ATCHAFALAYA SEDIMENT DELIVERY PROJECT (AT-02)

I. INTRODUCTION

I.1. Project Description

The Atchafalaya Sediment Delivery (AT-02) restoration project is a distributary channel maintenance and delta-lobe island creation project included in the Louisiana Coastal Wetlands Restoration plan second Priority Project List Report. The project is located in the northeastern region of the Atchafalaya Delta in St. Mary Parish, Louisiana (figure 1). The National Marine Fisheries Service federally sponsored the project. The AT-02 project consists of 2,182 acres of freshwater wetland and shallow open water within the Louisiana Department of Wildlife and Fisheries Atchafalaya Delta Wildlife Management Area, and is bounded on the north by Mile Island, on the west by East Pass, and on the east and south by Atchafalaya Bay. East Pass is a secondary distributary channel located on the eastern side of the Atchafalaya delta. Natal Channel and Castille pass are tertiary channels on the east side of East Pass. The Atchafalaya Sediment Delivery Project included re-opening the silted in Natal Cannel of some 8,800 linear feet with a 1,500-foot branch 7,400 down from East Pass; and re-opening the Castille Pass from its entrance for 2,100 linear feet. A project feature change occurred during the planning stage, when the alignment of Natal Channel was adjusted southward to avoid potential landowner conflict. During the construction of AT-02 there were several field changes (see section III.2) most notably were the reduction of the bottom width of Castille Pass from 190’ to 125’, and going from five contained disposal areas to three contained and two uncontained disposal areas.

The original project boundary did not encompass all of the features built and was revised to include them.

I.2. Project Personnel

Project Phase	Name	Position	Agency
Planning	Dr. Erik Zobrist	Project Manager	NMFS
Implementation	Mr. Rickey Ruebsaman	Local Supervisor	NMFS
Planning	Mr. Van Cook	Project Manager	LDNR
Implementation	Mr. Herb Juneau	Project Engineer	LDNR
Planning	Mr. Ivor Van Heerden	Research Scientist	LDNR
Planning	Mr. Greg Linscombe	Program Manager	LDWF
Planning	Mr. Mike Carloss	Assist. Program Manager	LDWF
Planning	Mr. Ike Mayer	Engineer Manger	BCG
Planning	Mr. Tome Windes	Job Superintendent	RRCC

Monitoring	Mr. .John Rapp	Monitoring Manager	LDNR
Monitoring	Mr. Chuck Armbruster	Biologist	LDNR
Monitoring	Mr. Erik Webb	Biologist	LDNR
Monitoring	Mr. Mark Fugler	Biologist	LDNR
Monitoring	Mr. John Bouregois	Biologist	LDNR
Inspection	Mr. Ira Netadire	Inspector	BCG
Inspection	Mr. Mark Dawsey	Inspector	BCG

II. PLANNING

II.1. Causes of Loss

What was assumed to be the major cause of land loss in the projected area?
First, let's start off by saying that there was no land lost in the Project Area. The area was slowly accreting from deposits of sediment from flows off the Atchafalaya River.

The Atchafalaya delta is bisected by the Lower Atchafalaya River navigation channel, which is maintained by the USACE for navigational purposes. Dredged material on the channel banks and increased channel depth have reacted to unnatural conditions forming an efficient conduit for river sediment to the Gulf of Mexico depriving the adjacent delta environments of sediment critical to the delta-building process. Also, distributary channels in the eastern portion of the Atchafalaya delta have undergone large reductions in cross-sectional area and flow efficiency, further reducing sediment delivery to the delta lobes (LDNR 1998, Gotech 1996).

While land loss had not occurred in the project area prior to project construction, the Atchafalaya Basin's rate of land loss from 1956 to 1978 and 1978 to 1990 was 0.1 mi^2/yr (figure 2). Loss of natural deltaic lobes was offset in these periods by the creation of dredge material islands throughout the Atchafalaya Delta by the USACE, as well as the progradation of the Wax Lake Delta. Therefore, though the Basin is slowly losing land, the actual rate of naturally lobe loss in the Atchafalaya Delta is likely masked by anthropogenic activities in the eastern basin and the emergence of the Wax Lake Delta to the west.

What were assumed to be the additional causes of land loss in the projected area?
Contributing to the reduction of land gain in this area are natural causes including, but not limited to, wave action (erosion), storm events, and herbivory. Subsidence rates are estimated to be 1.1-2.0 ft/century (Coast 2050 Region3 Atchafalaya Marshes Mapping Unit).

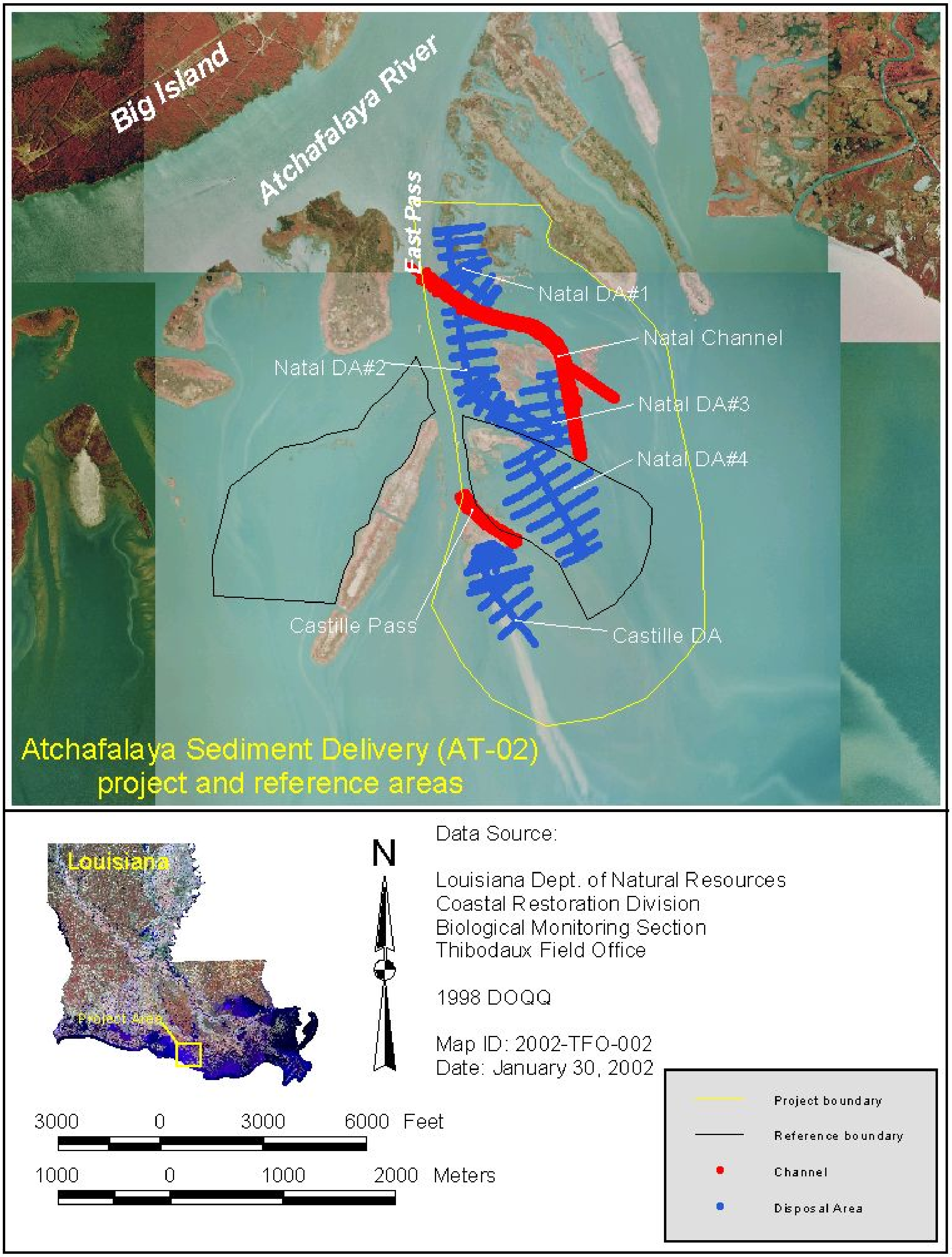

Figure 1. Atchafalaya Sediment Delivery (AT-02) project and reference area boundaries and features constructed.

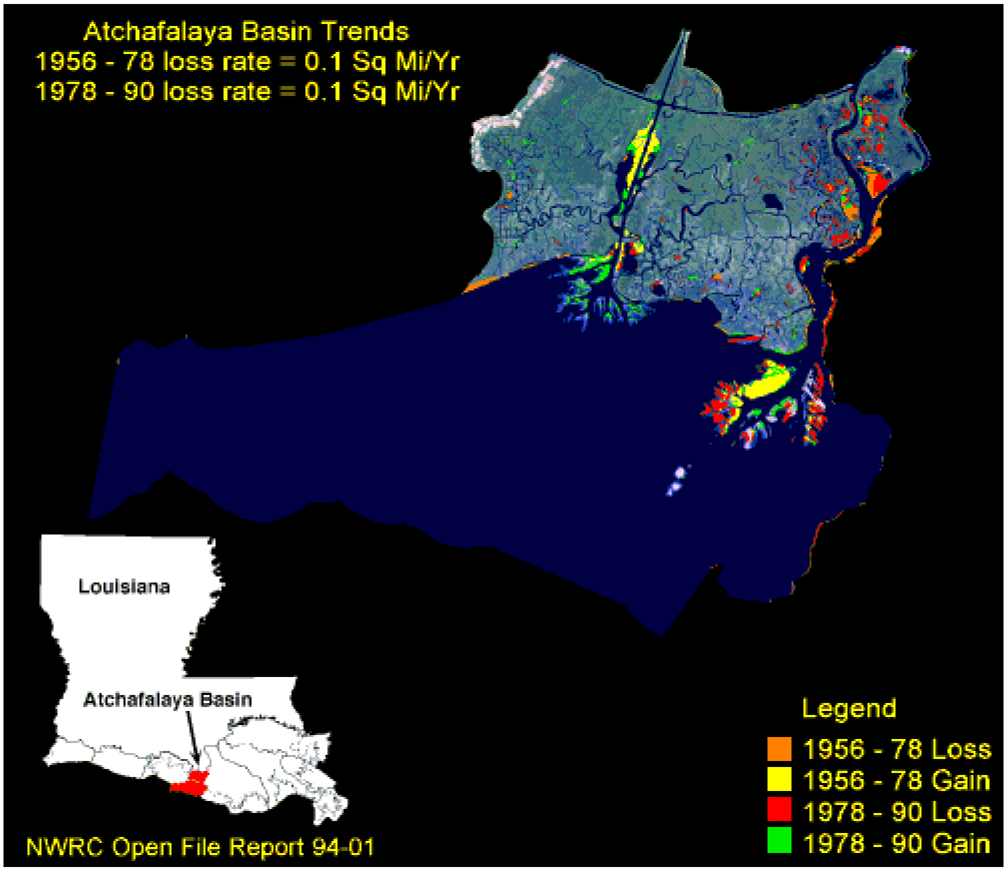

Figure 2. Areas and rates of land loss in the Atchafalaya Basin from 1956-1990.

II.2. Background

The Atchafalaya delta is a part of the Atchafalaya Bay delta complex, which also includes the Wax Lake delta located in western Atchafalaya Bay. The Atchafalaya delta and the Wax Lake delta formed in the shallow Atchafalaya Bay between the mouth of the Atchafalaya River navigation channel and the Point Au Fer shell reef. The Atchafalaya River has been a distributary of the Mississippi River since the 1500s and is typical of diversion or capture of mainstream flow by a distributary (van Heerden and Roberts 1980). In 1963 the Old River control structure was completed by the U.S. Army Corps of Engineers (USACE) and has since maintained the flow of the Atchafalaya River at the historical rate of 30% of the combined flow of the Mississippi and Red Rivers (Louisiana Coastal Wetlands Conservation and Restoration Task Force 1993). A subaqueous delta began to form at the mouth of the Atchafalaya River between 1952 and 1962 with the introduction of silts and fine sands to the bay. Prior to 1952 the lakes and bays within the Atchafalaya Basin floodway system, north of the Atchafalaya Delta, filled with sediment. Only prodelta clay deposition was occurring in the Atchafalaya Bay due to contact with higher salinity water (Louisiana Coastal

Wetlands Conservation and Restoration Task Force 1993). From 1962 to 1972 coarser materials began to be deposited into the Atchafalaya Bay and a period of distal bar and subaqueous bar accretion occurred (van Heerden and Roberts 1980). The spring flood of 1973 produced the first subaerial growth of the Atchafalaya Delta on both sides of the navigation channel with a total area of 1.95 mi_2 (5.1 km_2). During the progradational phase of delta growth, which occurred between 1973 and 1976, deposition of coarse sediment accounted for growth of new land at an average rate of 2.05 $mi^2 yr^{-1}$ (5.3 $km^2 yr^{-1}$). From 1977 to 1990 (a period of channel abandonment and lobe fusion) growth occurred at an average of 0.75 $mi^2 yr^{-1}$ (1.9 $km^2 yr^{-1}$) to form its present subaerial expression of 11.31 mi^2 (29.4 km^2)(van Heerden et al. 1991).

II.3. Project Goals and Objectives

WVA:

1. re-establish the natural sediment delivery system in this portion of the Atchafalaya delta.
2. enhance the system's natural delta building potential.

EA:

1. enhance the eastward development of the emerging lower Atchafalaya River delta and its adjacent coastal wetlands.

Monitoring Plan (6/96)
Objectives:

1) Restore Natal Channel and Castille Pass to functioning tertiary distributary channels thereby enhancing the system's natural delta-building potential.
2) Utilize dredged material from the dredging of Natal Channel and Castille Pass to create delta lobe islands suitable for establishment of emergent marsh.

Goals:

1) To increase the distributary potential of Natal Channel and Castille Pass by increasing their cross-sectional area and length.
2) Create approximately 230 acres of delta lobe islands through the beneficial use of dredged material at elevations suitable for emergent marsh vegetation.
3) Increase the rate of subaerial delta growth in the project area to that measured from historical photographs since 1956.

Monitoring Plan (7/98)
Objectives:

1. Restore Natal Channel and Castille Pass to functioning tertiary distributary channels thereby enhancing the system's natural delta-building potential
2. Utilize dredged material from the dredging of Natal Channel and Castille Pass to create delta lobe islands suitable for establishment of emergent marsh.

Goals:

1. To increase the distributary potential of Natal Channel and Castille Pass by increasing their cross-sectional area and length.
2. Create approximately 230 ac of delta lobe islands through the beneficial use of dredged material at elevations suitable for emergent marsh vegetation.
3. Increase the rate of sub-aerial delta growth in the project area to that measured from historical photographs since 1956.
4. Increase frequency of occurrence of submerged aquatic vegetation.

How were the goals and objectives for the project determined?
See Section II.1.

Are the goals and objectives clearly stated and unambiguous?
Yes. However, goals and objective have changed slightly during the project development, which can lead to different interpretations.
For example; goal one of the WVA should define natural sediment delivery and identify success criteria, and goal two should set a target. In the EA, the term enhance is ambiguous, i.e. mention target(s) and/or range of accretion desired. In the monitoring plans, goal one should identify distributary potential, very different, as range depends upon river stage, goal two should identify the number of islands to be created, along with elevational range with percent of acres and vegetation species associated with those ranges and identify range for acreage, goal three should define rate and add range of dates, i.e. 1973-76 or 1977-90, goal four conflicts with goals 1, 2, and 3. This objective was not in the original monitoring plan, if SAV remains a project objective then use density or species composition instead of frequency.

Are the goals and objectives attainable?
Yes. However, goals and objective have changed slightly during the project development, which can lead to different interpretations.

Do the goals and objectives reflect the causes of land loss in the project area?
N/A

III. ENGINEERING

III.1. Design Feature(s)

What construction features were used to address the major cause of land loss in the project area?
The construction feature used was hydraulic dredging to reopen Natal Channel and Castile Pass, two streams that flow from East Pass of the Atchafalaya River to the east toward Four League Bay and Point au Fer Island. Natal Channel had become completely plugged over the years and the head of Castille Pass had become partially plugged. The two plugged streams impeded the flow of

sediment-rich Atchafalaya River water toward the east to high land loss areas in the marshes of western Terrebonne Parish.

The dredged material from the above dredging operation was used to build wetlands in the immediate project area.

What construction features were used to address the additional causes of land loss in the project area?
No action was taken.

What kind of data was gathered to engineer the features?
<u>Conceptual Stage:</u>
1. A non-intensive survey of the Natal and Castille Pass channels was performed by Brown Cunningham Gannuch, the Engineer for the project. An intensive survey was performed of the mouth of the East Pass.
2. Modeling was performed of the hydrology of the mouth of the Atchafalaya River. This modeling included East Pass from which the two subject channels flow, but neither Natal Channel nor Castille Pass were modeled.
3. Aerial photography was collected and reviewed.
4. Numerous discussions were had with Louisiana Wildlife and Fisheries in regard to the type of wetlands that should be constructed in their refuge where this project is located.
5. The extensive research literature on this area by Ivor Van Heerden and others was reviewed and discussions were had with him.
6. COE dredging operations in the area involving beneficial use of dredged material were studied through published dredge cycle reports.

<u>Design Stage:</u>
1. Geotechnical tests were performed across the project area (Gore Engineering 1995). A single soil boring was taken at the head of Natal Channel, at the end of Natal Channel (proposed bifurcation), and at the head of Castille Pass.
2. Additionally, intensive and non-intensive surveys were conducted. The intensive readings were a detailed $30,000 survey performed of the entrance to East Pass. We had thought it was too shallow for construction equipment to pass to do the AT-02 dredging and we were considering dredging it open. The survey by Brown, Cunningham and Gannuch showed the pass to be deep enough and no dredging was required.

The non-intensive readings were spot survey readings taken to determine water elevations around mainly the Big Island project area. Some spot readings may have been taken in the vicinity of the Atchafalaya Sediment Delivery project, but no official record of them exists.

What engineering targets were the features trying to achieve?
A major target was increased flow of Atchafalaya River water to the east. The increased flow of water was supposed to eventually create 1900 acres, restore 15 acres, and protect 32 acres (WVA). However, no specific calculations for flow

were made by the engineering group to verify the creation, restoration, and protection of 1947 acres.

The target for creation of wetlands in the immediate project area with the dredged material was 185 acres. The wetlands created were to be a combination of deposits ranging from +3 ft to +1.5 ft. NGVD (BCG, 1995).

III.2. Implementation of Design Feature(s)

Were construction features built as designed? If not, which features were altered and why?
Project design features (table 1) were established with an elevation datum that has been shown to be 0.75 feet lower than actual datum, resulting in higher finished elevation than desired. Thus, reducing the number of constructed wetland acres created.

Several features were altered either during design or during construction:

1. **Design.** Natal Channel was conceptually intended to split into two smaller channels near its end, one channel passing along the north side of Teal Island and the second channel passing along the south side of Teal Island. At the request of DNR's legal department, the northern (more active) channel was deleted. It is believed they felt the northern channel could cause a land buildup from existing spoil islands to the mainland and that spoil islands so connected to the mainland could be claimed by a landowner.
2. **Construction Field Change No 1.** The planned bottom width of Castille Pass was changed from 190 ft to 125 ft. The decision to do this was made in the field when it became apparent that the natural bed of the channel was only about 125 ft wide and widening it would cause damage to an island on one side of the planned channel and to a well developed marsh on the other side
3. **Construction Field Change No 2.** During construction, it became obvious that the revised Natal Channel (see above discussion) was not going to be hydraulically adequate because of the deletion of the more active northern split of the channel. For that reason, revisions were made to the channel as it passed south of Teal Island in an attempt to make it more efficient. It was substantially lengthened by 1400 ft. In addition, a 1500 ft Long Branch channel was constructed from the main channel at a point 1,800 ft from the end of main channel. This branch channel was constructed in an eastern direction to reach deeper water in four league bay.
4. **Redredging of Head of Natal Channel.** Several months after completion of planned dredging of Natal Channel, it was noted that a shoal had developed at the head of Natal Channel reducing the depth from 10 ft to 5 ft. Hydraulic dredging was used to eliminate the shoal and, in an attempt to prevent a recurrence, dikes were constructed on opposite sides of the channel entrance creating, in effect, a jetty system.
5. **Confined disposal areas.** Natal disposal area number 4 and Castille Pass disposal areas not contained as originally planned.

6. **Containment area dike alignment.** In those disposal areas contained, some dike alignments were modified to accommodate the channel.
7. Some dredge material (amount is unknown) was placed at the toe of Rodney Island (as seen on aerial photography), however, its influence on the vegetative communities of Rodney Island is unknown.

Table 1. AT-02 project features

Structure_ID	Structure Class	Structure Description	Proposed	Bid/Designed	Built
Castille Pass Channel	Dredge Channels	2108' channel w/125' bottom width to -10.5' NGVD29; 1V:3H side slopes		Yes	Yes
Castille DA	Disposal/Fill/Marsh Creation	Unconfined disposal area to elevation of +1.0' NGVD29; 20.66 acres		No	Yes
Natal DA4	Disposal/Fill/Marsh Creation	Unconfined disposal area to elevation of +0.5' NGVD29; 94.77 acres		No	Yes
Natal DA1	Disposal/Fill/Marsh Creation	Confined disposal area to elevation of +2.0' NGVD29; 47.53 acres		No	Yes
Natal DA2	Disposal/Fill/Marsh Creation	Confined disposal area to elevation of +3.0' NGVD29; 70.07 acres		No	Yes
Natal DA3	Disposal/Fill/Marsh Creation	Confined disposal area to elevation of +2.0' NGVD29; 47.49 acres		No	Yes
Natal Channel	Dredge Channels	6900' channel w/190' bottom width to -10.0' NGVD29; 1V:2H side slopes		Yes	Yes
Natal Containment DA1	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		No	Yes
Natal Containment DA2	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		No	Yes
Natal Containment DA3	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		No	Yes
Natal Branch A	Dredge Channels	1500' channel w/150' bottom width to -10.0' NGVD29; 1V:2H side slopes		No	Yes
Natal Channel End	Dredge Channels	1400' channel w/150' bottom width to -10.0' NGVD29; 1V:2H side slopes		Yes	Yes
Natal TD1	Containment Dike/ Spoil Bank/Levee	Earthen Dike from redredged Natal Channel from 12+00 to 21+00; material bucket dredged and placed		No	Yes
Natal TD2	Containment Dike/ Spoil Bank/Levee	Earthen Dike from redredged Natal Channel from 12+00 to 21+00; material bucket dredged and placed south of Natal Channel to construct a		No	Yes
Castille containment-pre	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		Yes	No
Natal Containment DA1-pre	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		Yes	No
Natal Containment DA2-pre	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		Yes	No
Natal Containment DA3-pre	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		Yes	No
Natal Containment DA4-pre	Containment Dike/ Spoil Bank/Levee	Top dike elevation to +3.0' NGVD29; gapped after construction		Yes	No
Castille DA-pre	Disposal/Fill/Marsh Creation	Confined disposal area to elevation of +1.0' NGVD29; 39.9 acres		Yes	No
Natal DA1-A	Disposal/Fill/Marsh Creation			Yes	No
Natal DA5	Disposal/Fill/Marsh Creation			Yes	No

III.3. Operation and Maintenance

Were structures operated as planned? If not, why not?
There are no structures to be operated, however, there is $384,585.00 budgeted for maintenance of this project. No maintenance of any nature has been performed on the Project since the construction of same was completed. The re-dredging of the head of Natal Channel, see III.2.4, was completed during the construction of the Big Island Mining Project (AT-03) and construction funds from AT-02 were used.

Are the features still functioning as designed? If not, why not?
Castille Pass has remained free of plugging although some solids buildup is occurring mainly at the head of the Pass. Natal Channel is a different story. There is some loss of depth at the head of the channel. There is substantial loss of depth in the channel as the channel makes the turn to the south around Teal Island. The longevity of the Natal channel, section B, is in doubt. Natal channel section B is the portion of the channel as it curves around Ivor Island. It should be noted, however, that the deleted north channel is attempting to form on its own. It is the opinion of this group that the Natal Channel would have been much healthier had the north split channel been dredged as originally planned

Created marsh
The functionality of a building delta environment has not been adequately identified. Though functions have not been detailed, typical early successional vegetation communities have been well studied and described (Johnson et. al. 1985, Sasser and Fuller 1988, Schaffer et. al. 1992, Montz 1975). Johnson et. al. 1985 described typical early successional vegetative communities on an Atchafalaya Delta lobe: a dominant *Salix nigra* community at the head of the island, a thinner cover of *S. nigra* with a fairly dense herbaceous understory of *Colocasia esculenta*, *Scirpus americanus*, and others just downstream of the island head. Also immediately downstream of the *Salix nigra* head, and therefore biotically influenced by the presence of *S. nigra*, is a distinct *Typha latifolia* community. Continuing downstream along the steepest elevational gradient is a species rich seasonal vegetative community which grades into a community comprised mainly of *Sagittaria latifolia* and *Sagittaria platyphylla* at the lowest elevations (figure 3).

The designated reference island, as part of the monitoring effort, is Rodney Island. Rodney Island was one of six delta lobes used by Johnson et. al. (1985) to classify vegetative associations in the Atchafalaya Delta, therefore, the above description embodies the desired community assemblages. While we have components of each association across the created delta lobes, the vegetative communities on these created lobes were not similar to those on Rodney Island,

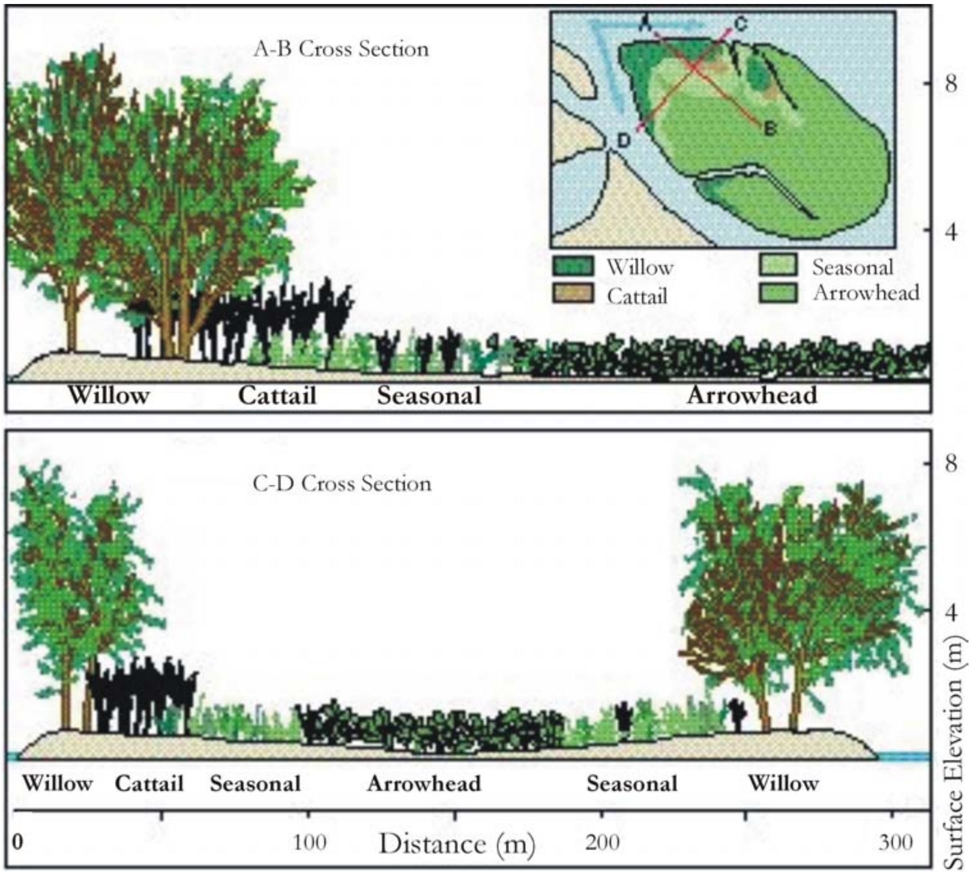

Figure 3. Typical early successional vegetative establishment on an Atchafalaya Delta lobe (reproduced from Johnson et. al. 1985).

as indicated by Non-metric Multidimensional Scaling of early successional vegetation cover value data.

Was maintenance performed?
See above

IV. PHYSICAL RESPONSE

IV.1. Project Goals

Do monitoring goals and objectives match the project goals and objectives?
Using the WVA as project goals, the WVA and monitoring plan goals do not match. However, the intent of both documents do match.

Candidate Project Fact Sheet Objective was listed as "create vegetated wetlands using sediments dredged for normal maintenance of the Atchafalaya Bay channel".

The 2nd Priority Project List Report listed the objective as "to re-establish the natural sediment delivery system in this portion of the Atchafalaya Delta and to enhance the system's natural delta building process." It continued that this was to be done "by dredging open Natal Channel and Ratcliffe Pass".

The Draft EA stated the objective as "to enhance the eastward development of the emerging lower Atchafalaya River Delta and its adjacent coastal wetlands". It would achieve this "by dredging open two primary distribution channels" and placing dredge material "strategically at five disposal sites along the new channels to further enhance delta development to the east".

The Monitoring Plan lists the objectives as: "1) restore Natal Channel and Castille Pass to functioning tertiary distributary channels thereby enhancing the system's natural delta-building potential, and 2) utilize dredge material from the dredging of Natal Channel and Castille Pass to create delta lobe islands suitable for establishment of emergent marsh".

All supporting documents do not have enough specific targets to adequately measure project success.

IV.2. Comparison to adjacent and/or healthy marshes

Attempt to answer the following (if a component is not applicable to the project or data availability is an issue, please indicate this in each section):

IV.2.1. Elevation

What is the range of elevations that support healthy marshes in the different marsh types?
Charles Sasser (personal communication) indicated that during vegetation surveys from 1978 to 1998 a benchmark was used to establish elevations on Rodney Island. They were unsure however of the datum, date of establishment, and accuracy of the benchmark. Thus we do not know. If possible, DNR may want to include this benchmark in the next survey of the surrounding areas.

While we do not know the elevations of vegetation plots on Rodney Island, we do know that vegetative community establishment and persistence on natural delta lobes is largely a function of elevation and typically occupies discrete elevation ranges (Johnson *et. al.* 1985). Since elevation of lobes in the eastern Atchafalaya Delta is an influential factor on plant communities, we were interested in whether vegetative communities on created lobes were also influenced by elevation. On our created lobes, one growing season after marsh creation (1998), the vegetative communities did not show response to elevation, but by the third growing season after creation (2000), elevation was significantly correlated (r^2=0.32) to ordination axis scores. Therefore, by the third growing season, plant communities were established along an elevational gradient.

By 2000, when the plant communities were first noticed to have colonized and persisted along an elevational gradient, it was felt that elevation ranges for each habitat type could be interpolated using digital elevation models generated using the spatial analyst and 3D analyst extensions in ArcView. Using individual polygons delineated in the habitat mapping process, underlain with digital elevation models, elevation ranges for each habitat types establishment have been determined (Table 2). These elevation ranges are likely going be dynamic over the course of the projects life as other factors co-influence the lobe such as flooding, accretion, herbivory, subsidence, possible dredge impacts, and drought. However, these ranges may prove useful as a planning tool for other projects in the Atchafalaya Delta.

Table 2. Pre- and post-construction elevation ranges on select disposal areas in the Atchafalaya Sediment Delivery (AT-02) project area. Ranges were determined using 1998 and 2000 habitat mapping overlain on digital elevation models generated using topographic data from the same years.

	Elevation Ranges (feet) of Habitat Types: As-built and Three Growing Seasons Following Construction			
	Natal Disposal Area #1		Natal Disposal Area #4	
	1998	2000	1998	2000
Beach/Bar/Flat	0.72 - 1.54	*N/A*	-0.26 - 2.66	0.59 - 1.61
Fresh Marsh	0.23 - 4.63	1.25 - 1.77	1.74 - 2.62	1.54 - 1.94
Wetland Forested	*N/A*	1.35 - 3.61	*N/A*	Survey missed habitat type

Does the project elevation fall within the range for its marsh type?
We do not know if the created lobes fall within the elevation range of natural lobes. Elevation ranges of early successional communities (1980 and 1982), though they may not be applicable in the evaluation of created lobe elevations, range from 0.03 to 1.18 feet.

Did the project meet its target elevation?
See section III.2.

What is the subsidence rate and how long will the project remain in the correct elevation range?
Coast 2050 Region 3 Atchafalaya Marshes Mapping Unit lists a subsidence rate of 1.1-2.0 ft/century. As long as the channel is maintained sediment delivery should be able to offset subsidence.

IV.2.2. Hydrology

What is the hydrology that supports healthy marshes in the different marsh types?
Target species for this area are adapted for survival in the hydrologic regime of this project. However, we cannot compare to adjacent natural marshes because of lack of elevation data.

Does the project have the correct hydrology for its marsh type?
As stated above the species predicted are suitable for the predicted hydrology.

What were the hydrology targets for the project and were they met?
There were no project targets for water flow stated.

IV.2.3. Salinity

What is the salinity regime that supports healthy marshes in the different marsh types?
The WVA gave a baseline salinity of 1 ppt during the growing season predicting a rise to 2 ppt without project and a reduction to 0.5 ppt with project. Salinity was not included in the monitoring plan.

Does the project have the correct salinity for its marsh type?
The project will remain within the salinity range for fresh marshes.

What were the salinity targets for the project and were they met?
No salinity targets were set.

IV.2.4. Soils

What is the soil type that supports healthy marshes in the different marsh types?
St. Mary Parish Soil Survey was last published in 1959, it currently being revised. Project Soil Type: Balize - Fine-silty, mixed, superactive, nonacid, hyperthermic; good potential for wetland plants, shallow water areas and wetland wildlife.
Balize soil characteristics are:

Bulk density	0.25-1.00 g/cc
Percentage organic matter	15-40% clay content
Soil salinity	0-2 mmhos/cm

Does the project have the correct soil for its marsh type?
Do not know for certain because we have not looked into soil characteristics of deposit areas after construction to correlate species zonation to soil type. It is accepted that the project will accelerate deposition of the same material that is currently being deposited.

IV.2.5. Shoreline Erosion

How have shoreline erosion rates changed in the project area compared to nearby reference areas?
No shoreline erosion rates were mentioned in the project documentation.

IV.3. Suggestions for physical response monitoring

Are there other variables that could be monitored to substantially increase the ability to understand the results of the project?
See section V.3.

V. BIOLOGICAL RESPONSE

V.1. Project Goals

(AT-02 Monitoring Plan: originally written – June 26, 1996, revised June 23, 1998) The project objectives are to restore Natal Channel and Castille Pass to functioning tertiary distributary channels, thereby enhancing the systems natural delta-building potential and utilizing the dredge-material with the intent to create delta lobe islands suitable for the establishment of emergent marsh. The specific goals established to evaluate the effectiveness of the project are:

1. Increase the distributary potential of Natal Channel and Castille Pass by increasing their cross-sectional area and length.
2. Create approximately 230 acres of delta-lobe islands through the beneficial use of dredged material at elevations suitable for emergent marsh vegetation.
3. Increase the rate of subaerial delta growth in the project area to that measured from historical photographs since 1956.
4. Increase the frequency of occurrence of SAV.

V.2. Comparison to adjacent and/or healthy marshes

V.2.1. Vegetation

What is the range in species composition and cover for healthy marshes in each type?
The majority of work on early vegetative succession in the Atchafalaya Bay area was performed by Johnson et al. (1985) and Sasser and Fuller (1988), with the earliest known work by Montz (1975). The former have established the description that typifies an Atchafalaya Delta lobe: a dominant *Salix nigra* community at the head of the island, immediately downstream of the *Salix* dominated island head is a discrete *Typha latifolia* community, further downstream is a dense, seasonal, herbaceous community comprised of *Colocasia esculenta, Scirpus americanus*, and other species with a thin cover of *S. nigra*, and continuing downstream is a community comprised mainly of *Sagittaria latifolia* and *Sagittaria platyphylla*. In short, there form three vegetative

associations: 1) *Salix nigra*, *Typha* sp., and *Sagittaria* spp. associations (Figure 3). Cover in Atchafalaya Delta freshwater marshes is seasonal, but typically approaches 100%.

Submerged aquatic Vegetation (SAV) was sampled in 1998 and 2000. To date, the frequency and occurrence of SAV within the project area has been difficult to evaluate due mostly to the drought experienced by southern Louisiana immediately following construction. Since SAV are influenced by both water level and salinity (both influenced by drought), the 2000 sampling period yielded little data.

Does the project have the correct species composition and cover for its type?
In comparisons to early succesional communities on Rodney Island (1980 and 1982), the species composition on the created lobes is different than that on the natural lobes. However, as stated above, it is not known whether the elevations on natural and created lobes is similar or different, and since these communities have a tendency to colonize along an elevational gradient, we must know elevations on our reference communities to make reasonable comparisons.

What were the vegetation targets for this project and were they met? If not, what is the most likely reason?
Vegetation targets were included in the project goal, which stated: Utilize dredge material from the dredging of Natal Channel and Castille Pass with the intent to create delta lobe islands at elevations suitable for the establishment of emergent marsh vegetation. Habitat mapping in 1998 and 2000 indicate large areas colonized by wetland forested, thereby not achieving the original stated goal of creating emergent marsh.

Figure 4 shows habitat type in 1998 (left) one growing season after dredging, and if the habitat converted to another by the third growing season in 2000 (right). Those areas with no color indicating a habitat type in 2000 were areas of no change. The amount of *Salix nigra* dominating the disposal areas is likely due to high elevations across the created lobes. Increased elevations are partly due to errors incorporated into the original survey. The contracted party delivered elevation data that was consistently 0.75 feet lower than its true elevation. This error was discovered in 2001 and all survey files were corrected, but the area had been built higher than specified due to these errors, and the result may be more areas of forested wetland. Additionally, 0.75 feet may seem an insignificant distance, but as stated above, Rodney island only had an original range in elevation of approximately 1.2 feet. This only stresses the importance of quality

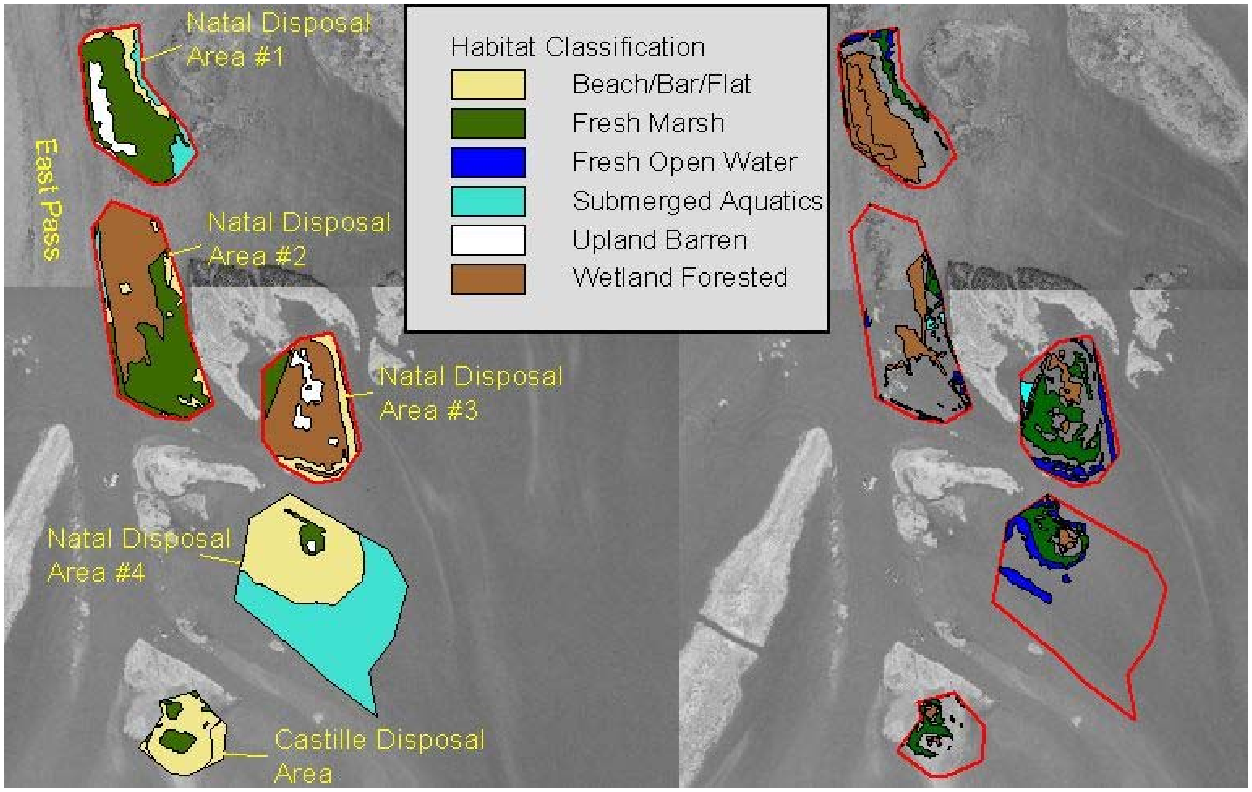

Figure 4. Habitat type on created lobes one growing season after dredging (1998, left) and habitat conversions three growing seasons after dredging (2000, right).

survey contractors and a reliable benchmark system from which to work. The latter of has been recently implemented.

If a certain marsh type is the goal for the project area, do the vegetation data suggest that we have the correct species composition. If not, is this due to one of the physical response variables.

V.2.2. Landscape

What is the range in landscapes that supports healthy marshes in different marsh types?
See above

Is the project changing in the direction of the optimal landscape? If not, what is the most likely reason?
The Delta has been changed so much because of USACE dredging operations that defining optimal has become challenging, especially in a landscape context. If you look in the vicinity of the project you'll only see a lot of dredge material disposal areas with sparsely interspersed naturally created lobes. Dredging has been so extensive throughout the delta that natural lobes are often covered by some dredge material (Rodney Island). This may lead to portions of fresh marsh

being converted to wetland forest and sometimes even upland barren. Therefore, optimal would be what is defined if you were to establish very strict goals for elevation, species composition, and soil properties.

V.2.3. Other

Herbivory has been noted by throughout the Delta as having severe implications on the successional progress of plant communities.

Exotic species. Non-native species have been found throughout the disposal areas. While we have found few noxious, invasive species, their mere presence threatens the future successional of the plant communities, and the assemblages of birds and other animals that utilize the area.

V.3. Suggestions for biological response monitoring

Are there other variables that could be monitored to substantially increase the ability to understand the results of the project?
Soil fertility of Atchafalaya River dredge material has never been examined by DNR, and to my knowledge has only been given cursory consideration in past USACE reports. Due to the vegetative communities on natural islands, and island morphology, that sediment laden waters interface with, a progression of sediment precipitation occurs: heavy, coarser-grain sands fall out of suspension first near the head of the island, with lighter silts and clays falling out of suspension as flood waters slow over the bottom portion of the herbaceously vegetated lobe. Through this process, each deltaic lobe grows in volume over time, but each soil particle has a varying ability to bind various nutrients - nutrients that may promote or inhibit growth of certain plant species. Basic soil tests examining soil texture would greatly expand our understanding of the types of sediment deposited over time by flood events. In terms of resource availability for plant community establishment and succession, soil nutrient tests could provide a much-needed insight. These are both simple, low-cost tests and should be incorporated into future monitoring plans.

Future surveys (pre-, as-built, and post) should be extended past the where the channels are proposed and built so we can assess whether the channels are extending themselves, or being captured by what may have been considered a hydrologically unimportant channel in the vicinity.

Water level measuring instruments should be deployed in the vicinity to determine the amount of time each island is flooded, what percentages of the islands are flooded at various river stages, and how those flood events are contributing toward plant community composition and soil characteristics.

It was found that traditional 2x2 meter plots used for vegetation sampling in 1998 and 2000 did not adequately sample the overstory (willow) that has developed on the disposal areas. The 2x2 m plot was used by LSU/CEI with a large degree of success on naturally created islands - presumably because the elevational range and soil textural class that willow thrives under is limited by natural processes and the size of the island.

VI. ADAPTIVE MANAGEMENT

VI.1. Existing improvements

What has already been done to improve the project?
Project benchmark elevation discrepancies have been identified and corrected.

VI.2. Project effectiveness

Are we able to determine if the project has performed as planned? If not, why?
Castille Pass appears to be working as designed while Natal Channel appears to be distributing more water than before the project, but rapidly reducing its ability to act as distributary channel because of shoaling. After just four years, it is too early to tell yet whether the project will create the 1,900 acres projected. However, it seems somewhat questionable that this expectation will be met. It is the opinion of this committee that the average creation of 95 acres per year will not be met.

What should be the success criteria for this project?

VI.3. Recommended improvements

What can be done to improve the project?
See section III.3, along with maintenance dredging of Natal Channel to –10 NGVD.

VI.4. Lessons learned

1. The hydrologic model should have included entire project area rather than specific channels to help identify natural developing areas. The model should include a sediment transport component. This exercise may also assist designers in better mimicking natural bifurcation and channel depths of the Atchafalaya Delta system.
2. Incorporation of more intensive, and accurate, pre- and post-construction surveys which include areas immediately outside construction area.
3. Develop well-defined project target(s).
4. Closer examination of project conceptual goals and verify the projected areas to be created.
5. Closer construction inspection. There was an apparent deposition of dredge material within the project reference area.

6. Habitat mapping of the project area at growing seasons one and three facilitated a better understanding of early succession of vegetative communities on dredge material. It was found that vegetation communities, on these created delta lobes, began to respond to the influences of elevation and the associated hydrologic gradient between the second and third growing seasons. In the case of this project, habitat mapping at growing season one was supplied by LDWF. However, if this is considered as a component of future dredge material monitoring plans, and the cost must be included within the LDNR/CRD budget, strong consideration should be given to postpone the mapping until after the dredge material has settled (this may change on a project by project basis). By waiting until dredge material settles, competition between plant communities for their preferred elevation range has largely taken place, and a reduction in the presence of annuals in the understory has occurred. This offset of monitoring will facilitate more reliable comparisons to reference islands and the budgeted monitoring funds can be better utilized. Additionally, by waiting for the above to occur, assessments of what has been created as a result of dredging will be a more accurate tool for future project planning.
7. There are some monitoring elements, that if conducted in the period immediately following construction, could greatly contribute toward the understanding of how quickly dredge material de-waters, and therefore, improve the planning of dredge material projects in the Atchafalaya Delta. The most notable are topographic and bathymetric surveys. In the case of this project, the dewatering and compaction processes may have been inaccurately captured by the as-built survey in October 1998 because it was surveyed during the same period as Big Island Mining (AT-03) - immediately following its construction phase which was six months later than AT-02. This is apparent through comparisons of elevation, using analysis of variance, between the as-built and post-construction survey conducted in October 2000. This test indicated no significant difference in elevation between 1998 and 2000. Due to the fluid nature of the dredge material placed in the AT-02 project area, the possibility of the dredge material not de-watering and decreasing in elevation was unlikely. Overall, close attention must be paid by engineering and monitoring sections to the logistics of monitoring variable implementation when trying to capture early construction processes. If this is collectively done, the loop of communication between groups can only strengthen the likelihood of future project success and understanding.

VII. SUPPORTING DOCUMENTATION

VII.1. Published References

Bourgeois, J. A. 1996, revised 1998. Monitoring Plan: PAT-2 Atchafalaya sediment delivery project. Baton Rouge: Louisiana Department of Natural Resources Coastal Restoration Division. 12 pp.

Johnson, W. B., C. E. Sasser, and J. G. Gosselink. 1985. Succession of vegetation in an evolving river delta, Atchafalaya Bay, Louisiana. Journal of Ecology 73:973-986.
Montz, G. N. 1975. Vegetation characteristics of the Atchafalaya River Delta. Louisiana Academy of Sciences 12:71-84.
Preliminary Geotechnical Investigation - November 1995 - Gore Engineering - Van Cook files
Sasser, C. E. and D. A. Fuller, eds. 1988. Vegetation and Waterfowl Use of Islands in Atchafalaya Bay. Final report submitted to Louisiana Board of Regents, 150 Riverside Mall, Suite 129, Baton Rouge, LA. Contract No. 86-LBR/018-B04.
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Van Heerden, I. L. 1983. Deltaic Sedimentation in Eastern Atchafalaya Bay, Louisiana. Louisiana Sea Grant College Program, Center for Wetland Resources. Louisiana State University, Bton Rouge, Louisiana. 117 pp.
Van Heerden, I. L. 1994. A Long Term Comprehensive Management Plan for Coastal Louisiana to Ensure Sustainable Biological Productivity, Economic Growth, and Continued Existence of its Unique Culture and Heritage. Natural Systems Management and Engineering Program, Center for Coastal, Energy and Environmental Resources, Louisiana State University, Baton Rouge, Louisiana. 31 pp.
Van Heerden, I. L., and H. H. Roberts. 1988. Facies Development of Atchafalaya Delta, Louisiana: A Modern Bayhead Delta. The American Association of Petroleum Geologists Bulletin 71 (4): 439-453.
Van Heerden, I. L., and H. H. Roberts, S. Penland, and R. H. Cunningham. 1991. Subaerial Delta Development, Eastern Atchafalaya Bay, Louisiana. GCSSEPM Foundation Twelfth Annual Research Conference Program and Abstracts.

VII.2. Unpublished Sources

Agency	Date	Contact	Document Type	Short Description	pages
DNR	1998	Van Cook	Engineering Closure Report	Brown, Cunningham, and Gannouch	129
DNR	1995	Van Cook	Engineering Summary Report	Brown, Cunningham, and Gannouch	31
DNR	1995	Van Cook	Engineering Design Report	Brown, Cunningham, and Gannouch	31
DNR	1995	Van Cook	Preliminary Geotechnical Investigation	Big Island Mining and Atchafalaya Sediment Delivery	35
NMFS	2000	John Foret	Priority Project Fact Sheet	Summary of Priority Project Lists 1-9	239
NMFS	1996	John Foret	EA	Gotech, Inc. Environmental Assessment	54
NMFS	1992	Patrick Williams	WVA	Wetland Value Assessment	12

VIII. PROJECT REVIEW TEAM

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APPENDIX A. PROJECT INFORMATION SHEET

Project Name and Number: AT-02 Atchafalaya Sediment Delivery
Date: March 11, 2002

INFORMATION TYPE	YES	NO	N/A	SOURCE
Fact Sheet	X			PPL 2, Web, Joy Merino/Erik Zobrist (NMFS)
Project Description	X			Joy Merino/Erik Zobrist (NMFS)
Project Information Sheet	X			Joy Merino/Erik Zobrist (NMFS)
Wetland Value Assessment	X			Joy Merino/Erik Zobrist (NMFS)
Environmental Assessment	X			Joy Merino/Erik Zobrist (NMFS)
Project Boundary (changed from original)	X			Joy Merino/Erik Zobrist (NMFS), GIS lab
Planning Data	X			Brown, Cunningham, Ganuch Report; Feasibility report. Van Cook (DNR)
Permits	X			Joy Merino/Erik Zobrist (NMFS), Van Cook (DNR)
Landrights	X			Van Cook (DNR), project location changes
Cultural Resources	X			In EA, Joy Merino (NMFS)
Preliminary Engineering Design	X			Joy Merino/Erik Zobrist (NMFS), Van Cook (DNR)
Geotechnical	X			Van Cook (DNR)
Engineering Design	X			Van Cook (DNR)
As-built Drawings	X			Van Cook (DNR)
Modeling Output	?			Brown, Cunningham, Ganuch Report: Van Cook (DNR)
Construction Completion Report	X			Brown, Cunningham, Ganuch Report: Van Cook (DNR)
Engineering Data	X			All surveys have been tied in (DNR)
Monitoring Plan	X			DNR, web www.saveLAwetlands.org
Monitoring Reports	X			DNR, web www.saveLAwetlands.org
Supporting Literature	X			Atchafalaya NMFS report (Shea Penland, Rick Raynie, Darin Lee), BUMP program (Shea Penland), Julie Waits Diss. (Joy Merino), LSU work (Jenneke Visser), Corps Lower Atch. Basin study (Richard Boe).
Monitoring Data	X			Additional DNR data since last Mon. rtp.
Operations Plan		X		
Operations Data		X		
Maintenance Plan: O&M Plan	X			In development (DNR)
Maintenance Data		X		
O&M Reports: Annual inspection rpts	X			1999 and 2000 reports avail (Herb Juneau)
Other				
Cost Share Agreement	X			DNR (was amended)
Data Needs:				
Compaction, soil cores, elevation				