MONITORING PLAN

PROJECT NO. C/S-26 COMPOST DEMONSTRATION

DATE: June 8, 1998

Project Description

The Compost Demonstration project encompasses 10.3 ac (4.2 ha) of brackish marsh located in Cameron Parish, Louisiana, along the western edge of Black Bayou Cutoff approximately 3,500 ft (1,067 m) south of the Intracoastal Waterway. Existing spoil banks make up the eastern and southern boundaries, whereas the western and northern edges of the project consist of open water. The project site is ten miles south-southwest of Vinton, Louisiana, with a project center at Lat. 30E02' 45" N and Long. 93E37' 10" W (figure 1).

The emergent vegetation in the predominantly open water project area consists of *Cladium jamaicense* (saw grass), *Juncus roemerianus* (needlegrass rush), *Sagittaria lancifolia* (bull-tongue), *Crinum americanum* (string lily), *Eleocharis* spp. (spikesedges), and *Spartina patens* (saltmeadow cordgrass) in the shallows. *Myriophyllum spicatum* (Eurasian water-milfoil) is the only submersed vegetation in the project area. The above mentioned emergent vegetation exists predominantly within the boundary of cell 1, while cells 2 and 3 are predominantly open water with *Myrica cerifera* (wax-myrtle), *Ligustrum sinense* (privet), *Sapium sebiferum* (Chinese tallow tree), *Ilex vomitoria* (yaupon), and *Acer rubrum* (red maple) on the elevated spoil bank (figure 2). The predominant soils within the project area are Gentilly muck and Clovelly muck which are both described as being very poorly drained, highly organic soils of brackish marshes (USDA-SCS 1995). Open water area within the project area has increased from 2.9 ac (1.2 ha) in 1956 to 7.7 ac (3.1 ha) in 1993.

The purpose of this three year marsh creation project is to demonstrate under field conditions the influence of compost in establishing vegetation on newly deposited dredged material in open water. The monitoring procedures established for this activity will determine if marsh creation in areas of shallow open water will benefit from the introduction of municipal tree trimmings as compostable material.

The project features include the construction of three 750 ft by 200 ft (229 by 61 m) containment cells enclosed by 5,300 linear ft (1,615 m) of levee (elevation of 3 ft [0.9 m] NGVD) that will be filled with compost and/or dredge material. Of the 5,300 ft, 2,850 linear ft (869 m) will be newly excavated, and 2,450 linear ft (747 m) is existing spoilbank. The contents of each cell will be as follows:

Cell 1	100% Compost Material (mix of existing clumps of emergent vegetation)
Cell 2	50% Dredge Material / 50% Compost Material (predominantly open water)
Cell 3	100% Compost Material (predominantly open water)

The cells will be built approximately as shown in figure 2, although some deviation may be necessary to follow the contours of the existing spoil banks, and for maximum stability of the

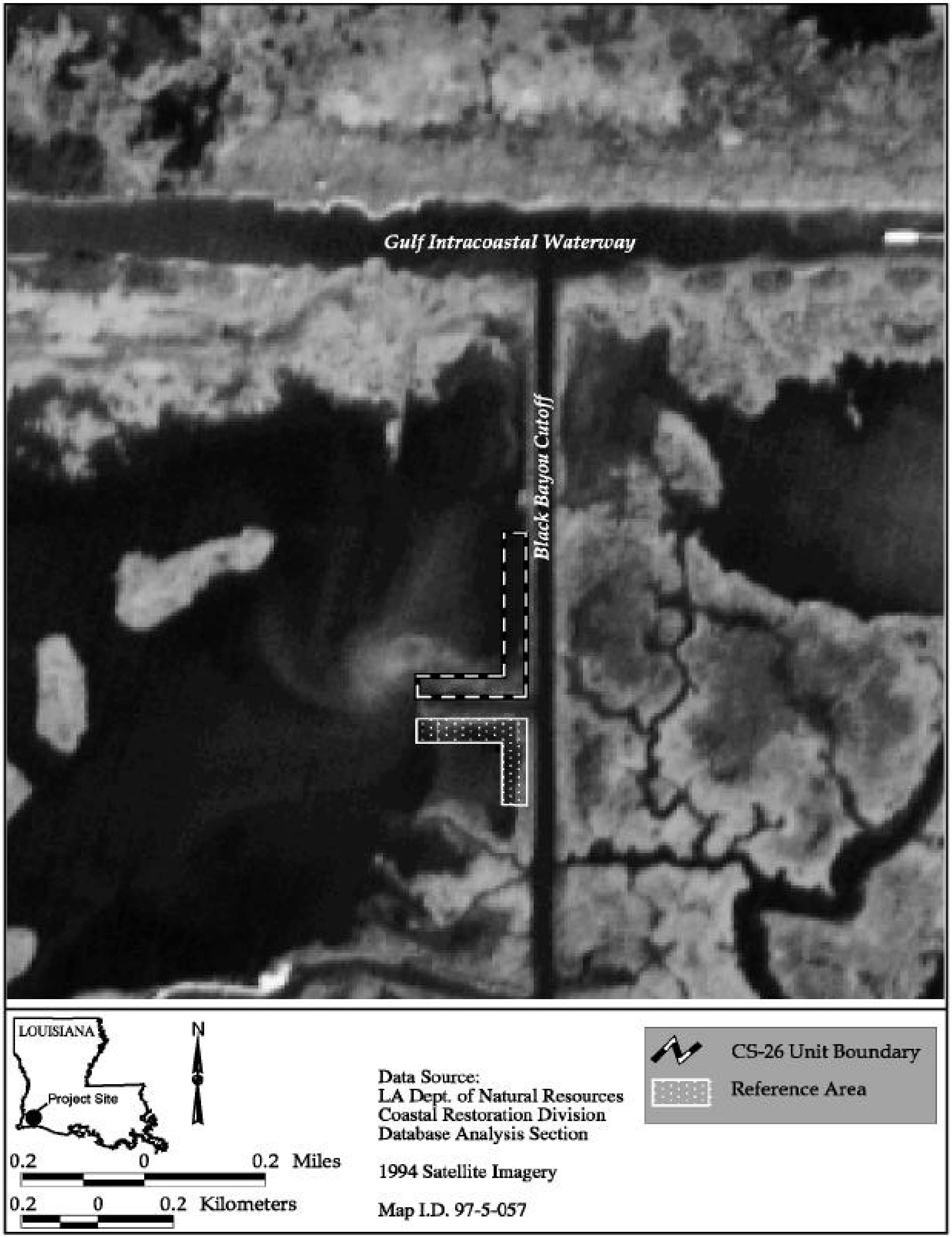

Figure 1. Compost Demonstration (C/S-26) project and reference area boundaries.

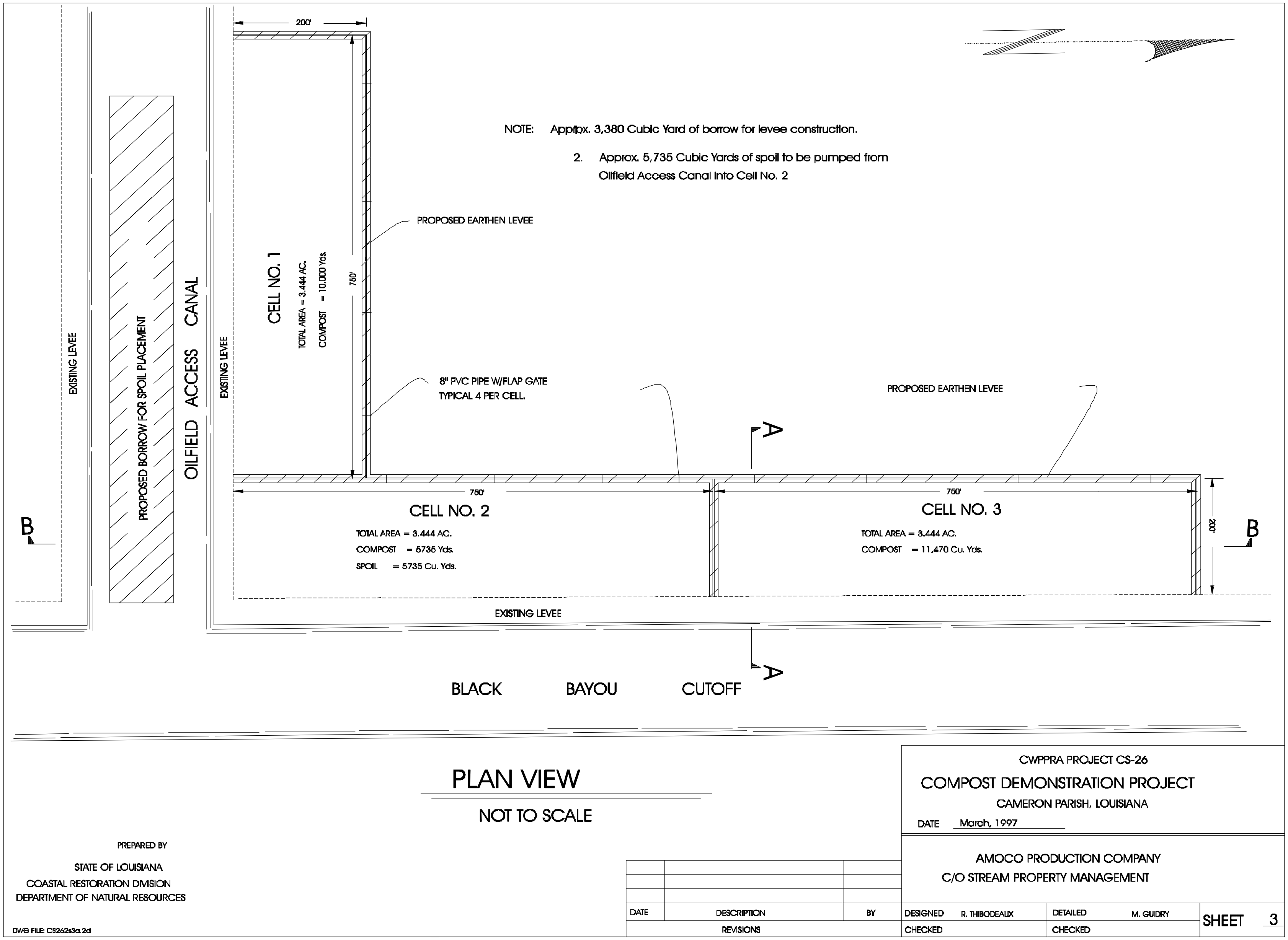

Figure 2. Plan view of Compost Demo (C/S-26) Project.

underlying area for the new levee construction. The levees will be built to settle to an elevation of 3 ft (0.9 m) by excavating marsh soils from adjacent borrow canals. After three years, the constructed levees should be eroded to marsh level at which time any existing levee will be removed manually. Twelve 8 ft (2.4 m) sections of 8 in (20 cm) diameter PVC with external flap gates will be installed in the levees during construction, to allow for water level control during compost and dredge material placement. After cell contents have settled, the PVC pipes will be removed. Cells 1 and 3 will receive approximately 10,000 yd^3 (7,646 m^3) and 11,470 yd^3 (8,770 m^3) of compost material respectively, and cell 2 will receive approximately 5,735 yd^3 (4,385 m^3) of compost material mixed to a slurry with an equal amount of dredge material. Each cell is expected to settle to a height of +1.5 ft (0.46 m) NGVD (EPA 1997).

Project Objectives

1. Evaluate effectiveness of using tree trimmings as compostable material and compost amended material in providing a growth medium for emergent vegetation.

2. Determine settlement rates of the compost amended materials and tree trimmings.

Specific Goal

The following goal will contribute to the evaluation of the above objectives:

1. Increase coverage of emergent marsh vegetation by addition of compost to project area and compare effectiveness of treatment cells.

Reference Area

The importance of using appropriate reference areas cannot be overemphasized. Monitoring on both project and reference areas provides a means to achieve statistically valid comparisons, and is therefore the most effective means of assessing project success. Various locations in the vicinity of the project area were evaluated for their potential use as a reference area. The evaluation of sites was based on the criteria that both project and reference areas have similar vegetative community, soil, hydrology, and salinity characteristics. The area adjacent to the southern boundary of the project area (figure 1) satisfies these criteria. Both project area and the proposed reference area are classified as intermediate marshes (Chabreck and Linscombe 1988), and both contain mainly the Gentilly muck soil type (USDA-SCS 1995). Both the project area and the reference area are bordered by an oil field keyhole and Black Bayou Cutoff.

The proposed reference area will be used in the evaluation of the vegetation monitoring element. Similar vegetation plots in the project and reference areas will be established for comparison purposes.

Monitoring Limitations

The following is a discussion of possible deleterious effects of using compost for marsh creation. Although potentially important, monitoring of these effects is beyond the scope of this monitoring plan. The TAG recommends that any water quality monitoring to assess environmental impacts from the project should be funded separately.

There is no reason to expect that dissolved oxygen (DO) or soil Eh in the compost marsh would differ from that in nearby natural marshes. Even pore water in natural wetlands is devoid of oxygen except in the upper few millimeters of soil (Mitsch and Gosselink 1984:88-146). Thus, absence of DO in the compost marsh would not be indicative of unnatural conditions. The intensity of oxygen starvation can be measured by soil Eh (Mitsch and Gosselink 1984:93-95; Faulkner et al. 1989), but indeed natural marshes in coastal Louisiana exhibit Eh low enough to allow even sulfate reducing bacteria and methane producing bacteria to be active (DeLaune et al. 1983, Burdick et al. 1989, McKee and Mendelssohn 1989, Nyman and DeLaune 1991). Thus, low Eh values would not be indicative of unnatural conditions in the compost marsh.

While it is highly likely that no difference in DO and soil Eh would be detected between the compost marsh and nearby natural marshes, the waters draining from the natural and compost marshes could differ in chemical composition, which could lead to different levels of stress on organisms in adjacent aquatic habitats. There are no relevant data from coastal marshes, but leachate from piles of wood chips might cause localized mortality in the Pacific northwest (Goudey and Taylor 1992; Samis et al. 1996; Taylor 1994; Taylor et al. 1996). This appears to be a new area of research; phenols resulting from the breakdown of lignin or resins produced by conifers seem to be the culprit and fish appear to be the victim (wood used for the C/S-26 Compost Demo Project will consist of a mixture of tree types including hardwoods and some conifers). See the discussion on the Bioremediation Discussion Group September18 to 25, 1997, for the source of the information (www.biogroup.gzea.com). Fish near the compost marsh would probably avoid the area where these naturally occurring compounds were concentrated enough to be toxic. Therefore, benthic communities should be the focus of any toxicity monitoring that is done in the area. The easiest way would be to compare benthic community composition and biomass between areas receiving drain water from the compost marsh and distant areas.

Monitoring Elements

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

1. Vegetation — To monitor species composition and % cover, a minimum of (5) 2.0 m^2 sampling plots will be established along a transect in each project cell and reference area using techniques described in Steyer and Stewart (1992). More specifically, the Braun-Blanquet method (Mueller-Dombois and Ellenberg 1974) will be utilized. Transects will be sampled in 2000 (immediately post-construction) and in 2001,

2002 and 2003. Descriptive observations of submersed aquatic vegetation will be noted.

2. Elevational Survey — To measure settlement of compost material due to decomposition and compaction, settlement plates will be deployed adjacent to each vegetation plot in 2000 (immediately post-construction) and measured in 2001, 2002 and 2003.

3. Sediments and Soils — To characterize soil condition over time, replicate soil cores will be taken in each vegetation plot and analyzed for % organic matter, bulk density, and soil salinity. Additional analysis will include carbon, nitrogen, and phosphorous concentrations along with pH levels and will be performed in 2000 (immediately post-construction) and in 2003.

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. The primary method of analysis will be to determine if differences exist in mean vegetation cover as evaluated by analysis of variance (ANOVA) that will consider cell treatments, time, and area. This model will determine if there is a detectable impact (e.g. increase in vegetation cover) in the project area after construction. Multiple comparisons will be used to compare means among different treatment cells and times. All data will be analyzed and transformed, if necessary, to meet the assumptions of normality and homogeneity of variances. The second set of hypotheses will be especially useful in partitioning the effects of natural events (i.e. storms, droughts) from the effects of the project. If H_o is not rejected, the possibility of negative effects will be examined. Ancillary observations will be used to aid in interpretation of results.

   Goal: Increase the occurrence (coverage) of emergent vegetation in the project area.

   Hypothesis:

   H_0: Occurrence of emergent vegetation within project cell-k at timepoint j will not be significantly greater than the occurrence of emergent vegetation within project cell-k at timepoint i.

   H_a: Occurrence of emergent vegetation within project cell-k at timepoint j will be significantly greater than the occurrence of emergent vegetation within project cell-k at timepoint i.

   Hypothesis:

H_0: Occurrence of emergent vegetation within project cell-k postconstruction will not be significantly greater than the occurrence of emergent vegetation within the reference area after construction.

H_a: Occurrence of emergent vegetation within project cell-k postconstruction will be significantly greater than the occurrence of emergent vegetation within the reference area after construction

Notes

1.	Implementation:	Construction Start:	August 1, 1999
		Construction End:	December 31, 1999
2.	EPA Point of Contact:	Jeanene Peckham	(504) 389-0736
3.	DNR Project Manager:	Garrett Broussard	(318) 893-3643
	DNR Monitoring Manager:	David Castellanos	(318) 893-3352
	DNR DAS Assistant:	Mary Horton	(504) 342-4122

4. The twenty year monitoring plan development and implementation budget for this project is $75,548. Progress reports will be available in 2001, 2002, and 2003, and a comprehensive report will be available in 2004. These reports will describe the status and effectiveness of the project.

5. EPA has concerns about water quality issues in the outfall area of the project. It was decided at the Sept. 23, 1997 TAG meeting that further discussion would take place between EPA and LDNR to address these issues. These concerns are addressed in the Monitoring Limitations section of this monitoring plan.

6. Concentrations of carbon, nitrogen, and phosphorous are not of primary concern. The ratios of carbon to nitrogen and nitrogen to phosphorous are of more importance in analysis of the decomposing tree trimmings.

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