

MONITORING PLAN
PROJECT NO. TE-27
WHISKEY ISLAND RESTORATION

DATE: July 23, 1998

Preface

To provide a comprehensive monitoring program for all Terrebonne Basin barrier island restoration projects, an agreement was reached between U.S. Environmental Protection Agency, National Marine Fisheries Service, and Louisiana Department of Natural Resources to combine monitoring survey budgets to use Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) technology. The SHOALS methods produce a more comprehensive elevational data set for the entire Terrebonne Basin barrier islands, without increasing the project specific surveying costs.

Project Description

The Whiskey Island Restoration project (figure 1) is located on Whiskey Island, which is part of the Isles Dernieres chain of barrier islands in Terrebonne Parish. Whiskey Island is the second island from the west (figure 2) in the Isles Dernieres chain and is centered at latitude 29° 03' 00" and longitude 91° 48' 00" (EPA/LDNR 1997). Abandonment of the Caillou headland by distributaries of the Lafourche delta lobe occurred approximately 500 years B. P. and led to the formation of the Isles Dernieres barrier shoreline (Penland and Boyd, 1985). Barrier islands form after delta lobe abandonment and marine processes rework delta sands into barrier beaches (Mendelssohn and Hester, 1988). The Isles Dernieres have fragmented into four smaller islands separated by tidal inlets 984 - 3937 ft (300 - 1,200 m) wide and 20 - 59 ft (6 - 18 m) deep (Penland et al. 1988). These islands, forming the southern boundary of Terrebonne Parish, represent a severely eroded barrier shoreline.

The inter-tidal zone on Whiskey Island's Gulf of Mexico side consists of a marsh peat platform that has been exposed by shoreline erosion. Above high tide level there is a mixture of sand and broken shells. With the exception of isolated, ring-shaped dunes [normally 2.3 ft (70 cm) high and 22.97 ft (7 m) in diameter], the surface consists of a bare washover flat with notable salt incrustation on the north side. The eroding central part of this island consists of a layer of bare sand and shell on the marsh peat platform (Ritchie et al. 1989). Soil types in the project area (figure 3) are the sand beaches and the salt water marsh, clays and mucky clays (U.S. Soil Conservation Service, 1960). Fine sand and shells distributed as the result of wave and wind action compose the Sand beaches (Sc) soil type. The sediments may be from other beaches that have eroded or from the floor of the Gulf of Mexico. On Whiskey Island, extending inland of the Sand beaches soil type is the Salt water marsh, clays and mucky clays (Sa) soil type. This soil type consists of alluvial sediments which, through time, have been reworked by waves and tides. They occur at near-gulf level and are

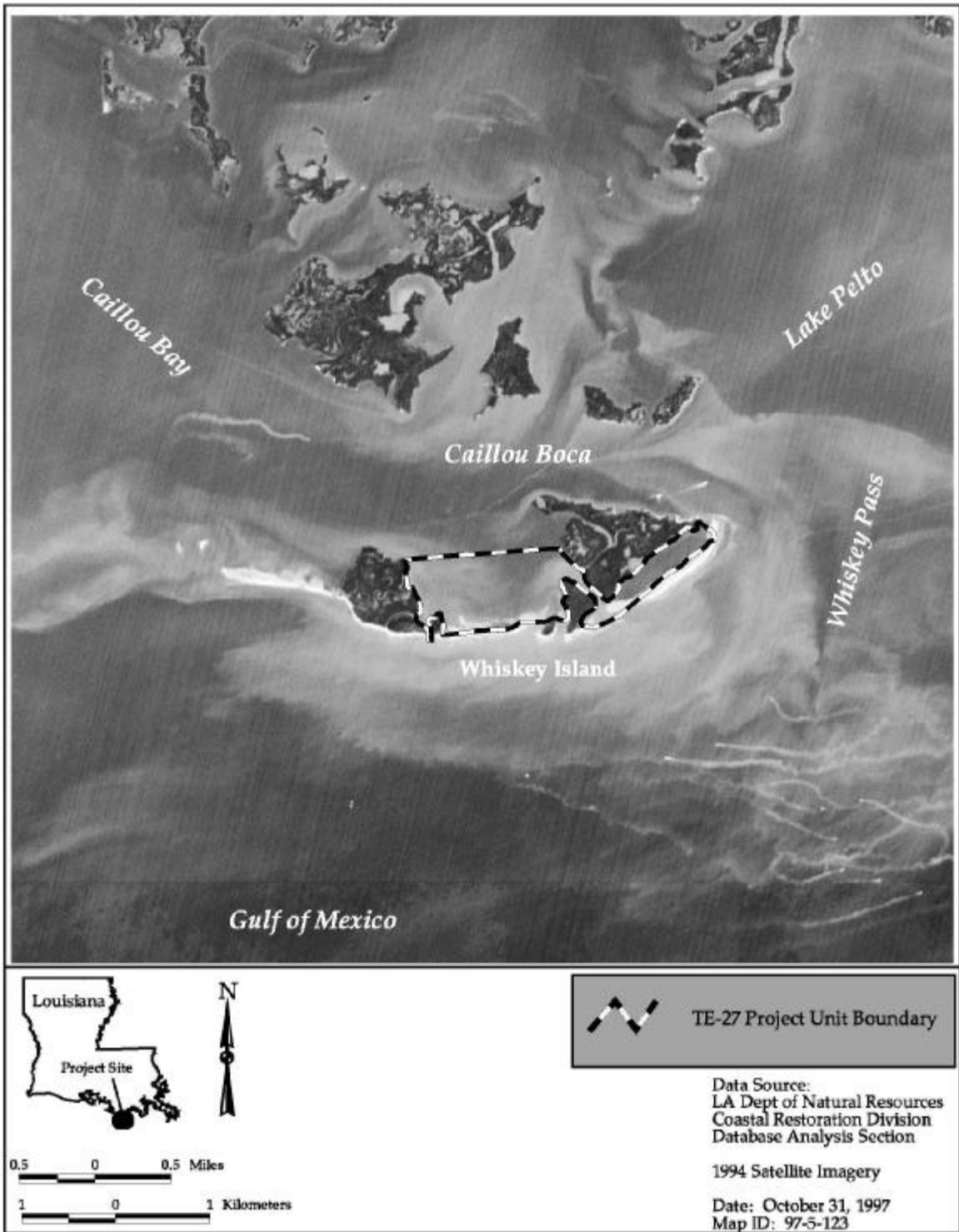


Figure 1. Whiskey Island Restoration (TE-27) project location and boundary.

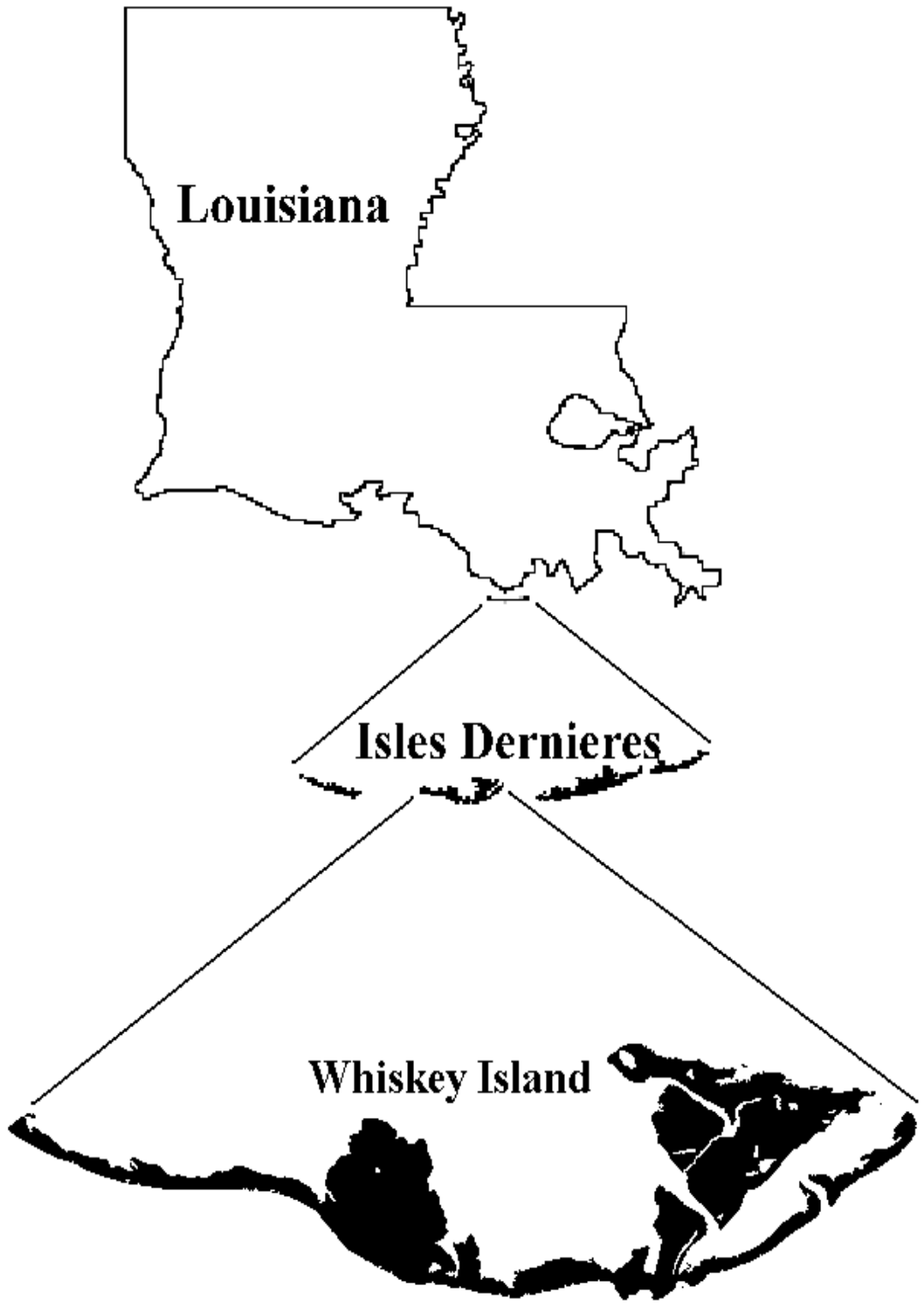


Figure 2. Project location - Whiskey Island Restoration project (TE-27)



Figure 3. Soil types of Whiskey Island (TE-27).

frequently flooded by normal tidal action. The sediments may be covered by several feet of salt water and transported inland during strong wind and/or storm events.

The beach vegetation is limited to *Ipomoea pes-caprae* (beach morning-glory) which colonizes the beach wrack line, and *Sesuvium portulacastrum* (seaside purslane) which survive minor washover events and accumulate sand to form characteristic low rounded dunes. Mangrove-saltmarsh, typical of the area and composed of *Spartina alterniflora* (smooth cordgrass), *Avicennia germinans* (black mangrove), *Batis maritima* (saltwort), and *Salicornia bigelovii* (bigelow glasswort) is found landward of the washover sheet. This mangrove-saltmarsh forms the dense organic mat that persists as the sand and shell dunes migrate over it. With further coastal erosion the mat is exposed as the characteristic "marsh platform" of the nearshore intertidal zone (Ritchie et al. 1989).

The Isles Dernieres steadily decreased at an average rate of 0.10 mi²/yr (0.27 km²/yr) from their 1887 area of 13.44 mi²/yr (34.8 km²) to a 1979 area of 3.94 mi² (10.2 km²). Shoreline erosion along the Gulf side of the islands averages 53.5 ft/yr (16.3 m/yr), with some episodes of erosion causing as much as 98.8 ft/yr (30.1 m/yr). Bayside erosion is reduced, averaging 5.6 ft/yr (1.7 m/yr) with a maximum of 10.8 ft/yr (3.3 m/yr). Land loss resulted when repeated storm impacts depleted the limited barrier sand reservoir and washed sands into tidal inlet and inner-shelf sinks. Without restoration, it is estimated that the Isles Dernieres would become subaqueous sand shoals between 2007 (McBride et al. 1991) and 2019 (Penland et al. 1988).

The Whiskey Island Restoration project includes creating approximately 355 acres (177 hectares) of dunes and wetlands, to heights ranging from +1 to +4 ft (+0.3m to +1.2m) North American Vertical Datum (NAVD), using sediment dredged from Caillou Boca and closing east end of Coupe Nouvelle (figure 4). Stabilization of the sediments will be encouraged by vegetation plantings on the newly created dune area as well as natural colonizing vegetation. Hand planted vegetation will include *Spartina patens* (marshhay cordgrass), *Spartina alterniflora* (smooth cordgrass) and *Panicum amarum* (bitter panicum).

Project Objective

To strengthen and stabilize Whiskey Island through sediment addition and vegetative growth which will maintain the protective barrier between the Gulf of Mexico and the lower Terrebonne Basin estuary system.

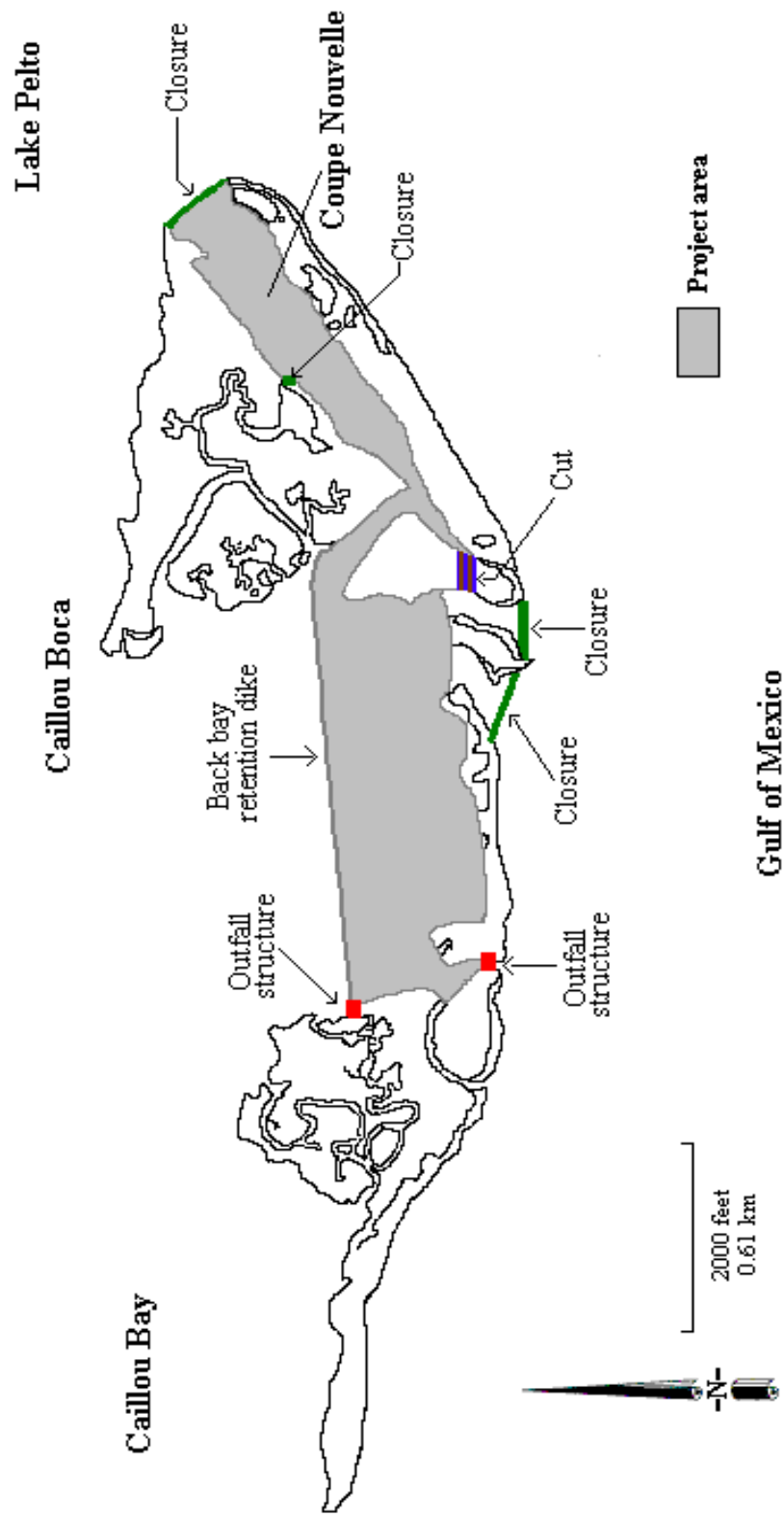


Figure 4. Project construction area and associated structures.

Specific Goals

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

1. Increase the elevation and width of Whiskey Island using dredged sediments
2. Reduce loss of dredged sediments through the growth of vegetation

Monitoring Elements

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

1. **Aerial Photography** Near vertical, color-infrared aerial photography (1:12,000 scale), flown in November 1997, will be acquired from the National Wetlands Research Center (NWRC) as the pre-construction standard for future changes in the island's dimension. The photography will be georectified for land/water ratio using NWRC standard operating procedures (Steyer et al. 1995).
2. **Topography** To document both horizontal and vertical change along the constructed area of Whiskey Island, transect lines were established at 76.20 m (250 ft) intervals by professional surveyors before construction. Samples were collected every 30.48 m (100 ft) across the island along each transect. A complete post-construction survey will be conducted under the construction contract. Post-construction surveys will be conducted in October to correspond with vegetation sampling and to avoid disturbance of nesting birds on the island. Beginning in October of 1999, the post-construction airborne lidar hydrographic surveys will be conducted using the Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) system (Lillycrop et al, 1997). The airborne lidar hydrographic survey will collect data along lines the length of the island. Data collected will be used to develop elevational transect lines. The SHOALS survey will be conducted in October 1999, 2001, 2003, 2007, and 2016.
3. **Vegetation** Hand planted and naturally colonizing vegetation as well as aerially seeded vegetation, if present, will be monitored by measuring % cover of all species found in approximately 64 - 3.3 ft C3.3 ft (1m C1m) plots. Four plots will be chosen along each of the 16 transects across the island. The vegetation plot position will be randomly selected, within 100 ft (30.48 m) right or left, along the elevational transect. Percent cover will be measured by estimating the percentage of the

ground area within each plot covered by each species identified. In an area of natural marsh unaffected by project construction, a reference area will be designated for vegetation comparisons. In the reference area, approximately 5 to 10 - 3.3 ft C3.3 ft (1m C1m) plots will be surveyed for percent cover of identified species. The number of reference plots will be determined by accessibility. The reference area data will be evaluated for validity of comparison to the project area after the year 2000 and a decision will be made as to the need to continue monitoring the reference area. Differential GPS coordinates will be recorded for each vegetation plot. Data will be collected in October 1999, 2001, 2003, 2007, and 2016 to correspond with the collection of elevational survey data.

Anticipated Statistical Tests and Hypotheses

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

1. Descriptive and summary statistics will be used on both historical data and data from aerial photography collected during pre-project and post-project implementation to assess land/water ratios of the island. This analysis will allow for the evaluation of goal 1 .
2. The primary method of analysis for elevation will be to determine differences in mean elevation and width as evaluated by a repeated measures ANOVA that will consider both spatial and temporal variation and interaction. This basic model will determine changes in island elevation, the volume of island sediment, and width of the project area after construction. All original data will be analyzed and transformed (if necessary) to meet the assumptions of ANOVA (e.g. normality).

Goal: Increase the width and elevation of Whiskey Island

Hypothesis A₁:

H₀: Mean width of the project sediment addition after project implementation at time point i, will not be significantly greater than the mean width at time 0

H_a: Mean width of the project sediment addition after project implementation at time point i, will be significantly greater than the mean width at time 0

Hypothesis A₂:

H₀: Mean height of the project sediment addition after project implementation at

time point i , will not be significantly greater than the mean height at time 0
 H_a : Mean height of the project sediment addition after project implementation at time point i , will be significantly greater than the mean height at time 0

- 3) Analysis of Variance (ANOVA), descriptive, and summary statistics will be used to evaluate vegetative growth (first-year analyses will concentrate on descriptive and summary statistics). Analysis will be based on percent cover of the species present. The ANOVA approach may include terms in the model to adjust for station locations and elevation. If we fail to reject the null hypothesis, we will investigate for negative effects. This ANOVA will allow for the analysis and long-term documentation of vegetative coverage changes on Whiskey Island.

Goal: Reduce loss of dredged sediments through the growth of vegetation

Hypothesis B_1 :

H_0 : Mean vegetation coverage at year i will not be significantly greater than mean vegetation coverage at time 0

H_a : Mean vegetation coverage at year i will be significantly greater than mean vegetation coverage at time 0

Hypothesis B_2 :

H_0 : Mean relative abundance of vegetation in the project area at time i will not be greater than mean relative abundance of vegetation in the reference area

H_a : Mean relative abundance of vegetation in the project area at time i will be greater than mean relative abundance of vegetation in the reference area

Notes

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|----|-------------------------|---------------------|----------------|
| 1. | Implementation: | Start Construction: | March 15, 1998 |
| | | End Construction: | June 1, 1998 |
| 2. | EPA Point of Contact: | Jeanne Peckham | (504) 389-0736 |
| 3. | DNR Project Manager: | Brian Kendrick | (504) 449-5057 |
| | DNR Monitoring Manager: | Mary Anne Townson | (504) 447-0974 |
| | DNR DAS Assistant: | Chris Cretini | (504) 342-9425 |

4. The twenty year monitoring plan development and implementation budget for this project is \$127,989. Progress reports will be available in June 2000 and June 2002 and comprehensive reports will be available in June 2004, June 2008, and June 2019. These reports will describe the status and effectiveness of the project.
5. Aerial seeding is still under consideration for the project. Vegetation growth from this will be included in the vegetation monitoring element if the seeding takes place.
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