**State of Louisiana**
**Department of Natural Resources**
**Coastal Restoration Division**

# Monitoring Plan

for

# Chandeleur Islands Marsh Restoration

State Project Number PO-27
Priority Project List 9

April 2001
Plaquemines and St. Bernard Parishes

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**MONITORING PLAN**

**STATE PROJECT NO. PO-27 (XPO-95) CHANDELEUR ISLANDS RESTORATION**

**DATE: April 4, 2001**

## Project Description

The Chandeleur Islands are a 72-km long barrier island chain located in easternmost St. Bernard and Plaquemines Parishes, Louisiana about 70-miles (113-km) east of downtown New Orleans (Figure 1). The islands are bound by the Gulf of Mexico to the north, south, and east, and by Chandeleur and Breton Sounds to the west. Contained within the Breton National Wildlife Refuge, the islands are managed by the United States Fish and Wildlife Service (USFWS). The Chandeleur Islands Restoration (PO-27) project area encompasses Chandeleur Island, the northernmost island in the Chandeleur Island chain (Figure 2).

The islands, which comprise the largest and oldest transgressive barrier island arc in the northern Gulf of Mexico, are the remnant land mass of the St. Bernard delta complex which was abandoned some 1,500 years ago (Debusschere et al. 1990; Suter et al. 1988). Delta abandonment initiates barrier island development through the erosion of abandoned headlands and the redistribution of eroded sediments as flanking barrier islands (Penland et al. 1985, Penland et al. 1988). Subsidence of the abandoned delta leads to the detachment of the barrier shoreline and the creation of a barrier island arc, such as the Chandeleur Islands, which migrates landward from its initial position. The final stage in barrier shoreline evolution occurs when erosional factors such as relative sea level rise and storm impacts begin to overcome the ability of the island arc to regenerate itself through washover deposits and flood tidal delta deposits. This eventually transforms the barrier arc to a submerged inner shelf shoal.

The Chandeleur Islands have been retreating west-northwest toward the mainland for the last 100 years at rates greater than 15-m $yr^{-1}$ in the southern islands, and decreasing northward to less than 5-m $yr^{-1}$ (Penland et al. 1985). The asymmetric morphology of the island arc is due to its almost parallel orientation to the dominant southeasterly wave approach, causing extensive northward longshore transport. The northern portion of the island arc is dominated by wide beaches with multiple bars and large washover fans separated by hummocky dune fields. The dune zone is vegetated by shrubs and grasses, and grades into a high salt marsh populated by black mangrove (*Avicennia germinans*) and salt marsh cordgrass (*Spartina alterniflora*) (Kahn and Roberts 1982). Other species which occur on the islands include saltgrass (*Distichlis spicata*), wiregrass (*Spartina patens*), beach tea (*Croton punctatus*), beach morning-glory (*Ipomoea stolonifera*), wax myrtle (*Myrica cerifera*), and groundsel bush (*Baccharis halimifolia*). The southern islands are narrower, lower in elevation, and eventually give way to small island fragments and shoals separated by tidal inlets toward the southern tip. The barrier beach generally consists of broken *Rangia* and oyster-shell litter mixed with well-sorted fine quartzose sand (Kahn and Roberts 1982).

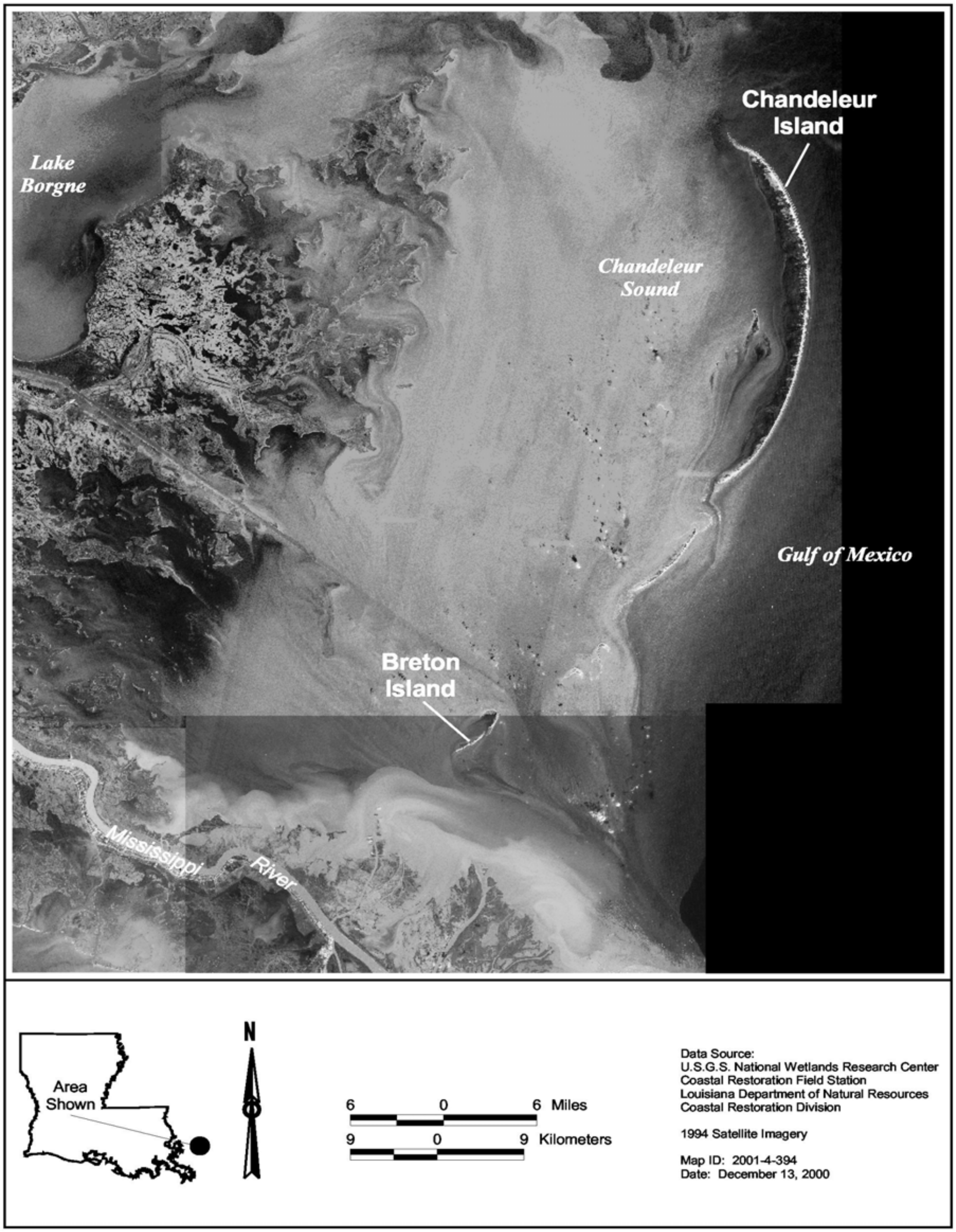


Figure 1. Location of Chandeleur Islands in St. Bernard Parish, Louisiana.

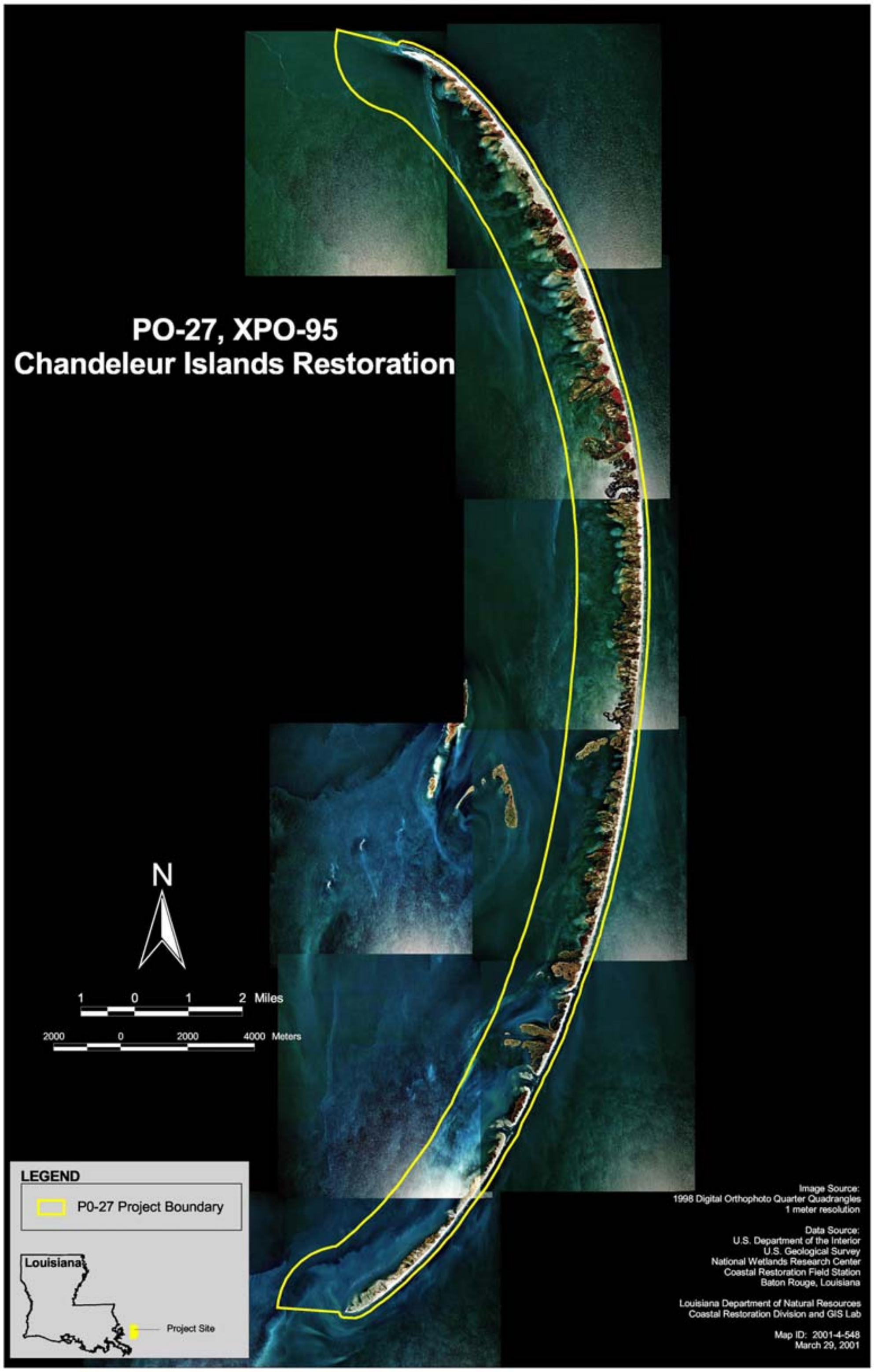


Figure 2. Chandeleur Islands Restoration (PO-27) project boundary.

The Chandeleur Islands have experienced an average land loss rate of 0.08-$km^2$ $yr^{-1}$ since 1869 (Penland et al. 1985). At current land loss rates, the islands are expected to become subaqueous in about 200 years (Suter et al. 1988; Penland and Suter 1988). According to Kahn and Roberts (1982), the long-term deterioration of the island arc is being enhanced by 1) subsidence of the St. Bernard delta sediments, 2) absence of sediment supply, and 3) the frequent passage of destructive tropical cyclones. For instance, Hurricanes Camille and Georges reduced the area of the islands by 35% and 40% respectively. During storm events, sediment is eroded from the beach face and nearshore bars of barrier islands and is deposited seaward. The constructive period between storms is usually of insufficient length to allow the barrier island to completely regenerate. In many transgressive barrier island systems, such as the Chandeleurs, sediment is often deposited as overwash on the landward side of the island (or seaward side depending on direction of storm surge flooding) due to overtopping or breaching of the barrier during storm events. Overwash deposits in the backbarrier marshes are often colonized by salt marsh vegetation and sea grasses, counteracting some beach erosion and promoting landward migration of the islands (Debusschere et al. 1990).

The Chandeleur Islands are frequently overwashed due to the passage of cold fronts and tropical storms (Boyd and Penland 1981). Extensive overwash and breaching of the islands occurred most recently with the passage of Hurricane Georges in 1998. The hurricane passed within five miles east of the islands creating over 100 washover channels through the barrier chain. Ritchie and Penland (1988) note the importance of vegetation in the establishment and stabilization of coastal dunes. If a washover area is not subjected to repeated disruption due to overwash events, plant colonization produces ground cover and encourages sand aggradation. The purpose of the proposed project is to provide stabilization to 364-acres (1.47-$km^2$) of unvegetated hurricane washover deposits on 22 overwash fan sites through vegetative plantings (Figure 3). Stabilization of washover deposits will allow for the accretion of back barrier marshes through sediment trapping, the re-colonization of sea grass beds due to stabilization of sub-tidal sand flats, and the protection of up to 30-acres (0.12-$km^2$) of main island habitat through wave reduction and sediment trapping.

This project will be planted in two phases. Monitoring will be conducted only on Phase I of the project, which will account for 40% of the total plantings. Phase I will involve the planting of 66,000 vegetative plugs and 15,000 four-inch (0.1-m) containers of Smooth Cordgrass (*Spartina alterniflora* cv. Vermilion) on 15 of the 22 proposed overwash sites mainly along the southern half of the island. The final number and location of sites will depend on the condition of the sites at the time of planting. Plants will be configured in eight rows spaced 10-ft (3.05-m) apart along the shoreline, with the first row starting 20-ft (6.10-m) seaward from the mean water level for both shoreline and island layouts (Figures 4 and 5). Rows 1-2 will consist of plugs planted 5-ft on center and rows three (3) through eight (8) will consist of plugs and four-inch containers planted 10-ft on center. The total number of plants planted at each site will be variable. The mean water line, which will be used as the baseline for the for the layout of the plant rows, will be delineated approximately 15 days prior to the commencement of planting. Phase I planting is scheduled for April - June 2001. Phase II planting is anticipated for April - June 2002.

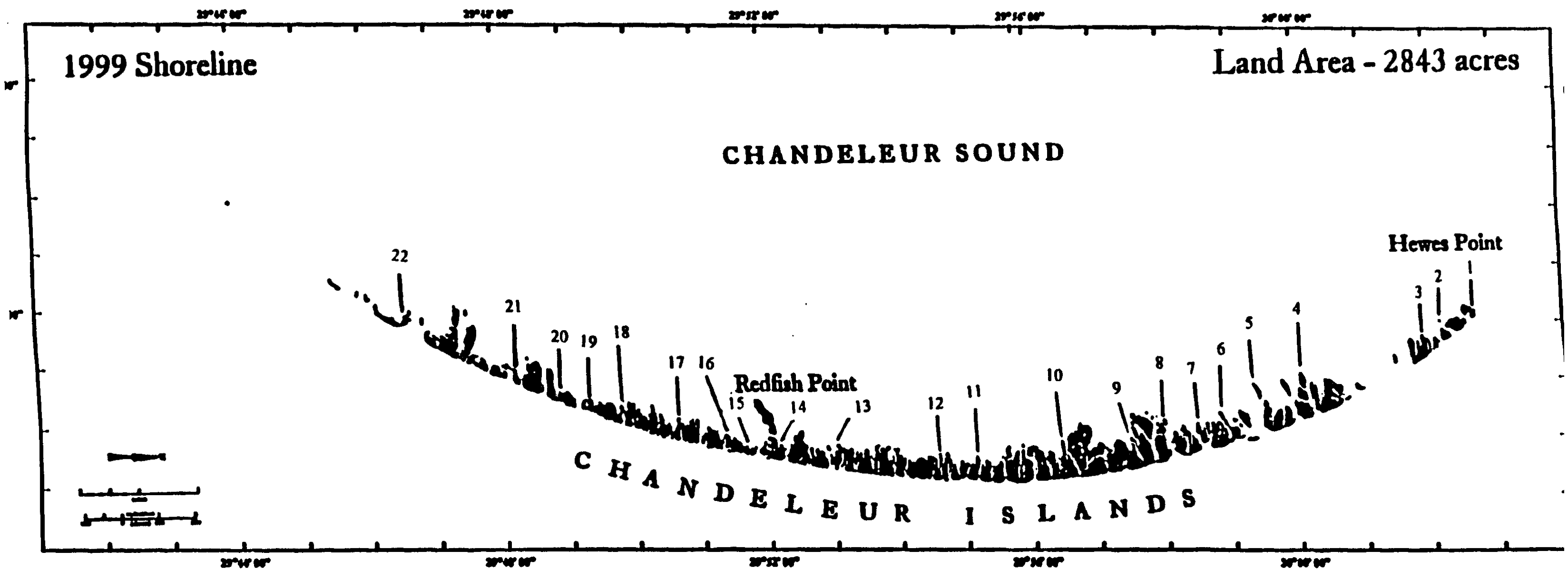


Figure 3. Proposed planting sites for the Chandeleur Islands Restoration (PO-27) project.

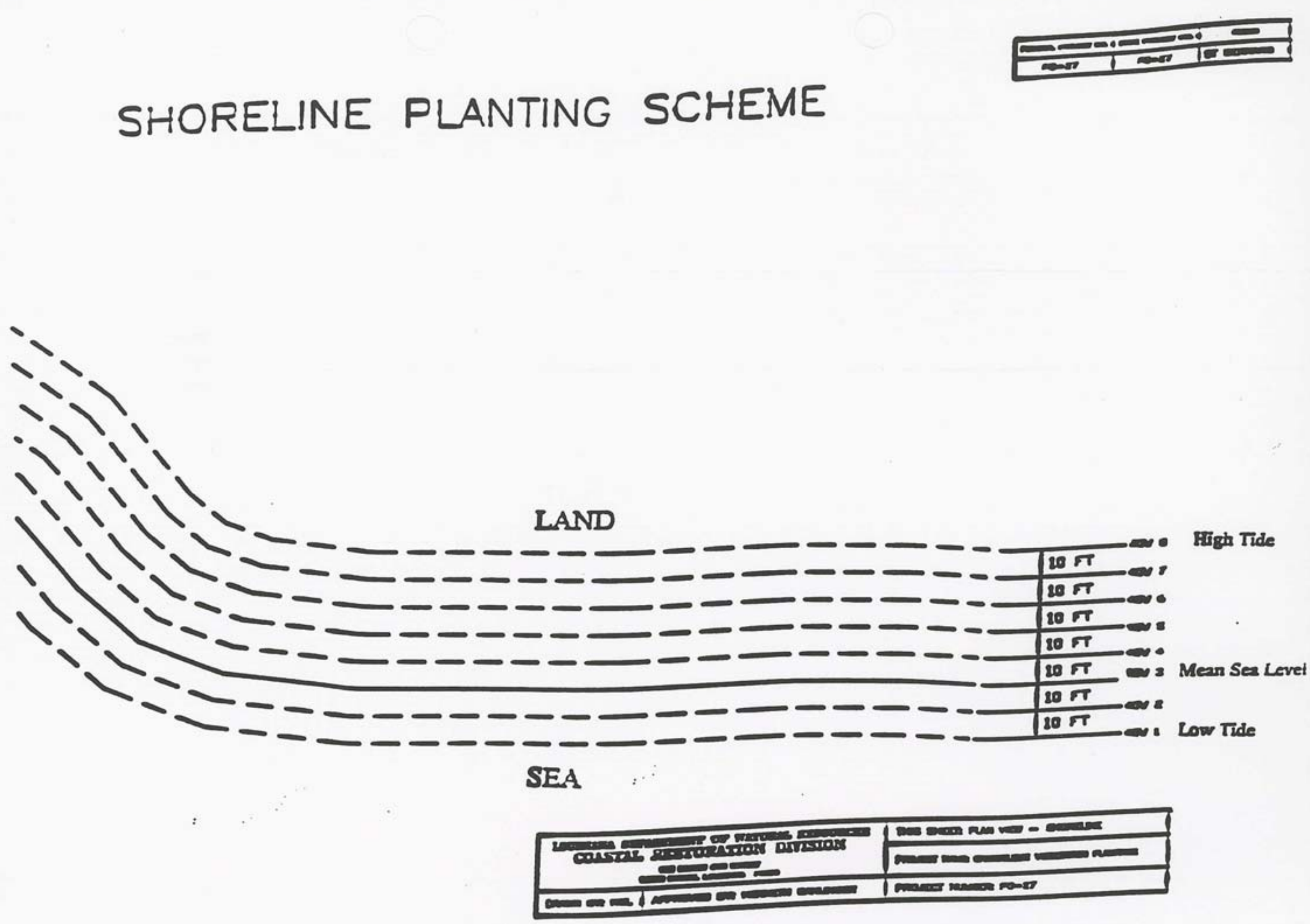


Figure 4. Shoreline planting scheme for the Chandeleur Islands Restoration (PO-27) project, Phase I.

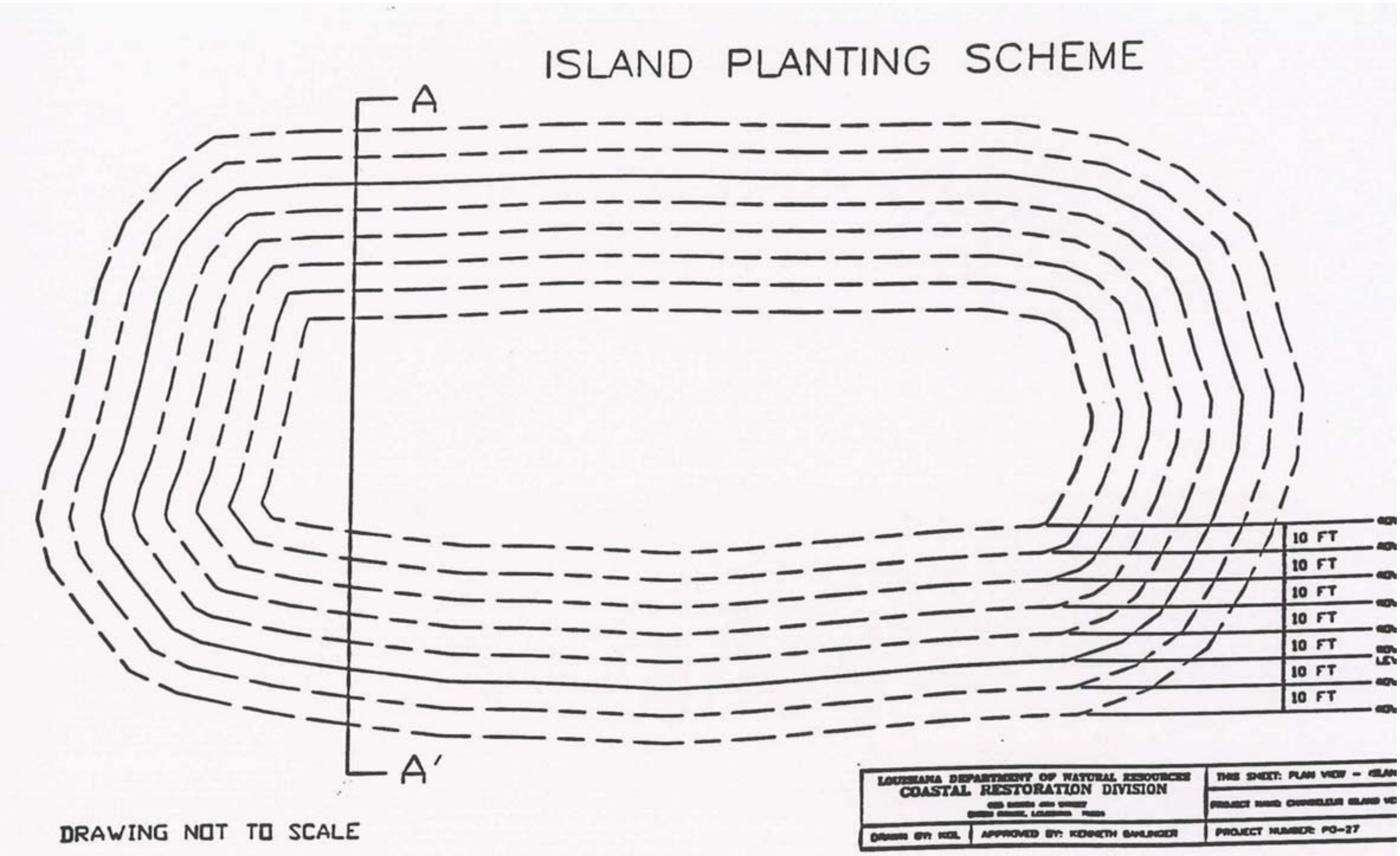


Figure 5. **Island planting scheme for the Chandeleur Islands Restoration Project (PO-27), Phase II.**

Project Objective

Stabilize hurricane overwash deposits through the use of vegetation plantings to trap and hold sediments.

Specific Goals

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

1. Increase % cover of emergent vegetation in planting areas.

2. Maintain or increase intertidal area, as indexed by elevation data, within and adjacent to the planting sites. Areas within the elevation range of mean low water and mean high water will be defined as "intertidal".

Reference Areas

As an informal reference, aerial photography taken throughout the entire island area will be utilized to differentiate between natural colonization processes in unplanted areas and project-affected colonization at the planting sites. Vegetation within planting sites and unplanted areas will be quantified using land-water analysis of the aerial photography.

Monitoring Elements

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

1. Aerial Photography — To document vegetated and non-vegetated areas color-infrared aerial photography (1:12,000 scale) will be obtained. Photography will be georectified, and photo interpreted using land-water analysis following procedures outlined in Steyer et al. (1995). Each project site will be quantified separately. Photography will be obtained in December 2000 (pre-construction), 2003, and 2005. Additional photography may be obtained in response to major storm events if funds are available.

2. Vegetation — Percent cover and species composition will be determined at a subset of Phase I planting sites. The Braun-Blanquet method will be used to survey vegetation in 2-$m^2$ plots along randomly selected transects, which will be established across selected sites to bisect planting elevation contours. The number of transects and

vegetation plots will be determined by the relative size of each planting area; however, a minimum of three transects and twelve plots (4 plots/transect) will be established at each site. Surveys will be conducted in spring of 2001 ("as built"), as well as in early fall in years 2001, 2002, 2003, and 2005.

3. Elevation — Elevation will be surveyed in and adjacent to the planting sites to document changes in intertidal area. Surveys will be conducted along the same transects established for vegetation monitoring. Elevations will be recorded at 20-ft intervals along each transect as well as at any significant changes in elevation within those intervals. The transects will be carried out at least 60-ft beyond the most seaward planted row or to the seaward edge of the SAV bed, if feasible. The transect will also be carried across any interior unplanted area in the case of an island planting. In addition, elevation will be taken at the center of each vegetation plot. A permanent benchmark has been established on the island to be used as a reference datum. Surveys will be conducted in conjunction with vegetation surveys in the spring of 2001 ("as built"), and in the fall of 2003 and 2005.

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

The following hypotheses correspond with the monitoring elements above and will be used to evaluate the accomplishment of the project goals:

1, 2. Descriptive and summary statistics will be used on historical data and aerial photography data collected during pre- and post-project implementation to assess whether the post-project marsh gain rate deviates from the expected "future without project" conditions. Acreage of vegetated marsh will also be calculated and documented over time.

2. Paired t-tests, analysis of variance (ANOVA), descriptive, and summary statistics will be used to evaluate vegetative planting success based on vegetative sampling data. The ANOVA models may include terms to adjust for station locations and elevation. If we fail to reject the null hypothesis, we will investigate for negative effects. Historical data will be used when available.

*Goal:* Increase % cover of emergent vegetation in the planting areas.

*Hypothesis:*

$H_0$: Mean percent cover of vegetation within the planting sites at year *i* will not be significantly greater than mean percent cover of vegetation at year *i-1*. *Note*: *i*=1 (year 2002), 2 (year 2003), 4 (year 2005); *i-1*=0 (year 2001)

$H_a$: Mean percent cover of vegetation within the planting sites at year *i* will be significantly greater than mean percent cover of vegetation at year *i-1*. *Note*: *i*=1 (year 2002), 2 (year 2003), 4 (year 2005); *i-1*=0 (year 2001)

3. Data obtained from elevation surveys of planting areas will be evaluated through paired t-tests or ANOVA. The percentage of data points which fall within the elevation range defined as 'intertidal' will be compared among "as built" and post-construction sampling years. These tests will allow for the analysis and documentation of vertical changes in the area within and adjacent to the planting sites. If we fail to reject the null hypothesis, we will investigate for negative effects.

   *Goal:* Maintain or increase intertidal area within and adjacent to planting sites.

   *Hypothesis:*

   $H_0$: Intertidal area within and adjacent to vegetative planting sites after project implementation at year *i* will not be equal to or significantly greater than intertidal area at year *i-1*. *Note*: *i*=2 (year 2003), 4 (year 2005); *i-1*=0 (year 2001)

   $H_a$: Intertidal area within and adjacent to vegetative planting sites after project implementation at year *i* will be equal to or significantly greater than intertidal area in previous sampling years. *Note*: *i*=2 (year 2003), 4 (year 2005); *i-1*=0 (year 2001)

Notes

1. Implementation:

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|---|---|---|
| | Start construction of Phase I: | May 2001 |
| | End construction of Phase I: | June 2001 |
| | Start construction of Phase II: | April 2002 |
| | End construction of Phase II: | June 2002 |

2. NMFS Point of Contact: Rachel Sweeney (225) 389-0508

3. DNR Project Manager: Greg Grandy (225) 342-6412
   DNR Monitoring Manager: Melissa Kay Hymel (504) 288-4684

4. The twenty-year monitoring plan and implementation budget for this project is $174,263. Costs for elevation surveys in 2001 will be paid from construction funds.

5. A monitoring comprehensive report will be available in 2006.

6. References:


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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 report no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp. plus appendices.

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