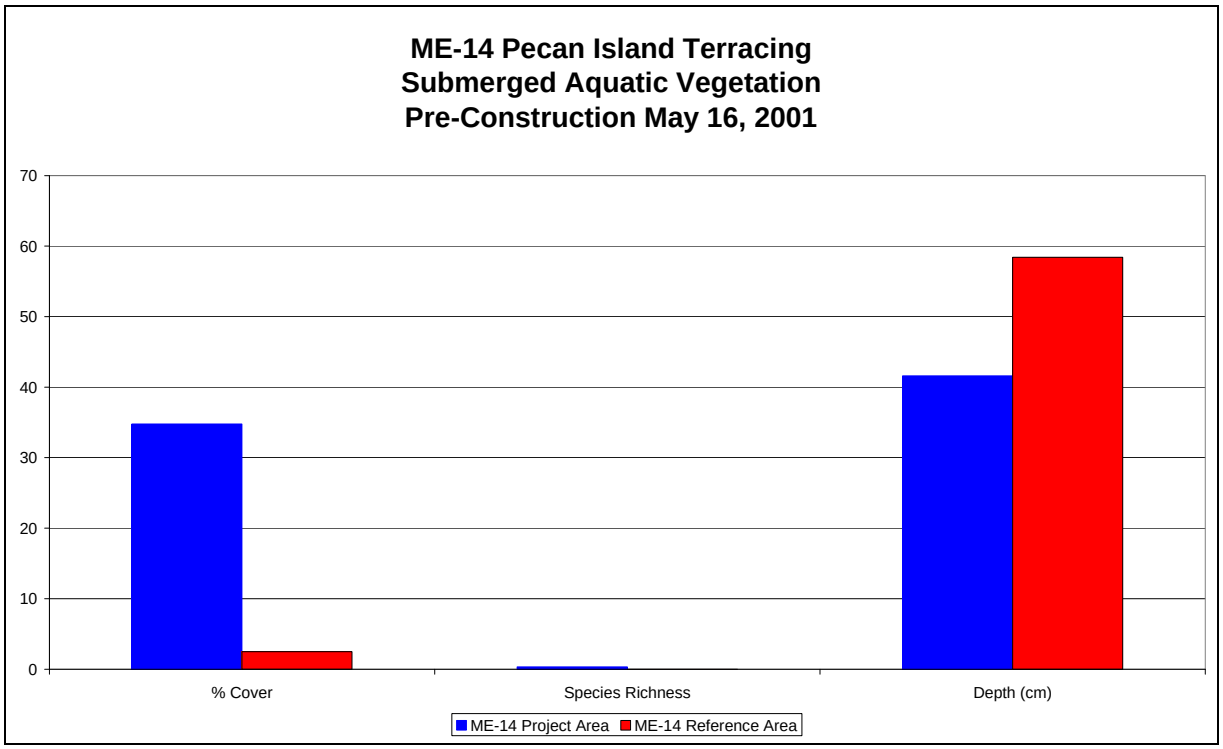


Figure 10. Pecan Island Terracing (ME-14) submerged aquatic vegetation % cover, species richness, and water depth. Species consisted of one unknown alga.

V. Conclusions

a. Project Effectiveness

Although the project has been constructed for only 3 months, both planted and unplanted terraces were quickly colonized by natural vegetation including, but not limited to, *Paspalum vaginatum*, *Cyperus odorata*, *Panicum dichotomiflorum*, *Echinochloa walteri*, *Amaranthus australis*, *Sesuvium portulacastrum*, *Spartina patens*, *Eclipta prostrata*, *Iva frutescens*, *Vigna luteola* and *Kosteletzkya virginica*. Early plant colonization was predominately on the slopes of the terraces. Vegetation noticed on the crown of terraces not planted nor sampled was identified as *Sesbania drummondii.*

Initial observations have determined that the typical section of the earthen terraces for the Pecan Island Terrace Creation Project (ME-14) consisting of a 10 ft. crown width constructed to (+) 3.75 ft NAVD88 with 4:1 side slopes along with the 300 ft. spacing between terraces has been effective in reducing wind fetch and allowing colonization of plants. The constructed height of (+) 3.75 ft NAVD88 was per recommendations of the Geotechnical Report for the soil type within the project area and is anticipated to settle to (+) 2.5 ft NAVD88 within five (5) years.

b. Recommended Improvements/Actions

Assessment surveys performed by a licensed engineering/land surveying firm will be performed within five years or sooner (depending on results of annual inspection) to assess post construction settlement data for comparison to the anticipated settlement outlined in the Geotechnical Report.

c. Lessons Learned

The number of terraces constructed and their close proximity to one another reduced fetch and the erosive action of waves. South Louisiana's mild climate and adequate precipitation creates optimal growing conditions for vegetation species located within the natural seed bank. Intensive planting schemes may be unnecessary for some situations thereby creating a more natural selection of vegetation in a succession. In a high energy environment and depending on the season when the terraces are complete, the time in which the natural vegetation becomes established may be a concern. If the earthen terrace is subjected to fetch soon after construction, as may be the case on the terraces located on the open water marsh side, risk of slope failure may be likely with unconsolidated soils. Rapid erosion of the terraces would then prevent the establishment of natural vegetation.