LAKE HERMITAGE MARSH CREATION PROJECT (BA-42)

FINAL (95%) DESIGN REPORT
OCTOBER 2008

Coastal Protection and Restoration Authority of Louisiana

COASTAL WETLANDS PLANNING, PROTECTION, AND RESTORATION ACT

U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR

COASTAL WETLANDS PLANNING, PROTECTION, AND RESTORATION ACT

OFFICE OF COASTAL PROTECTION AND RESTORATION

UNITED STATES FISH AND WILDLIFE SERVICE

LAKE HERMITAGE
MARSH CREATION PROJECT
BA-42

PLAQUEMINES PARISH, LA

FINAL (95%) DESIGN REPORT
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1.0 INTRODUCTION

The Lake Hermitage Marsh Creation Project (herein referred to as BA-42) is located within the Barataria Hydrologic Basin in Plaquemines Parish, Louisiana, to the west of the community of Pointe a la Hache, and northwest of the community of Magnolia as shown in Figure 1. The Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Task Force approved BA-42 for Phase I (engineering and design) as part of the 15th Priority Project List. The United States Fish and Wildlife Service (USFWS) was designated as the lead federal sponsor with funding approved through the Coastal Planning, Protection and Restoration Act of 1990 by the United States Congress and the Wetlands Conservation Trust Fund by the Louisiana Office of Coastal Protection and Restoration (OCPR) is serving as the local sponsor and is also performing the engineering and design work.

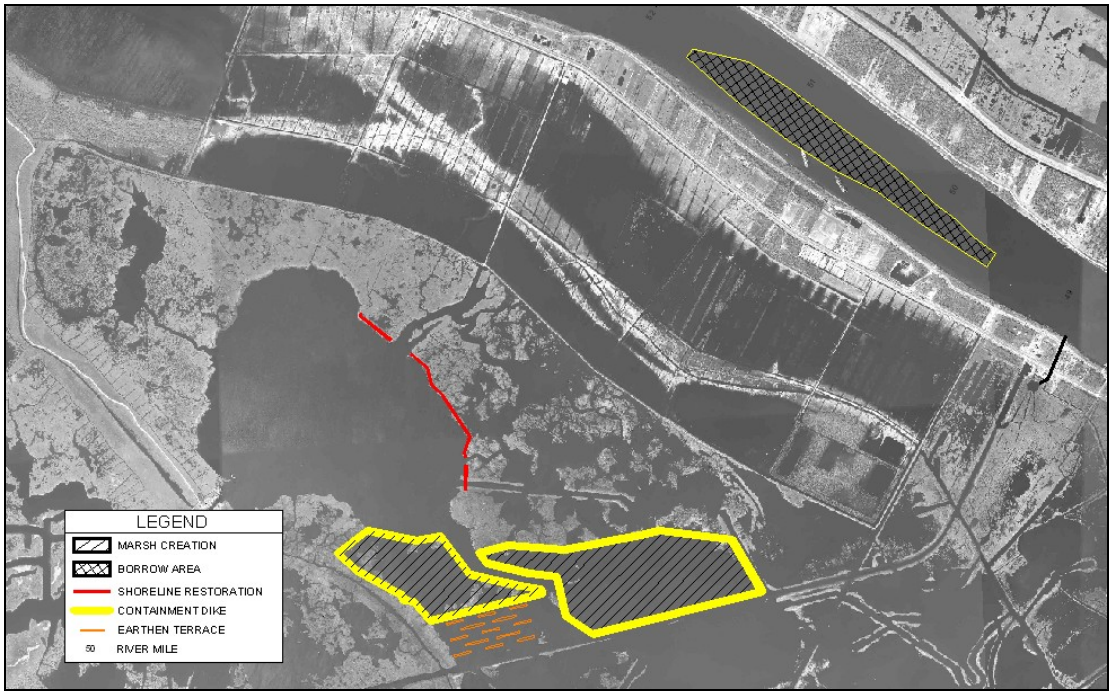

Figure 1 – Project Layout

The primary goal of BA-42 is to re-create marsh habitat in the open water areas along the southern rim of Lake Hermitage. This will maintain the lake-rim function along this section of shoreline, especially southeast of Lake Hermitage where very little land is left between the lake and the oil field canals. Interior ponding, subsidence, and shoreline erosion of the lake rim are the major causes of wetland loss in the project area. Although the shoreline erosion rates are relatively low, breaching and enlargement of tidal channels allow high tidal energy to intrude into the interior ponds of the project area and the interior marshes have experienced accelerated loss rates. Additionally, shoreline protection/restoration will reestablish the integrity of the eastern lake rim to prevent breaching into the interior marshes.

Restoration strategies to be used for this project include marsh creation, shoreline restoration, and terraces as depicted in Figure 1. The construction of the marsh creation sites for BA-42 involves hydraulically dredging sediment from the Mississippi River to fill open water areas located within the marsh. Small earthen dikes or levees will be constructed around the designated fill sites to contain the dredged slurry. Sediment dredged from the Mississippi River will also be used to construct the shoreline protection/restoration and earthen plug features. Topographic/bathymetric surveys, magnetometer surveys, geophysical surveys, and a geotechnical investigation have been completed. Additionally, a tidal datum analysis has been performed by OCPR to determine the mean water elevations in the fill sites. These efforts have been carried out in order to determine a suitable target fill elevation, site conditions, and quantity of fill material needed for the project features.

The project team, consisting of members of USFWS and OCPR, performed an on-site kick-off meeting on June 27, 2006. Based on that meeting, a work plan was developed to identify and address the project requirements. The engineering and design, environmental compliance, real estate negotiations, operation/maintenance planning, and cultural resources investigations have been executed to the 30% level of completion as required by the CWPPRA standard operating procedures.

2.0 SURVEYS

Topographic, bathymetric, and magnetometer survey data was collected within the project area in order to facilitate the design of the marsh creation cells, shoreline restoration feature, and earthen terraces. Additionally, a geophysical, bathymetric, and magnetometer survey was performed in the Mississippi River to delineate a sediment borrow site. The majority of the design survey effort was performed from February 2, 2007 to April 12, 2007 by Sigma Consultant Group, Inc. All horizontal coordinates are referenced to Louisiana State Plane Coordinate System, North American Datum of 1983 (NAD 83). All elevations are referenced to North American Vertical Datum of 1988 (NAVD 88).

2.1 Horizontal and Vertical Control

Two permanent secondary monuments exist in the vicinity of Lake Hermitage. "BA04c-SM-01" is located on the bank of a pipeline canal south of the project area, at coordinates 29°32'00.97" N, 89°49'07.87" W. "876 1602 C TIDAL" is located in the vicinity of the Hermitage community, near the fire station, at coordinates 29°33'33.83" N, 89°53'05.03" W. These two secondary monuments were used as horizontal and vertical control for the fill site survey and the borrow site survey. The data sheets for these monuments are located in Appendix A.

2.2 Fill Site Surveys

A 23,000 foot survey baseline was established along the remnants of an oil field canal spoil bank south of the project area. This baseline is identified as "Oil Field Canal Baseline" in the Marsh Creation Plan View drawing included in Appendix B. The baseline was staked with 10 foot lengths of 1 inch PVC pipe at the beginning and ending stations, and at 3,000 foot intervals. The baseline begins at the western end of the canal and proceeds northeastward to the bend in the canal. A second survey baseline was established along the eastern lake shoreline of Lake Hermitage. This baseline is identified as "Eastern Lake Shoreline Baseline" in the Marsh Creation Plan View drawing included in Appendix B. The baseline begins near an unnamed canal and proceeds northward for 7,000 feet along the eastern shore of Lake Hermitage.

Survey transects were taken along the two established baselines at 500 foot increments. The transects were taken in open water, across open marsh areas and extended 25 feet past existing marsh into open water along the perimeter of the fill sites. Position, elevation, and water depth were recorded every 25 feet along each transect or where elevation changes of greater than 0.5 feet occur. Transects extended beyond the spoil banks of the southern oilfield canal and across the marsh creation and terrace fill sites. Transects "Line 2" and "Line 3" were taken perpendicular to the survey transects that pass through Fill Site A and Fill Site B. Transect "Line 1" was taken across Lake Hermitage. Additional cross sections were taken near the bridge at the community of Hermitage and also at the designated earthen plug location. The bridge at the community of Hermitage was surveyed to determine the low chord elevation.

2.3 Staff Gages

Two staff gages were set at the project site to monitor water levels during the topographic survey. Staff Gage 1 is located in Lake Hermitage at 29° 34” 03.85” N latitude and 89° 51” 41.81” W longitude. Staff Gage 2 is located at the end of a pipeline canal bordering marsh creation cell 1 at 29° 33’ 24.72” N latitude and 89° 50’ 46.35” W longitude. These staff gages were used to monitor water levels during the survey and to help verify the calculated tidal datum.

2.4 Marsh Elevation Survey

Average Marsh Elevation Surveys were conducted at three sites that were predetermined to have apparent healthy marsh. These surveys consisted of a minimum of twenty spot elevations at each location utilizing the same equipment used to acquire the elevations in the marsh creation cells. The survey shot was taken such that the tip of the rod was resting on the vegetation root. Average marsh elevations for each location were derived by using the following procedure: (sum of elevations at location # divided by total number of elevations at same location # = Average Marsh Elevation). Table 1 shows the results from data acquired from the three average marsh elevation surveys. All elevations shown are referenced to the North American Vertical Datum of 1988 (NAVD 88). Locations of the marsh elevation surveys are shown in the Marsh Creation Plan View drawing included in Appendix B.

SPOT ELEVATION	SITE NO. 1 N=393,831 E=3,748,880	SITE NO. 2 N=387,809 E=3,749,381	SITE NO. 3 N=387,518 E=3,745,997
1	1.15	0.92	1.18
2	1.10	1.00	1.21
3	1.31	1.34	1.18
4	1.19	1.13	1.23
5	1.33	1.03	1.17
6	1.35	0.95	1.13
7	1.17	1.13	1.23
8	1.08	1.13	1.36
9	1.18	1.31	1.18
10	1.13	1.14	1.31
11	1.11	1.10	1.21
12	1.07	0.95	1.23
13	1.07	1.00	1.22
14	1.09	1.08	1.15
15	1.13	1.39	1.15
16	1.07	1.06	1.15
17	1.04	1.10	1.11
18	1.17	1.34	1.12
19	1.17	1.25	1.22
20	1.18	1.26	1.12
21	1.10	0.99	1.15
TOTAL	24.21	23.63	24.99
AVERAGE	1.15	1.13	1.19

CUMULATIVE AVERAGE= 1.16

Table 1-Average Marsh Elevation Survey Results

2.5 Mississippi River Borrow Site Survey

A bathymetric survey was performed in the Mississippi River from River Mile 49.0 to 52.0 at 800 foot increments. Sections were extended to the protected side of the westbank levee every 1600 feet. Bathymetric data was surveyed using an Odom Echotrac 3200 model. GPS positioning was collected using Leica System 530 GPS receivers in RTK mode. Overbank portions of the transects were collected using the Trimble System 5700 GPS receivers in RTK mode. Drawings of the transect locations and cross section views are shown on the drawing titled "Mississippi River Sections" located in Appendix B. The mud line elevation data obtained from this survey was used for determining borrow/dredge quantities.

2.6 Highway Cross Sections Survey

Cross sections were taken across LA Highway 23 at two proposed dredge discharge pipeline crossings near the intersection with the southern remnant oil field canal (Jefferson Canal). These transect locations are shown in the drawing titled "Highway 23 Transects" located in Appendix B. The highway cross sections are necessary to create a pipe jacking plan for the installation of the dredge discharge pipe under the highway. Due to existing underground utilities in the vicinity of these two site, a new crossing has been proposed. Additional surveys were taken along the newly proposed pipeline highway crossing alignment in order to finalize the crossing details. Details on this survey and the proposed pipeline route are discussed in Section 9.0.

2.7 Magnetometer Survey

A magnetometer survey of the Mississippi River, fill sites, earthen terrace field and proposed access routes was conducted in attempts to identify potential pipelines and other metallic obstructions in the project area. For the marsh creation area, a GEOMETRIC-858 Cesium magnetometer was used to identify ferrous anomalies. For the Mississippi River segment, a Marine Magnetometer Model G 882 was used to identify ferrous anomalies. Horizontal positions for both locations were determined using the NAVCON GPS system.

The magnetometer survey verified the location of an 18 inch pipeline that runs along the eastern portion of the project area. Additionally, this survey revealed that a smaller line (with a diameter less than 6 inches) may exist in the Jefferson Canal. Other magnetic anomalies were detected. Since these anomalies are located in portions of the project area where no dredging would occur, further investigation was not initiated. A map showing the magnetometer survey lines and the location of the anomalies is located in Appendix B.

2.8 Geophysical Survey

A geophysical survey was performed in the borrow site to compliment the magnetometer survey results, obtain information regarding river bottom material and morphological

features, and to detect any large underwater obstructions that may exist in the borrow site. This survey was accomplished using the R/V Coastal Profiler (see Figure 2), which is owned and operated by the Louisiana State University Coastal Studies Institute, and consisted of a magnetometer survey, a side-scan sonar survey, and a full spectrum sub-bottom profile survey.

Figure 2 – R/V Coastal Profiler

A Geometrics Model G882 marine cesium magnetometer was used for the magnetometer survey. The magnetometer sensor and associated electronics are housed in a waterproof tow body and is pulled behind the vessel with a tow cable. The system is equipped with Maglog software which allows the operator to receive, display, and manage data from the tow body on a personal computer. The interpretation of the magnetometer data identified eighteen magnetic anomalies within the borrow site. Of these anomalies, three were associated with the pipeline crossings located on the southeastern portion of the borrow site. The remaining anomalies were interpreted to be the result of passing ships or small pieces of metallic debris located on the river bottom.

Side-scan sonar data was acquired using a Klein 2260NV digital dual frequency tow fish with a swath range of 200 meters. The main purpose of this survey was to efficiently map the water bottom to detect any features that may obstruct dredging operations. This is accomplished by measuring the reflection amplitudes from the tow fish to the water bottom. No major underwater objects were detected. This survey did detect a pattern in the river bed known as sand waving, which was more prevalent on the southern portion of the borrow site.

The sub-bottom profile was obtained using a high frequency chirp system. The R/V Coastal Profiler is equipped with an EdgeTech SB512i tow fish and Model FS 5B Signal Processor. This system sends an acoustic signal towards the river bottom. Since different sediment types reflect the acoustic signal with different strengths, the bottom "hardness" can be interpreted from the amplitude of the signal. The sub-bottom profile data revealed numerous sand waves and poorly defined sub-bottom reflectors. This is typical for water bottom conditions with thick sand layers.

3.0 GEOTECHNICAL ANALYSIS

In order to determine the suitability and physical characteristics of the soils in the BA-42 project area for the proposed project features, a geotechnical investigation and analysis was performed by Eustis Engineering Services, L.L.C. (Eustis) and completed on October 1, 2007. Eustis was tasked to collect soil borings, perform laboratory tests to determine soil characteristics, perform stability analyses on the proposed containment levees, earthen terraces and shoreline protection/restoration features, calculate the settlement of the proposed containment dikes, earthen terraces, and marsh fill sites for different fill elevations, and determine an adequate cut to fill ratio for dredge and fill operations. A detailed summary of the geotechnical investigation and analysis is presented in the Geotechnical Investigation report prepared by Eustis. This document can be made available upon request.

3.1 Field Investigation

A total of thirteen subsurface borings were drilled in the project area during the period of April 12, 2007 through April 30, 2007 at locations shown in Figure 3. Three borings were drilled in the Mississippi River to a depth of 40 feet, six borings were drilled in the interior marsh areas to depths of 40 feet, two borings were drilled in the interior marsh areas to a depth of 60 feet, one boring was drilled in the interior marsh areas to a depth of 100 feet, and one boring was drilled on land (near the proposed dredge pipeline crossing) to a depth of 60 feet. Undisturbed soil samples were obtained with rotary type drilling equipment. For the borings located in the Mississippi River, the drilling rig was mounted on a barge and positioned using anchors and wenches. The borings taken in the interior marsh areas were mounted on a marsh buggy. Soil samples were laboratory tested for classification, strength, and compressibility.

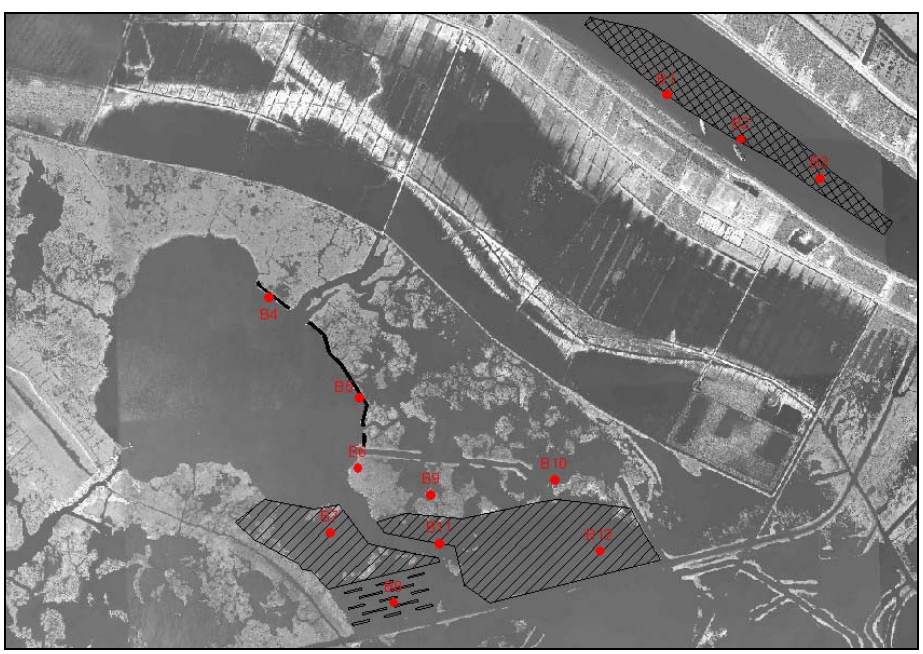

Figure 3 – Soil Borings Locations

3.2 General Subsurface Evaluation

The samples extracted from the Mississippi River borings were relatively consistent, revealing poorly graded sands that varied in density from loose/medium near the surface to dense at approximately 30 feet below the mudline. The samples extracted from borings in and around Lake Hermitage revealed very soft, plastic clays throughout the full depth of the borings. The boring logs for BA-42 can be found in Appendix C.

3.3 Slope Stability Analysis

Slope stability analyses were performed for the earthen containment dikes and the three proposed shoreline protection/restoration alternatives (an offshore rock dike, an onshore rock dike, and an onshore sand fill). The slope stability of any embankment or dike has two types of driving forces: (1) the forces induced by the soil weight, and (2) any seepage forces which tend to cause the soil to slide. In response to these driving forces, the subsurface soils have a resistant force in the form of shear strength, which attempts to keep the slope from sliding. Both the driving forces and the resisting forces are dependant on the geometry of the situation: the "Failure Surface". Eustis utilized the software package PCSTABL to perform this analysis. PCSTABL is two-dimensional limit equilibrium model that utilizes Spencer's Method, which isolates individual blocks of soil and computes the ratio of resisting forces to driving forces. This ratio is known as the global slope stability safety factor.

Eustis performed this analysis for the earthen containment dikes using composite data from the marsh fill soil borings. Containment dike heights of 5.0 feet, 5.5 feet, 6.0 feet, and 6.5 feet with 5.0 feet crown widths were analyzed. It was also assumed that the borrow sites for the containment dikes are located on the interior of the marsh fill cell. Eustis recommended that the toe of the containment dikes be built no closer than 25.0 feet from the edge of the borrow site. A similar slope stability analysis was performed for the terraces. Terrace heights of 4.0 feet, 5.0 feet, and 6.0 feet were analyzed. A crown width of 20.0 feet was used for this analysis. Eustis also recommended that the toe of the terraces be built no closer than 25.0 feet from the borrow site.

Stability analyses and estimation of the failure surfaces were also performed on three shoreline protection/restoration alternatives: an offshore rock dike, an onshore rock dike, and an onshore sand fill feature. The computer program Slope/W, developed by Geoslope International, Ltd., and Spencer's Method of Slices were utilized for these analyses. Since a flotation channel would be necessary to mobilize barges of rip rap, Eustis recommended that both rock dike features be constructed no closer than 25.0 feet from this channel.

3.4 Settlement Analysis

Settlement analyses for BA-42 were performed using two computer programs: a software package CSETT, developed by the Corps of Engineers, and the program SD3 developed by the University of Texas-Austin. Actual consolidation curves were used in the

calculations for the soil types that required consolidation tests. Both programs implement the Boussinesq stress distribution theory. Published correlations for pre-consolidation pressure, coefficient of consolidation, and compression/re-compression indices were used for other soil types to obtain consolidation indices using shear strength, Atterberg Limits, and moisture content values. Settlement analyses were performed for marsh creation fill sites, the earthen containment dikes, the terraces, and the three shoreline protection/restoration alternatives.

The primary purpose of the settlement analysis in marsh creation design is to determine the target construction fill elevation and the total volume of material required. The final elevation of the marsh fill (at year twenty) is governed by two forms of settlement: (1) The settlement of the underlying soils in the fill cells caused by the loading exerted by the dredged material, and (2) the self-weight consolidation of the dredged material (see Figure 4).

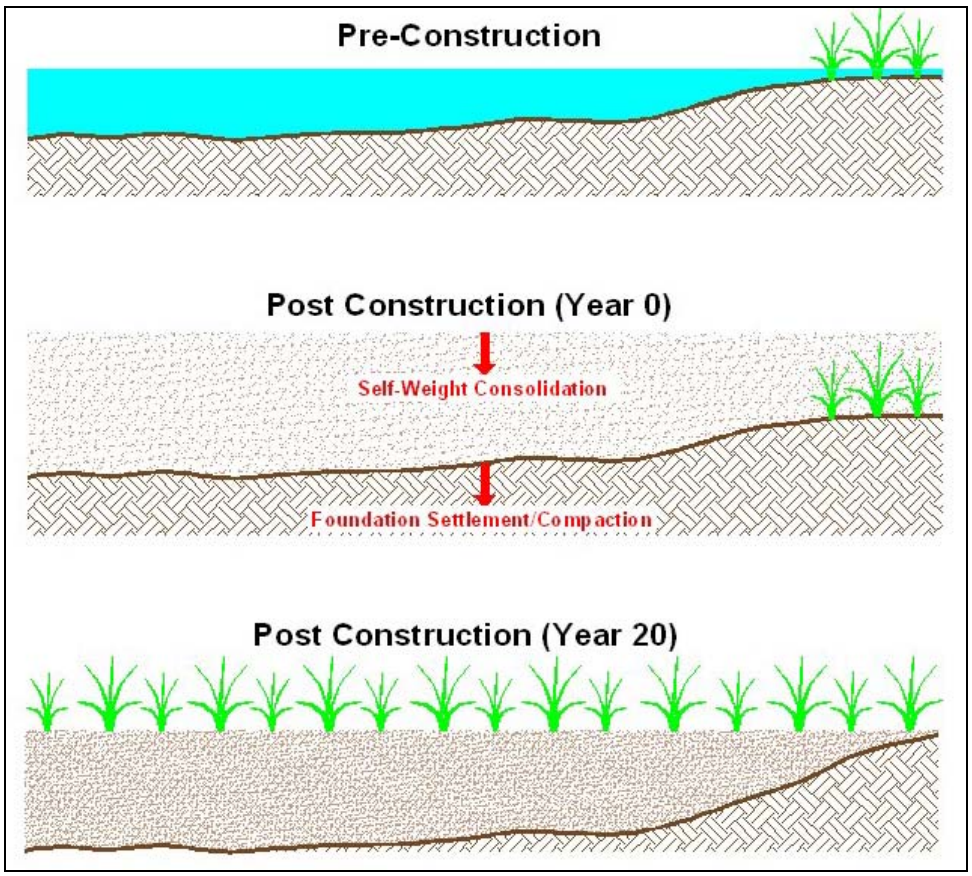

Figure 4 – Marsh Fill Settlement

Data from low pressure consolidation tests was used to calculate the time-rate of settlement of the underlying soils of the fill cells. Self-weight consolidation tests were performed on a composite sample of the borrow site (Mississippi River) material to determine the consolidation of the dredged material after placement. Eustis' settlement and consolidation analyses were performed at fill heights of 3.5 feet, 4.0 feet, 4.5 feet, and 5.0 feet. It was assumed that dredging/filling operations would take place over a one

year period. Figure 8 of Appendix D includes the Eustis marsh fill settlement curves which show the total time-rate settlement (includes self-weight consolidation) for each assumed fill height.

Settlement calculations for the earthen containment dikes were based on the soil conditions of various borings in the fill sites (see Appendix C for boring logs). An assumed water depth of 1.0 foot was used throughout the project area and dike heights 5.0 feet, 5.5 feet, 6.0 feet, and 6.5 feet were evaluated. A containment dike construction period of sixty days was also assumed. The purpose of this analysis was to produce a dike height that would maintain an elevation of +3.0 feet NAVD 88 throughout the duration of construction. Figure 11 of Appendix D includes the Eustis containment dike settlement curves which show the time rate settlement for each assumed fill height. A similar settlement analysis was performed for the terrace design with assumed heights of 4.0 feet, 5.0 feet, and 6.0 feet. The purpose of this analysis was to produce a terrace template that would maintain an elevation of +2.3 feet NAVD 88 throughout the twenty year life of the project.

Eustis' settlement analysis for BA-42 also included an estimation of the magnitude of settlement for the rock dike and sand fill features. This analysis assumed that a geotextile separator fabric will be placed beneath these features. Since the calculated breaking wave height of +2.3 feet NAVD 88 is the governing design criteria for the shoreline protection/restoration feature, Eustis assumed the templates for the shoreline protection/restoration features maintain an elevation of +2.3 feet NAVD 88 throughout the twenty year life of the project.

3.5 Results/Recommendations

Marsh Fill:
(see Figure 8 in Appendix D)

Containment Dikes:
- Crown Elevation: +5.5 feet NAVD 88
- Side Slope: 1(V):6(H)
- Crown Width: 5.0 feet
- Accepted Safety Factor: 1.3

Earthen Terraces:
- Crown Elevation: +3.6 feet NAVD 88
- Side Slope: 1(V):3(H)
- Crown Width: 20.0 feet
- Accepted Safety Factor: 1.6

Rock Dike (onshore/offshore):
- Crown Elevation: +3.5 feet NAVD 88
- Side Slope: 1(V):3(H)

- Crown Width: 4.0 feet
- Accepted Safety Factor: 1.3
- Magnitude of Settlement: 1.0 foot (over twenty years)

Sand Berm:

- Crown Elevation: +4.2 feet NAVD 88
- Lakeside Side Slope: 1(V):50(H)
- Marshside Side Slope: 1(V):25(H)
- Crown Width: 50.0 feet
- Accepted Safety Factor: 2.1
- Magnitude of Settlement: 1.5 feet (over twenty years)

3.6 Cut:Fill Ratio Recommendations

OCPR tasked Eustis to determine an estimated cut:fill ratio for BA-42. Two cases were considered in this analysis: (1) the quantity of in-situ borrow material necessary to construct the containment dikes using mechanical dredging techniques, and (2) the quantity of material that will be dredged hydraulically from the Mississippi River and placed in the fill cells. The cut:fill ratio for mechanical dredging was primarily based on the expected transport losses during construction and desiccation of the clayey material in the project area and consolidation of the material under its own weight. With these factors in mind, Eustis recommended a 2:1 cut:fill ratio for mechanical dredging (for containment dikes and terraces). The primary losses associated with hydraulic dredging for marsh creation will result from containment failure, leaking pipelines, and losses during dewatering of the fill sites. With these factors in mind, Eustis recommended that a cut:fill ratio between 1.25:1 and 1.5:1 be used for BA-42. Additionally, the project team assumed that the magnitude of losses would be greater during construction of the sand fill shoreline restoration feature. Therefore, a cut:fill ratio of 2.0:1 will be used for the shoreline restoration feature.

4.0 WIND ANALYSIS

The New Orleans Naval Air Station (Alvin Calendar Field), located approximately 10 miles south of New Orleans, LA, in Belle Chase, was selected to gather historical wind data due to availability and close proximity to the project area. Based on statistical analysis of the hourly wind data available from 1997 to 2003, and the orientation of the Lake Hermitage shoreline, it was determined that the BA-42 wind analysis would only be based on wind directions from 140° to 330° clockwise from north (see Figure 5).

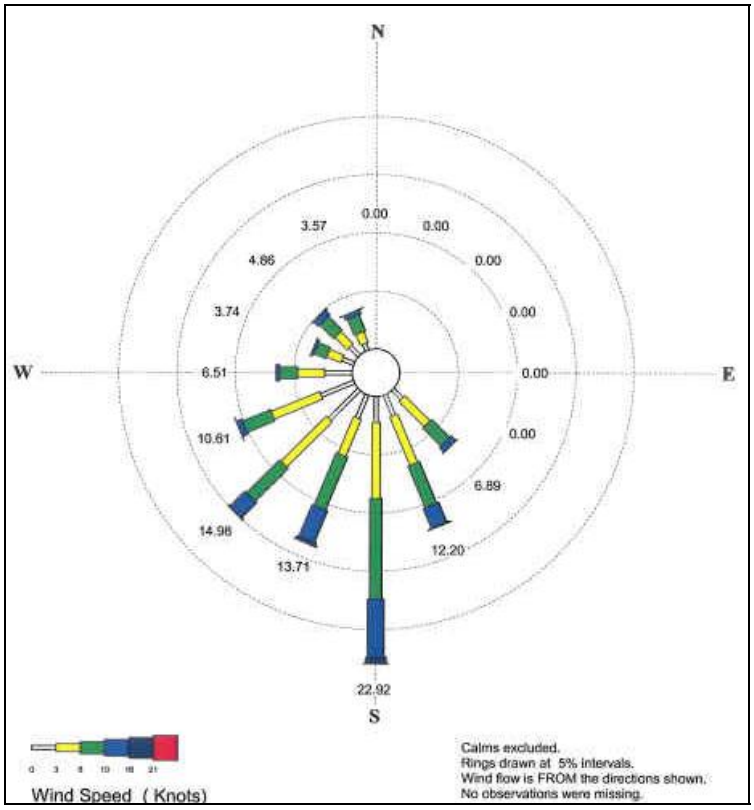

Figure 5 – Wind Rose for New Orleans Naval Air Station, 1993-2000

A statistical analysis was performed and the 90th percentile wind speed was determined to be 14.0 miles per hour (12.0 knots). The 90th percentile wind direction associated with the 90th percentile wind speed was calculated to be 204° clockwise from north. This wind speed and direction were chosen for the design wave described in the analysis below.

5.0 HYDRAULIC ANALYSIS

5.1 Tidal Datum

OCPR monitoring gage BA04-17 was selected to determine historical water levels due to its proximity to the project area and database availability. This gage is located at 29°31'14.20"N, 89°49'27.87"W, approximately 3 miles southeast of the project area. Hourly water level data was recorded from August 13, 1997 to June 22, 2000.

A normal tidal epoch lasts approximately 19 years. In order to accurately estimate Mean High Water (MHW) and Mean Low Water (MLW) elevations, a data set which has less than 19 years of data should be correlated to a gage which has data from a full tidal epoch using a technique known as the Range-Ratio method. NOAA station #8761724 located at Grand Isle, Louisiana near Barataria Pass at 29°15'48"N, 89°57'24"W was used as the control station for making this correlation. The period of record used for the nineteen (19) year tidal epoch was from January 1, 1985 to December 31, 2003. The results of the tidal datum determination for BA-42 are shown in Table 2. A more detailed summary of how this tidal datum was calculated is shown in Section I of the Design Calculation Packet located in Appendix E.

KNOWN VARIABLES	ELEV. FT NAVD 88
MHWc = 19 YEAR MEAN HIGH WATER AT CONTROL STATION	1.37
MTLc= 19 YEAR MEAN TIDE LEVEL AT CONTROL STATION	0.85
MLWc = 19 YEAR MEAN LOW WATER AT CONTROL STATION	0.32
MRc = 19 YEAR MEAN TIDE RANGE AT CONTROL STATION	1.05
TLc = MEAN TIDE LEVEL FOR THE OBSERVATION PERIOD AT CONTROL STATION	0.95
Rc = MEAN TIDE RANGE FOR THE OBSERVATION PERIOD AT CONTROL STATION	0.92
TLs = MEAN TIDE LEVEL FOR THE OBSERVATION PERIOD AT SUBORDINATE STATION	0.71
Rs = MEAN TIDE RANGE FOR THE OBSERVATION PERIOD AT SUBORDINATE STATION	0.48
CALCULATED VARIABLES	**ELEV. FT NAVD 88**
MHWs = 19 YEAR MEAN HIGH WATER AT SUBORDINATE STATION (MHWs=MTLs+MRs/2)	0.88
MTLs= 19 YEAR MEAN TIDE LEVEL AT SUBORDINATE STATION (MTLs=TLs+MTLc-TLc)	0.61
MLWs = 19 YEAR MEAN LOW WATER AT SUBORDINATE STATION (MLWs=MTLs-MRs/2)	0.34
MRs = 19 YEAR MEAN TIDE RANGE AT SUBORDINATE STATION (MRs=(MRc*Rs)/Rc)	0.54

Table 2 – Summary of Tidal Datum Determination

5.2 Setup

The wave setup is defined as the difference in still-water levels on the windward and the leeward sides of a body of water caused by wind stresses on the surface of the water. This was factored into the wave height calculation to obtain the absolute wave height. The setup for Lake Hermitage was determined using the 90th percentile water and wave conditions from the historical records. The average recorded water level associated with the 90th percentile wind speed and direction is 1.06 feet (0.323m) NAVD88. This value minus the mean high water level yields a setup of 0.18 feet (0.055 m). Section II of the

Design Calculation Packet located in Appendix E includes the spreadsheet used to calculate the setup.

5.3 Deep Water Wave Hind Casting

Bathymetric data for Lake Hermitage was collected during the original survey. From this data, the average depth of Lake Hermitage is 4.6 feet (1.4 meters) deep. Three wave cases were analyzed as shown in Figure 6. The longest fetch associated with the 90th percentile wind direction is 0.90 miles or 4,744 feet (Case 2). The worst case wind-generated wave is Case 3, which includes a fetch distance of 1.35 miles or 7,130 feet.

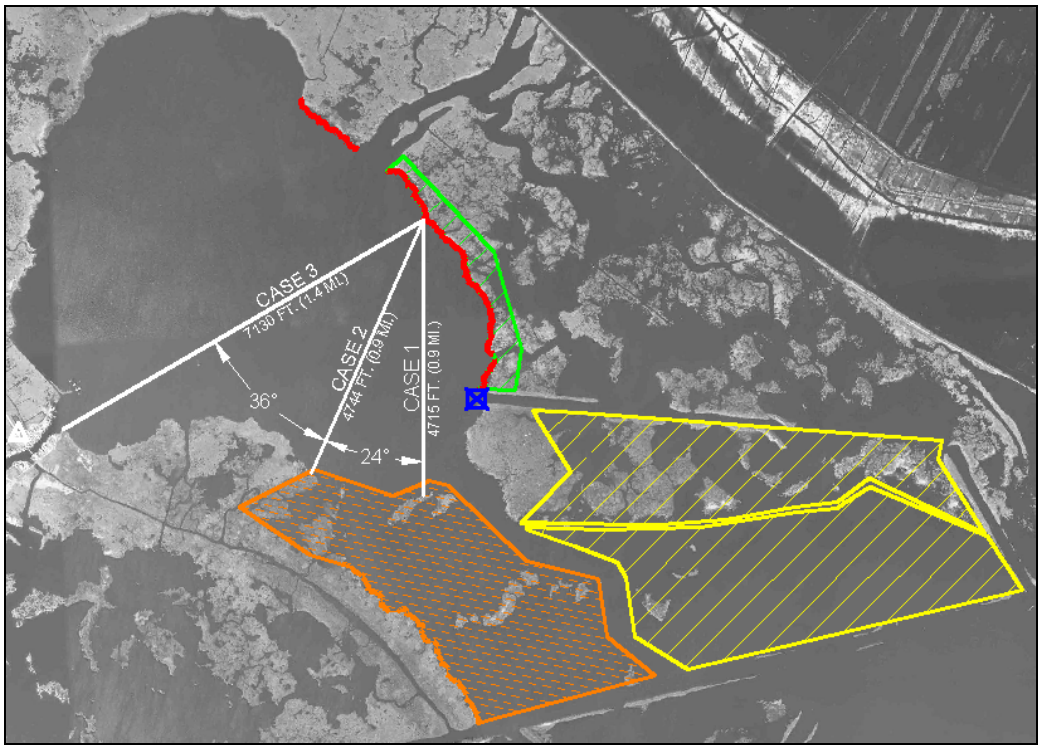

Figure 6 – Fetch Scenarios for Wind Generated Wave

Using the U.S. Army Corps of Engineers Coastal Engineering Manual (USACE CEM), the (Case 3) deep water wave height and period was determined to be 0.46 feet (0.139 meters) and 1.122 seconds, respectively (Interactive CEM, Equations II-2-35 to II-2-38). The values for the deep water wave height from these equations are relative to still-water elevation and represent the wave profile from crest to trough. The deepwater waves generated were not fetch or shallow water limited.

For this design, the components of the absolute deep water wave height include the setup, mean high water level, and relative deep water wave height. Therefore, the absolute deep water wave height (H_{abs} = setup + MHW + H/2) is 0.18 ft + 0.88 ft + 0.23 ft = 1.29 ft NAVD88.

5.4 Wave Transformation

As a deep water wave propagates shoreward along increasing bathymetry, it loses energy and height due to frictional forces. These frictional forces are caused by the reflection and refraction of the wave with the bottom surface. Calculations were performed based on the methodologies in Chapter II of the USACE CEM to determine the height of the 90th percentile wind generated wave in deep water as it is transformed onshore at the BA-42 project area (see Table 3). It was determined that the 90th percentile wind generated wave would break between the 0.0 and 1.0 foot NAVD88 contours assuming an initial wave reflectivity angle of 0 degrees.

Contour	Wave Height		
(ft NAVD88)	H/2 (ft)	Water Type	h_{mhw}+Setup+H/2 (ft NAVD88)
-7	0.23	Transitional	1.29
-6	0.23	Transitional	1.29
-5	0.23	Transitional	1.29
-4	0.23	Transitional	1.29
-3	0.23	Transitional	1.29
-2	0.23	Transitional	1.29
-1	0.22	Transitional	1.28
0	0.21	Transitional	1.27
1	0.02	Shallow	1.09

Table 3 - Deep Water Wave Transformation

The details of this analysis are shown in Section II of the Design Calculations Packet located in Appendix E.

5.5 Wave Run-up

The maximum height to which a breaking wave will run up onto the shoreline cannot be calculated using current methodologies. Instead, in order to remain conservative, the minimum breakwater height required to provide protection against the 90th percentile wind generated and breaking wave is taken as the sum of the setup, mean high water level and the wave height corresponding to the design contour. According to Table 3 approaching waves on the eastern shoreline of Lake Hermitage will break when they reach the -1.0 foot NAVD88 contour. For this contour the highest 90th percentile breaking wave height along the project is calculated to be approximately +2.3 feet NAVD88 (0.18 feet NAVD 88 + 0.88 feet NAVD 88 + 1.28 feet NAVD 88). The crown height of the chosen shoreline protection/restoration feature must maintain this elevation in order to provide optimum performance throughout the twenty year design life of the project. To remain conservative, this elevation was also chosen for shoreline protection/restoration features that could be constructed closer inland (on shore) than the -1.0 foot NAVD 88 contour.

6.0 MARSH CREATION DESIGN

This project proposes to create marsh by dredging sediment from the Mississippi River for placement into the designated sites shown in Figure 1 and the Final Design Drawings located in Appendix F. The marsh creation design was separated into three components: the marsh creation fill sites, the dredge borrow site, and the containment dikes. The design and analysis of each component is discussed in the sections below.

6.1 Fill Site Design

The primary goals of the Marsh Creation features are to address the widespread marsh loss in this area and to reestablish the southern shoreline of Lake Hermitage. These goals governed the configuration of the fill cells, which does not vary significantly from the original Phase 0 (planning level) layout. Another factor that contributed to the layout was the presence of a historic bayou that ran between Fill Site A and Fill Site B (see Figure 7). Due to a Louisiana State Water Bottoms statute, and in an effort to improve the natural hydrology throughout the project area, the Project Team decided to restore the alignment of this small channel.

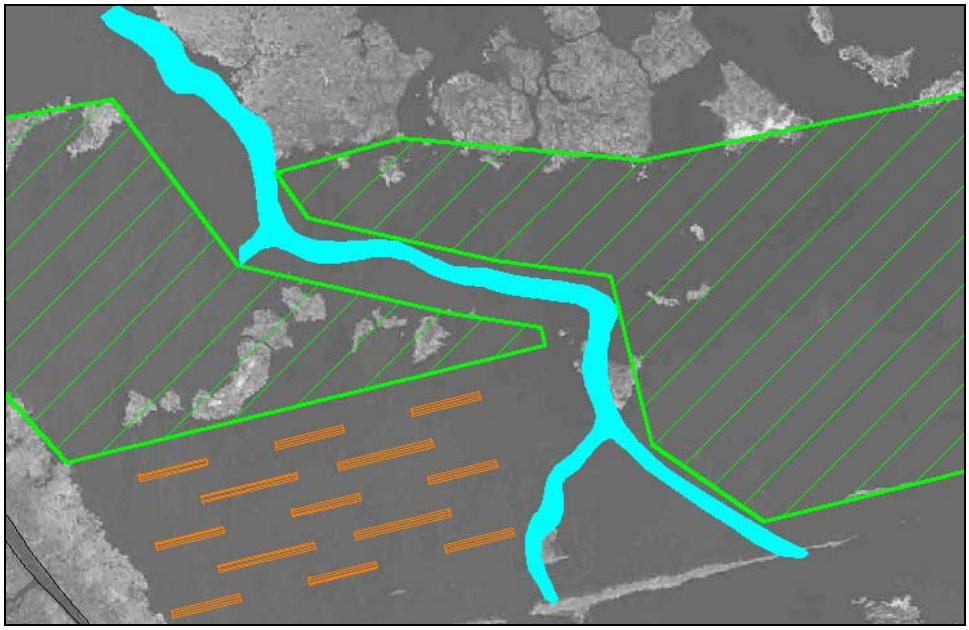

Figure 7 – Alignment of Historic Bayou

In addition to the fill site configuration, a key design component of BA-42 involves the calculation of the fill site volumes. Before this could be accomplished, a target construction fill elevation had to be determined. This elevation was governed by several factors including average healthy marsh elevation, the tidal datum, the physical properties of the borrow material, and the bearing capacity of the foundation soils in each fill site.

The first step of the target fill elevation design involved an examination of the existing marsh conditions. The average marsh elevation survey performed during the Fill Site

Survey revealed that the average marsh elevation of the existing healthy marsh locations was approximately +1.2 feet NAVD 88 (see Section 2.4 for additional details). The calculated tidal datum (MHW=+0.88 feet NAVD 88, MLW=+0.34 feet NAVD 88) discussed in Section 5.1 verified that the existing marsh predominantly fell above the portion of the project inter-tidal zone; the range of elevations that lie between the upper and lower extents of the tidal datum. Since scientists from both USFWS and OCPR preferred the created marsh to be as close as possible to the existing marsh conditions, the Project Team decided that the criteria for the determination of a twenty year target elevation would be existing healthy marsh elevation. To achieve a sustainable marsh elevation throughout the life of the project, the marsh platform will initially be pumped to a higher elevation during construction and allowed to settle to the desired target elevation over time.

In order to determine the construction fill elevation, OCPR tasked Eustis to perform consolidation settlement calculations for boring locations B-7, B-8, B-11, and B-12, which are located in marsh fill sites. The calculations were performed for potential fill heights of 3.5 feet, 4.0 feet, 4.5 feet, and 5.0 feet. The purpose of these analyses was to assist in the determination of a construction fill elevation that would be as close as possible to the existing marsh elevation after twenty years. The marsh fill consolidation curve produced by Eustis (Figure 8 in Appendix D) indicates that placement of 4.0 feet of fill (to a target fill elevation of +1.8 feet NAVD 88) would ultimately settle to an approximate elevation of +1.3 feet NAVD 88. For constructability purposes, a target fill elevation of +2.0 feet NAVD 88 was chosen for the BA-42 fill sites. The settlement values are composed of foundation settlement and self-weight consolidation. Due to the composition of the dredged material from the Mississippi River, self-weight consolidation settlement is anticipated to occur instantaneously and be on the order of 2-3 inches.

Once the target fill elevation was determined, the marsh fill volumes were calculated. As shown on the Final Design Drawings located in Appendix F, the marsh creation portion of the project is broken up into two fill sites, each analyzed separately. Cross-sectional areas of the transects in each fill site were calculated using the data produced by the Fill Site Survey described in Section 2.2. Fill site volumes were then computed using these cross-sectional areas. Table 4 summarizes the results of the volume calculations for each fill site. A more detailed summary of the fill site design is provided in Section III the Design Calculation Packet located in Appendix F.

FILL SITE	AREA (acres)	VOLUME OF FILL (yd^3)
A	352	2,531,259
B	182	1,194,525
Totals	534	3,725,784

Table 4 – Summary of Marsh Creation Volumes and Acreage

6.2 Borrow Site Design

The controlling factors of this design component include the borrow site location and the size of the borrow site (acreage and depth), as well as USACE restrictions. The borrow site must contain sufficient sediment to meet the calculated marsh fill volume requirements. The following is a list of USACE physical borrow site restrictions:

- All excavations must be at least 750 feet from any protection levee centerline;
- Borrow sites must be outside the USACE maintained navigation channel;
- Excavation in the river must not be made less than 4,000 feet upstream of a bridge crossing;
- The side slopes of the borrow site must be no steeper than 1(V):5(H); and
- The excavation must proceed from landside to riverside limits to minimize the possibility of overburden failure of the bank.

The location for the borrow site was chosen to be between Mississippi River Miles (RM) 49.5 and 52. This stretch of the river is located near the marsh fill site and the depths are shallow enough to be reached using a large hydraulic dredge. Immediately upstream and downstream of this section, the water depths are too great to be dredged by a conventional dredge. This borrow site contains sufficient sediment for the marsh fill sites. Additionally, areas near or adjacent to concrete revetment mats were avoided.

The western boundary of the borrow site is delineated by a 750 foot offset from the centerline of the Mississippi River levee. This boundary exists to ensure that a 1.3 factor of safety remains for the slope stability of the Mississippi River levee. If the elevation of the protected side of the river levee is greater than the elevation of the river side, the elevation of the protected side must be projected towards the river to intersect the 750' offset line. At this intersection, side slopes of 1(V):5(H) are projected toward the river to the intersection of the mudline. This is the point dredging is permitted to begin. A cross-sectional diagram of this USACE regulation is shown in Figure 8 below.

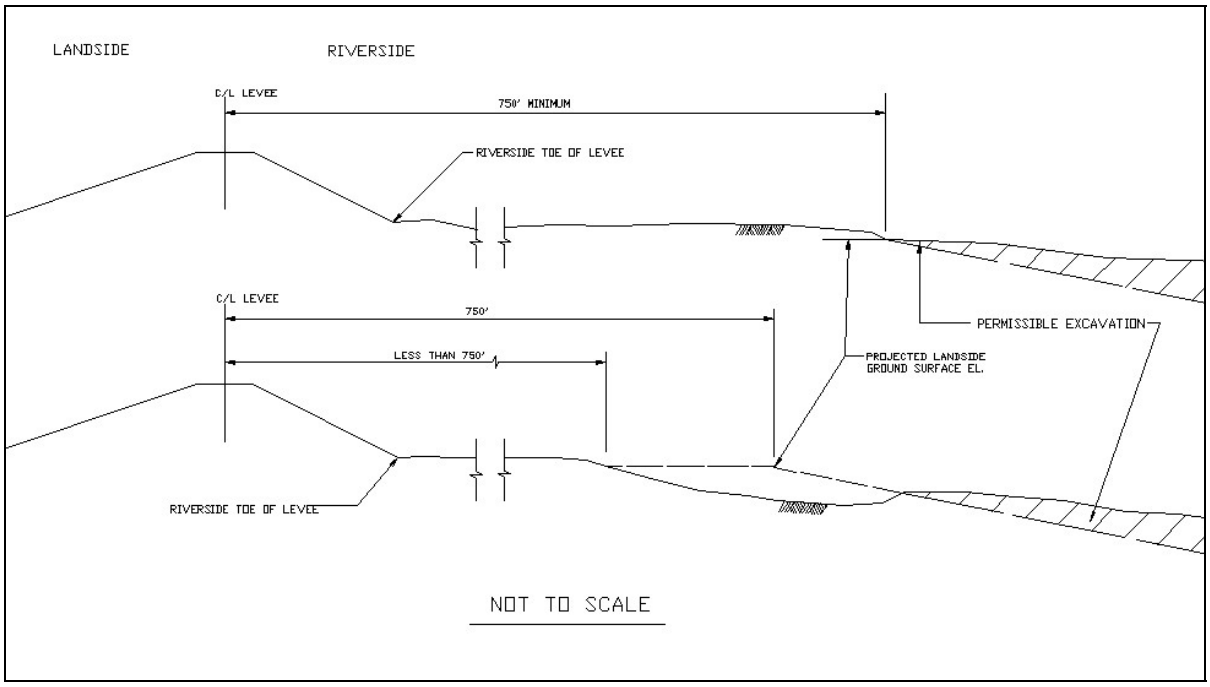

Figure 8 – USACE Mississippi River Dredging Regulations

In this stretch of river, the navigation channel is located near the eastern bank, delineating the eastern boundary of the borrow site. There is no bridge within 4,000 feet of this area. Figure 9 shows the general plan view of the borrow site. There is minimal revetment along the western bank of this river section. The eastern bank of the river is reveted, but is not an issue for this project. Although the magnetometer surveys indicated the borrow site is free of known pipelines, the contractor will be required to perform a magnetometer survey prior to excavation.

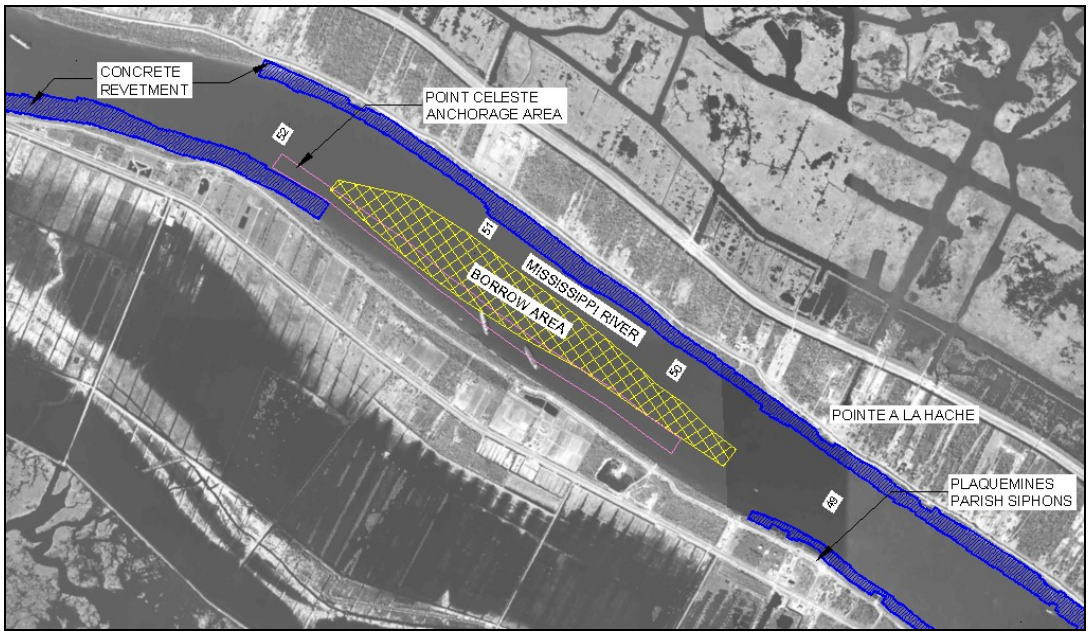

Figure 9 – Designated Borrow Site

The size of the borrow site is governed by the volume of material calculated to fill the marsh creation fill sites as discussed in Section 6.1. The borrow volume is computed by simply multiplying the fill volume by the cut:fill ratios for hydraulically dredged material mentioned in Section 3.6. The maximum depth of cut is assumed to be elevation -66.0 feet NAVD88. A conventional dredge can cut to a maximum of approximately 70.0 feet below the water surface. Historical water surface elevation data in the Mississippi River at Alliance and Venice shows that the water elevation in the summer typically fluctuates between +3.0 feet NAVD 88 and +4.0 feet NAVD 88. Since this is the most likely time for the material to be dredged, the maximum depth of cut was estimated to be -66.0 feet NAVD88 to account for the water level elevation of +4.0 feet NAVD88. The total volume of available sediment in this reach of the river is 6,247,664 cubic yards. The total fill volume required is 5,400,511 cubic yards, (including refilling containment dike borrow sites). Details on the borrow site design are shown in Section VII of the Design Calculations Packet located in Appendix E.

6.3 Containment Dike Design

The primary design parameters associated with the containment dike design include crown elevation, crown width, and side slopes. OCPR tasked Eustis to determine these parameters using slope stability and settlement analyses. Eustis recommended that the containment dikes be built to a +5.5 feet NAVD 88 crown elevation, with a 5 feet crown width and 1(V):6(H) side slopes to maintain a factor of safety of 1.3. Constructing the dikes to a crown elevation of +5.5 feet NAVD 88 should insure that an elevation of +3.0 NAVD 88 is maintained throughout construction (assumed to be one year). This recommendation is based upon the assumption that the marsh buggy excavator contractor would demobilize his equipment once the construction of the containment dikes is complete. OCPR construction specifications require that the contractor maintain the containment dikes throughout construction. After discussing the matter with Eustis, it was decided that an initial constructed and maintained crown elevation of +3.0 feet NAVD would suffice. The containment dikes shall be constructed using in-situ material from within each fill site. Once these parameters were determined, cross-sectional areas and containment volumes were calculated using the methods described in Section IV of the Design Calculations Packet located in Appendix E. As recommended by Eustis, a mechanical dredging cut:fill ratio of 2.0:1 was applied to the calculated fill volumes. Table 5 provides the approximate segment lengths and volumes of each containment dike segment.

Segment	Avg. Base Elevation (ft. NAVD 88)	Avg. Height (ft.)	Segment Length (ft.)	Fill Volume (yd^3)	Borrow Volume (yd^3)
A1	-1.85	4.85	972	5951	11902
A2	-1.27	4.27	5382	26061	52122
A3	0.94	2.06	1824	2416	4832
A4	-0.60	3.60	2269	8048	16096
A5	-0.26	3.26	2971	8811	17623
A6	0.39	2.61	1727	3449	6898
A7	-0.77	3.77	925	3567	7133
A8	-2.55	5.55	398	3131	6262
A9	-2.50	5.50	2202	17043	34086
A10	-1.06	4.06	1234	5450	10899
B1	-1.66	4.66	3511	19971	39942
B2	-1.65	4.65	133	753	1506
B3	-1.35	4.35	659	3303	6605
B4	-1.68	4.68	1549	8884	17767
B5	-2.05	5.05	1484	9796	19593
B6	1.00	2.00	755	950	1901
B7	-2.43	5.43	1545	11678	23355
B8	0.02	2.98	1140	2878	5756
B9	-0.36	3.36	764	2392	4783
B10	0.56	2.44	1573	2791	5583
B11	-0.18	3.18	216	614	1227
B12	-1.04	4.04	261	1143	2286
B13	-1.04	4.04	776	3393	6787

Table 5 – Summary of Containment Dike Quantities

7.0 EARTHEN TERRACE DESIGN

Another proposed project feature is to create approximately 7,300 linear feet of earthen terraces by excavating material from adjacent borrow sites as shown in the Final Design Drawings located in Appendix F. The terrace field will play a major role in dampening the wave action in the project area and should provide ample area for marsh and vegetation to establish itself. The design and analysis of the terraces is discussed in the sections below.

7.1 Terrace Design

The main design component of the terrace field involves the establishment of the terrace template. Before this could be accomplished, a design elevation must be determined. The construction crown elevation of a terrace is typically governed by the significant wave height, the physical properties of the borrow material, and the bearing capacity of the foundation soils in the terrace area. Although the construction of the adjacent marsh creation cells would eliminate most wave action at the proposed terrace field location, the calculated wave height of +2.3 feet NAVD 88 was chosen as the governing factor in the terrace template design. Eustis' recommended construction crown elevation of +3.6 feet NAVD 88 was chosen in order to maintain a design elevation of +2.3 feet NAVD 88 throughout the twenty year life of the project.

The terrace layout includes an overlapping configuration with 500 foot spacing between terrace rows. Per Eustis' recommendation, the terrace borrow sites should be located at least 25.0 feet from the southern toe of each terrace. The borrow site dimensions include a cut depth of 10.0 feet, a 1(V):3(H) side slope, and a bottom width of 20.0 feet. Cross sectional areas and volumes were calculated based on these parameters using the methods described in Section V of the Design Calculations Packet located in Appendix E. As recommended by Eustis, a mechanical dredging cut:fill ratio of 2.0:1 was applied to the calculated fill volumes. Table 6 shows the approximate lengths and volumes of each terrace.

Terrace	Avg. Base Elevation (ft. NAVD 88)	Avg. Height (ft.)	Terrace Length (ft.)	Fill Volume (yd^3)	Borrow Volume (yd^3)
T1	-1.92	5.42	500	3639	7279
T2	-2.20	5.70	500	3916	7832
T3	-2.08	5.58	500	3796	7593
T4	-2.01	5.51	700	5218	10437
T5	-2.15	5.65	700	5412	10825
T6	-2.35	5.85	500	4068	8136
T7	-2.03	5.53	500	3747	7494
T8	-2.08	5.58	500	3796	7593
T9	-1.99	5.49	700	5191	10382
T10	-1.92	5.42	700	3639	7279
T11	-2.42	5.92	500	4140	8279
T12	-1.67	5.17	500	3400	6800
T13	-1.78	5.28	500	3504	7009

Table 6 – Summary of Terrace Quantities

7.2 Terrace Construction

Because of the relatively high water depths and poor soil conditions, construction of the BA-42 terrace field will require special provisions. Based on the OCPR's experience with terrace construction, the design template could be obtained if the contractor utilizes a staged construction process. This is accomplished by first building the terrace to just above MLW elevation and allowing it to dewater. Once this "base" has been established, the remainder of the terrace template can be constructed. Several lifts are anticipated to obtain the desired elevation of +3.5 NAVD 88. Once constructed, a new contract would be issued for terrace planting.

8.0 SHORELINE PROTECTION/RESTORATION DESIGN

8.1 Design Alternatives

Several shoreline protection/restoration alternatives were considered for the eastern rim of Lake Hermitage. These alternatives consisted of an offshore rock dike, a rock dike placed on the shoreline, and sand fill template placed on the shoreline. The shoreline protection feature proposed in Phase 0 (planning) included the placement of 6,000 feet of rip rap along the eastern shoreline of Lake Hermitage. Since Lake Hermitage has an average water depth of 4.6 feet, it is anticipated that approximately 2.6 miles of access channel would have to be dredged to mobilize barges of rock to the project site. Additionally, the Project Team concluded that the relatively mild wave climate in Lake Hermitage did not warrant the construction of a "hard" shoreline protection feature. The Project Team then investigated hydraulically pumping sand fill onto the shoreline to restore the degraded shoreline. This feature would not require the contractor to dig access, and would not result in a significant increase in the mobilization cost of the project as the rock feature would. The geotechnical analysis indicated that the sandy material in the borrow site would be suitable for constructing this type of feature. For these reasons the Project Team elected to move forward with the shoreline restoration feature.

The shoreline restoration feature will consist of a sand fill template placed along the existing shoreline. The shoreline restoration template will be designed to maintain its integrity against the design wave based on the twenty year design life of the project. The approximate materials quantity calculations are shown in Section VI of the Design Calculation Packet in Appendix E.

8.2 Typical Cross Section

The shoreline restoration template parameters recommended by Eustis were utilized for the design of this feature. These parameters include a crown width of 50 feet, a lakeside slope of 1(V):50(H), and a marshside slope of 1(V):25(H). To insure that a crown elevation of +2.2 feet NAVD is maintained throughout the twenty year life of the project, Eustis recommended the shoreline restoration template be constructed to a crown elevation of +4.2 feet NAVD 88. For constructablity purposes, a crown elevation of +4.0 feet NAVD will be used. The typical cross section for the shoreline restoration feature is shown in Figure 10.

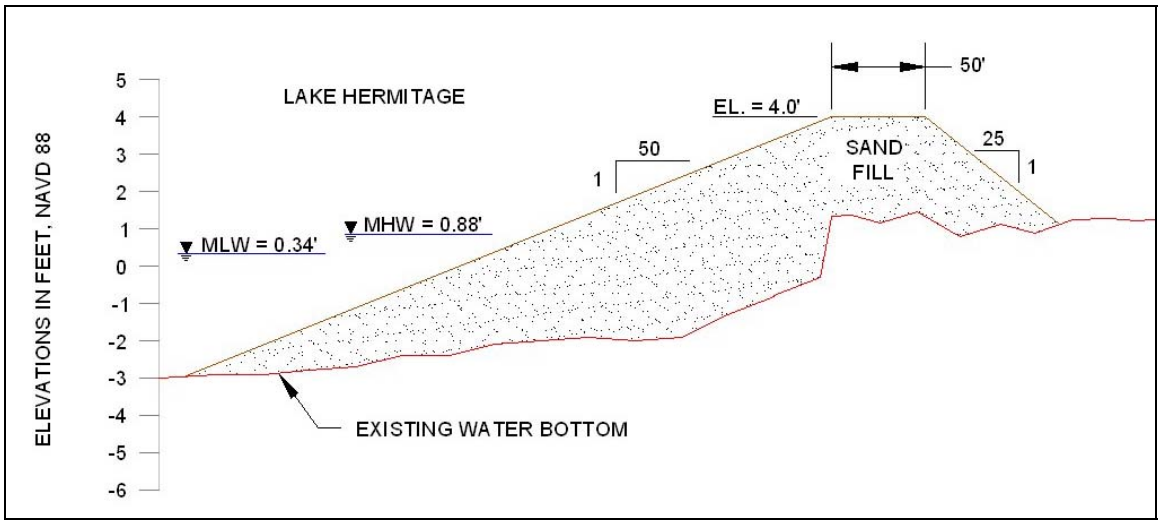

Figure 10 – Typical Shoreline Restoration Section

8.3 Shoreline Restoration Alignment

Design surveys revealed that a small ridge with an average crown elevation of +0.9 feet NAVD 88 exists along the eastern shoreline of Lake Hermitage. The alignment of the shoreline restoration template places its centerline onto the approximate centerline of the existing shoreline ridge. The shoreline restoration feature will be constructed in straight line segments which should create a more efficient alignment for the feature to protect against wave energies. Additionally, construction surveying and stake out will also be more uniformly facilitated using straight line segments. The alignment spans approximately 7400 linear feet from the northeastern corner of Lake Hermitage to beyond the pipeline canal located at the southeastern corner. The Preliminary Design layout of BA-42 included an earthen plug at the mouth of this canal that would be constructed using dredged sediment from the Mississippi River borrow site. Although this point on the lakeshore does not experience the highest wave energies, the Project Team was concerned about the integrity of an earthen plug against wave forces. Therefore, the Final Design of BA-42 includes an extension of the shoreline restoration feature to 200 linear feet beyond the pipeline canal. The plan view for the alignment of the shoreline restoration feature is shown on the Final Design Drawings located in Appendix F. Once constructed, a new contract would be issued for plantings on the new shoreline template.

9.0 DREDGE PIPELINE TRANSPORT

The dredge slurry discharge pipeline will cross the Mississippi River levee on the Plaquemines Parish tract of land surrounding the West Pointe a la Hache Siphons. A suitable levee crossing shall be built as per the USACE's requirements shown in the Final Design Drawings located in Appendix F. A casing will be installed underneath Highway 23 in accordance with all Louisiana Department of Transportation and Development specifications. From Highway 23, the pipeline will be placed on Plaquemines Parish property until it reaches Jefferson Canal. It will then run parallel with the pipeline canal indicated in the figure below. Figure 11 shows the proposed pipeline route in the vicinity of the Mississippi River Levee and Highway 23.

Figure 11 – Proposed Pipeline Crossing

In order to develop a jacking plan for the pipeline casing, Sigma performed surveys at two proposed pipeline crossings at Hwy 23 as discussed in Section 2.6 and shown in Appendix B. During Preliminary Design, it was determined that neither of these proposed crossings was feasible because of underground utilities near the locations. On September 25, 2008, an OCPR survey crew was mobilized to performed additional surveys at a newly proposed crossing. Surveys were also performed near the Mississippi River Levee at the West Point a la Hache Siphons. Coordinates for overhead utilities, fire hydrants, water meters, manhole covers, drains, and culverts were also obtained during this survey. Additionally, locations and depths of all underground utilities were obtained from conversations with the respective utility provider. This data was used to develop the Utility Layout Highway and Highway Crossing Detail shown on drawings in Appendix F.

Figure 12 – OCPR Survey Crew

10.0 CONSTRUCTION

10.1 Construction Sequence

Several construction items associated with BA-42 are dependent upon the completion of other tasks. Therefore it is critical that the Project Team establish a construction sequence to ensure that the contractor builds the project according to specification. The Gantt chart in Figure 13 shows a proposed construction sequence and the estimated construction time associated with each item.

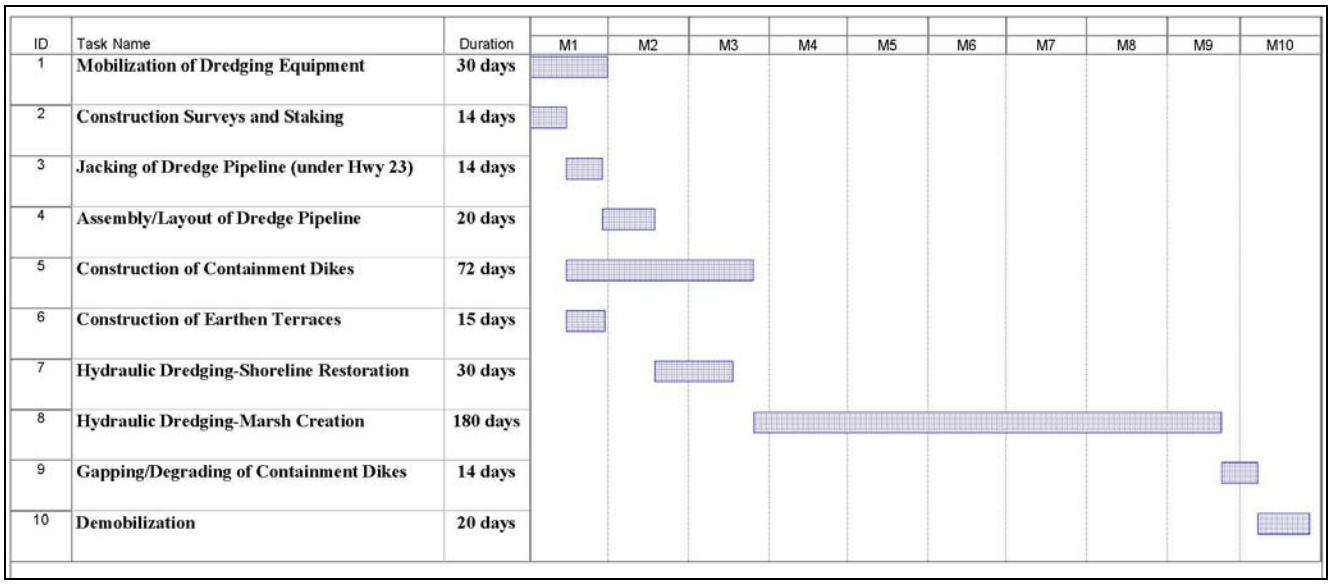

Figure 13 – Construction Sequence and Schedule

10.2 Construction Cost Estimate

Project:	**Lake Hermitage Marsh Creation (BA-42)**	**Date:**	**2-Oct-08**		
Computed by:	**Rudy Simoneaux, E.I.**	*Project Priority List 15* (ver.082408)			
Item No.	**Work or Material**	**Quantity**	**Unit**	**Unit Cost**	**Amount**
1	Mobilization/Demobilization	1	LS	$2,763,251	$2,763,251
2	Construction Surveys	1	LS	$300,000	$300,000
3	Grade Stakes and Flagging	84	EACH	$500	$42,000
4	Hydraulic Dredging for Marsh Creation	3,725,784	CY	$6.17	$22,988,090
5	Hydraulic Dredging for Shoreline Restoration	278,496	CY	$5.92	$1,648,696
6	Shaping Grading/Earthwork-Shoreline Restoration	1	LS	$100,000.00	$100,000
7	Vegetative Plantings for Shoreline Restoration	5,487	LF	$2.00	$10,974
8	Earthen Containment Dikes	34,268	LF	$28.62	$980,750
9	Earthern Terraces	7,300	LF	$45.18	$329,814
10	Vegetative Plantings for Earthen Terraces	7,300	LF	$4.00	$29,200
11	Marsh Fill Settlment Plates	4	EA	$2,500.00	$10,000
12	Jack and Bore Highway	150	LF	$600	$90,000
	ESTIMATED CONSTRUCTION COST				**$29,292,775**
	ESTIMATED CONSTRUCTION + 15% CONTINGENCY				**$33,686,691**

11.0 MODIFICATIONS TO APPROVED PHASE 0 PROJECT

As a result of Phase 1 activities, the approved Phase 0 project has undergone a few minor modifications. The Phase 0 project included 593 acres of marsh creation and nourishment. The Phase 1 project includes 534 acres of marsh creation. Additionally, the Phase 0 project included a 300-acre terrace field with approximately 16 subaerial acres. A 182-acre portion of that terrace field was replaced with a marsh creation cell to reestablish the southern shoreline of Lake Hermitage. The Phase 1 terrace field consists of 107 acres with approximately 6.5 subaerial acres. The foreshore rock dike proposed at Phase 0 has been replaced with the shoreline restoration/sand fill feature discussed in Section 9.0

12.0 COMMENTS ON PRELIMINARY (30%) DESIGN

The Preliminary Design Review Meeting for BA-42 was held on August 26, 2008 at the Baton Rouge office of OCPR. The meeting announcement was sent out to all CWPPRA agencies, as well as several other agencies and organizations involved in the project. This meeting included a detailed presentation on the history of the project, the design process, and the status of all CWPPRA Standard Operating Procedure (SOP) requirements. Figure 14 shows the attendance for the BA-42 Preliminary Design Review Meeting.

Lake Hermitage Marsh Creation (BA-42)
Preliminary (30%) Design Meeting

LOCATION: Louisiana Department of Natural Resources, LaSalle Bldg. Baton Rouge, LA **DATE:** August 26, 2008

NAME	REPRESENTING	PHONE	EMAIL
Kevin Roy	USFWS	337-291-3120	kevin_roy@fws.gov
Andrew Beall	CPRA	225-342-1952	andrew.beall@la.gov
Albertine McKinble	PPL	504-912-5773	albertine.kinble@plugpowerinc.com
Rudy Simoneaux	CPRA-DNR	225-342-6758	rudy.simoneaux@la.gov
P.J. HAHN	PPG. CZM	504-297-5629	PJHAHN@PLACEMINERESPACE.com
JASON KROLL	NRCS	318 473 7816	jason.kroll@la.usda.gov
Michael Nichols	NRCS	318 473-7690	mike.nichols@la.usda.gov
Beth McCasland	USACE	504-862-2021	elizabeth.l.mccasland@usace.army.mil
David Lindquist	OCPR	225-342-4683	david.lindquist@la.gov
PATRICK WILLIAMS	NOAA/NMFS	225-389-0508	patrick.williams@noaa.gov
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JOHN JUNGENSEN	NRCS	318-473-7694	john.jungensen@la.usda.gov
Luke E. LeBas	OCPR	342-4102	
JERRY CARROLL	OCPR	225-342-1532	jerry.carroll@la.gov
Joyce Montgomery	OCPR	225-342-5068	joyce.montgomery@LA.gov
Barry Richard	MFO-OCPR	504-280-4059	Barry.Richard@LA.GOV
Bill Boshart	MFO-OCPR	504-280-4005	Bill.Boshart@la.gov
Kelley Templet	OCPR	225-342-1592	kelley.templet@la.gov
Jacob Haffner	OCPR		Jacob.Haffner@la.gov
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Tim Landers	EPA	214-665-6678	landers.timothy@epa.gov

Figure 14 – Preliminary Design Review Meeting Attendance

The BA-42 Project Team received formal comments on the Preliminary Design Documents from the Environmental Protection Agency (EPA), the Army Corps of Engineers (COE), and the National Marine Fisheries Service (NMFS). The majority of these comments were repetition of the issues discussed at the Preliminary Design Review Meeting. The main issue that was discussed involved the Project Team's decision to include a small terrace field in the southwestern portion of the project area. During Preliminary Design, the Project Team looked into the additional cost of expanding Fill Site B south to create approximately 110 additional acres of marsh. This addition would have resulted in a hydraulic dredging volume increase of 1,027,958 cubic yards and a construction cost increase of approximately $6,400,000. Although not as beneficial as created marsh, the terraces will serve to provide additional habitat for fish and wildlife. In particular, the terraces will provide extensive edge habitat which is extremely important for marine organisms and wading birds.

Another issue discussed was the design methodology involved in the determination of the containment dikes target elevation. The Project Team received several comments inquiring why the design strays away from the recommendation provided by Eustis. The project design requires that the containment dikes be constructed at least 1.0 ft. above the maximum elevation of the marsh fill. Therefore, all dikes should be constructed to elevation +3.0 ft. NAVD 88. Eustis recommended that constructing the dikes to +5.0 ft. NAVD 88 would insure that the dikes maintain the desired elevation throughout construction without the contractor having to rebuild them. The Project Team decided that since the construction contract will require the contractor to maintain these dikes throughout construction (by adding multiple lifts), the target elevation of the dikes should be +3.0 ft. NAVD 88. This construction activity has been accounted for in the unit price for containment dikes.

Additionally, the Project Team received comments regarding the gapping or degrading plan for the containment dikes once hydraulic dredging has been completed. The Project Team agrees that gapping/degrading of the containment dikes is critical to the long term hydrology and fisheries access of the created marsh. However, location and size of containment dikes gaps should be determined once the proposed marsh fill site has been constructed and accepted for payment. The emergence of fill site ponds and low points will allow the Project Team to identify ideal drainage points around the fill sites. Therefore, degrading/gapping of all dike will be include in the specification. However, a field decision regarding the exact locations of the gaps will be made upon completion of hydraulic dredging operations.

13.0 REFERENCES

Eustis Engineering Services, L.L.C. *Geotechnical Investigation, State of Louisiana, Lake Hermitage Marsh Creation (BA-42), Plaquemines Parish, LA.* Metairie, LA. October 2007

Sigma Consulting Group, Inc. *Survey Methodology Report, Lake Hermitage Marsh Creation (BA-42), Topographic, Bathymetric, and Magnetometer Survey.* Baton Rouge, LA. June 2007.

Coastal Studies Institute, Department of Oceanography and Coastal Sciences, Louisiana State University, *Results of the Lake Hermitage Marsh Creation Project (BA-42) Geophysical Survey.* Baton Rouge, LA. October 2007.

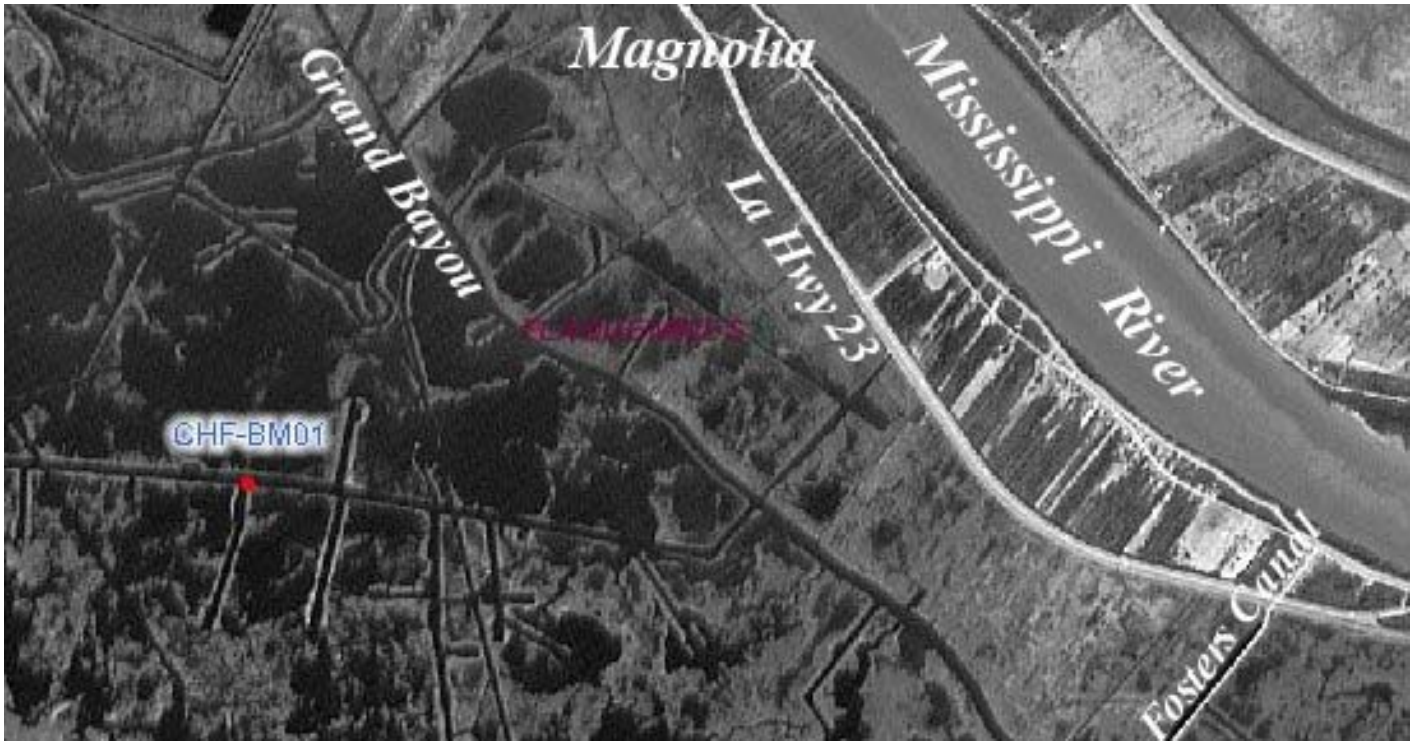
Cole, George M. *Water Boundaries*. New York, NY: John Wiley & Sons, Inc. pp. 24-27., 1997

Herbich, John B. *Handbook of Dredging Engineering, 2nd Edition*. McGraw Hill

United States Army Corps of Engineers, EM 1110-2-5027. *Confined Disposal of Dredged Material.* Washington, D.C. 1987

APPENDIX A

Secondary Monument Data Sheets



VICINITY MAP

Reproduced from LDNR "SONRIS" Interactive Map

Station Name: "BA04c-SM-01" (CHF- BM-1)

Monument Location: From "Happy Jack Marina" proceed, by boat, southwesterly in Martins Canal for approximately 1.6 miles to its intersection with Grand Bayou. Turn right and proceed northwesterly in Grand Bayou for approximately 3.1 miles to its intersection with an oil field canal. Turn left and proceed southwesterly and northwesterly in the oilfield canal for approximately 2.1 miles to the monument on the south bank. Monument is located approximately 50 feet bank from the south bank and 18 feet from the east bank of an intersecting canal in the top of a spoil bank.

Monument Description: NGS Style floating sleeve monument; 9/16" stainless steel rods driven 60 feet to refusal, set in a sand filled 6" PVC pipe with access cover and projects about 1 foot above the ground.

Cap Stamping: BM-1

Date of Survey: December 29, 2004

Monument Set By: C.H. Fenstermaker & Associates, Inc.

For: *LA Department of Natural Resources, CRD*

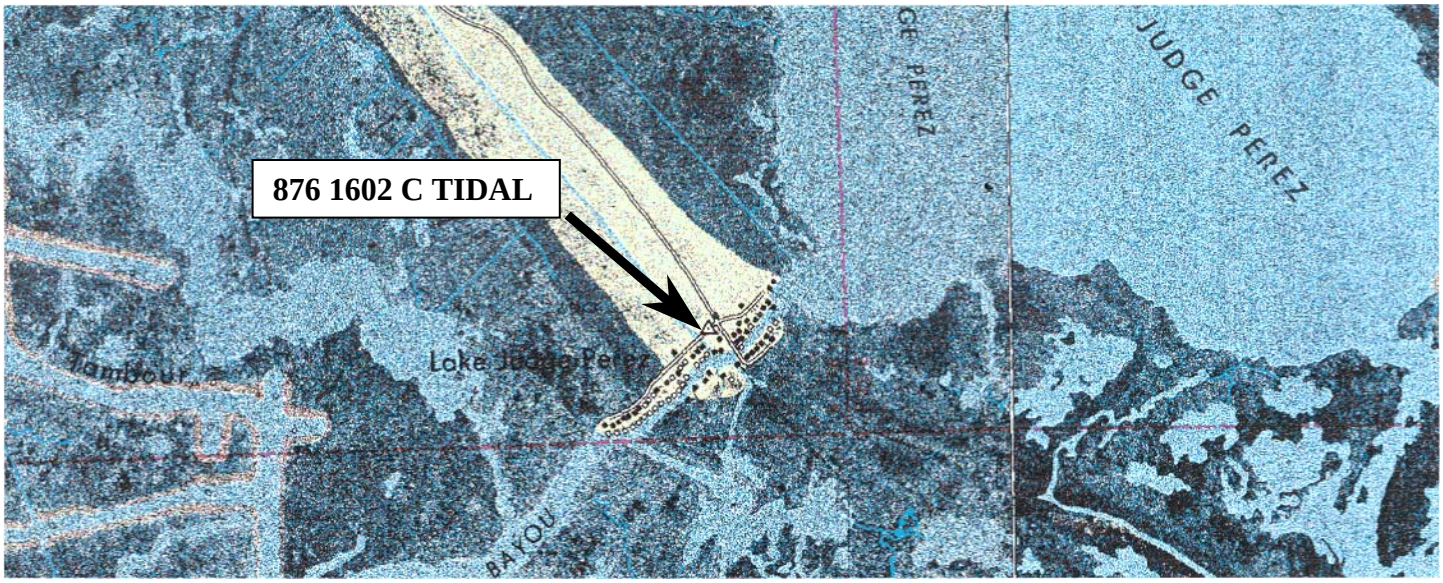
NAD 83 Geodetic Position
Lat. 29° 32' 00.96778"N
Long. 89° 49' 07.86897"W

NAD 83 Datum LSZ (1702) Ft
N= 379,068.31
E= 3,762,442.45

NAVD88 Height (Geoid99)
Elevation = 3.47 ft / 1.057mtrs

Ellipsoid Hgt: -23.728mtrs
Geoid99 Hgt: -24.786mtrs

Position determined by using Real-time Kinematic (RTK) survey from GPS Monument "C 195"
Position determined by John Chance Land Surveys, Inc. for the Louisiana Department of Natural Resources, Coastal Restoration Division



VICINITY MAP Scale: 1" = 2000'

Reproduced from USC&GS "POINTE A LA HACHE" & "LAKE LAURIER Quadrangles

Station Name: "876 1602 C TIDAL"

Monument Location: From Myrtle Grove, Louisiana proceed southeast on State Highway 23 to mile marker 46.7. Turn right on Hermitage Road and proceed southeasterly for 4.95 miles to the station on the right. The station is located 95.1 feet north of the north corner of a fire station, 17 feet northeast of the centerline of Hermitage Road, 20.2 feet southeast of the centerline of East Bayou Road, and 1.6 feet southwest of a plastic witness post.

Monument Description: Brass disk set on a 22.0 meter stainless steel rod driven to refusal.

Date: March 2002

Monument Established By: Unknown

Published NAD 83 (1992) Geodetic Position
Lat. 29°33'33.83137"N
Long. 89°53'05.03563"W

Published NAVD 88 (Feet)
Elevation = 2.

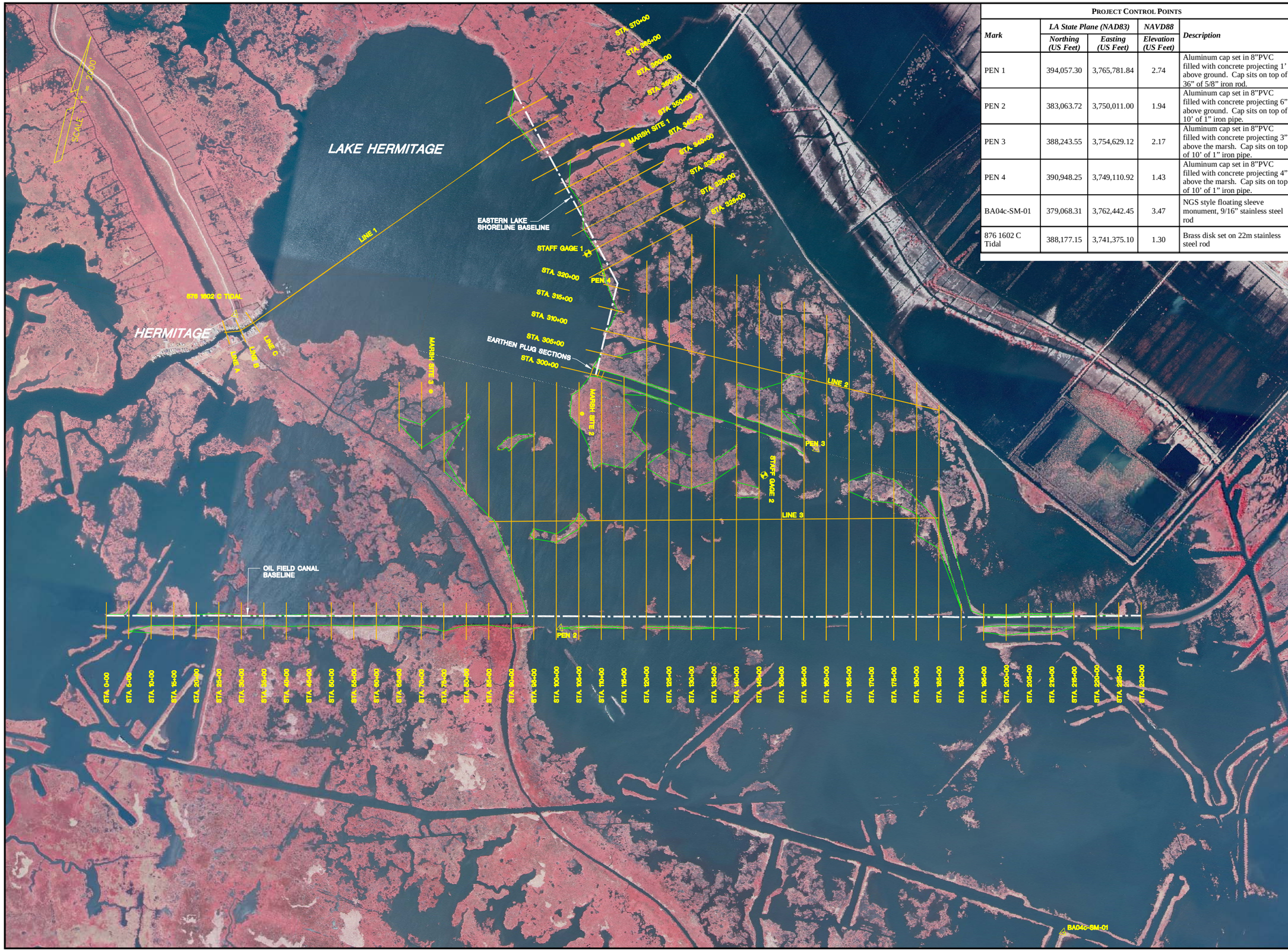
Held NAD 83 (1992) Geodetic Position
Lat. 29°33'33.83137"N
Long. 89°53'05.03563"W

Held NAD 83 Position
LA South Zone (1702)(Survey Feet)
N = 388,177.15
E = 3,741,375.10

Adjusted NAVD 88 (2002 CHFA)
(Survey Feet / Geoid 99
Elevation = 1.31

APPENDIX B

Sigma Consultants, Inc. Survey Drawings



PROJECT CONTROL POINTS

Mark	LA State Plane (NAD83) Northing (US Feet)	LA State Plane (NAD83) Easting (US Feet)	NAVD88 Elevation (US Feet)	Description
PEN 1	394,057.30	3,765,781.84	2.74	Aluminum cap set in 8"PVC filled with concrete projecting 1' above ground. Cap sits on top of 36" of 5/8" iron rod.
PEN 2	383,063.72	3,750,011.00	1.94	Aluminum cap set in 8"PVC filled with concrete projecting 6" above ground. Cap sits on top of 10' of 1" iron pipe.
PEN 3	388,243.55	3,754,629.12	2.17	Aluminum cap set in 8"PVC filled with concrete projecting 3" above the marsh. Cap sits on top of 10' of 1" iron pipe.
PEN 4	390,948.25	3,749,110.92	1.43	Aluminum cap set in 8"PVC filled with concrete projecting 4" above the marsh. Cap sits on top of 10' of 1" iron pipe.
BA04c-SM-01	379,068.31	3,762,442.45	3.47	NGS style floating sleeve monument, 9/16" stainless steel rod
876 1602 C Tidal	388,177.15	3,741,375.10	1.30	Brass disk set on 22m stainless steel rod

SHEET NUMBER 1

DESIGNED LEAR BREAUX
CHECKED
DETAILED AMEDEE KING
CHECKED
DATE JUNE 2007
SHEET 1 OF 1

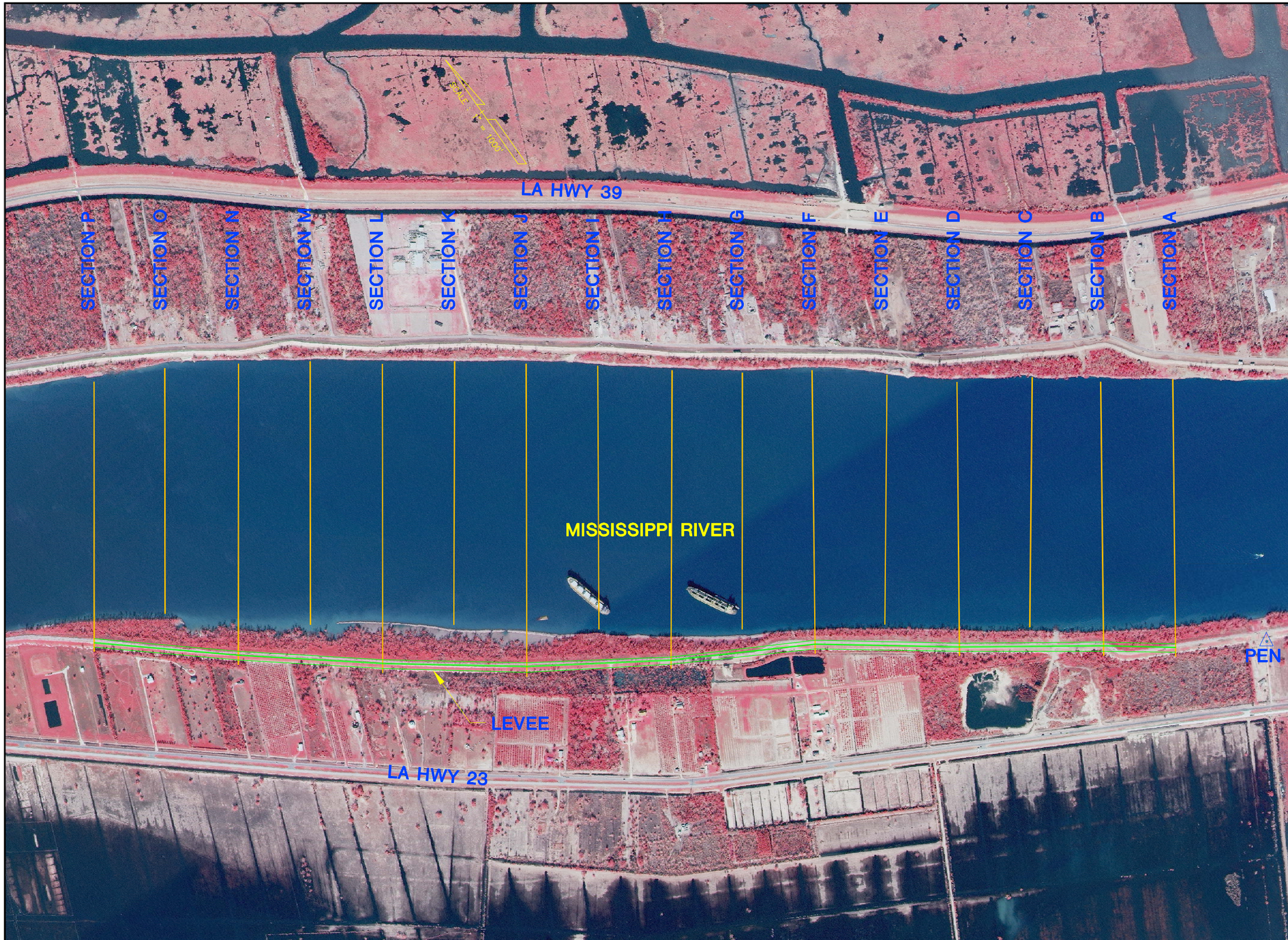
NO.	DATE	REVISION DESCRIPTION	BY

LAKE HERMITAGE MARSH CREATION
PLAQUEMINES PARISH, LOUISIANA
TOPOGRAPHIC & BATHYMETRIC SURVEY
STATE PROJECT BA-42

MARSH CREATION PLAN VIEW

SIGMA CONSULTING GROUP, INC.

F:\02020\60912\01800\60912sur.dwg /Marsh Creation1 Jun 13, 2007 - 3:53pm



SHEET NUMBER	10
DESIGNED / CHECKED	LEAR / BREAUX
DETAILED / CHECKED	AMEDEE / KING
DATE / SHEET	JUNE 2007 / 1 OF 3

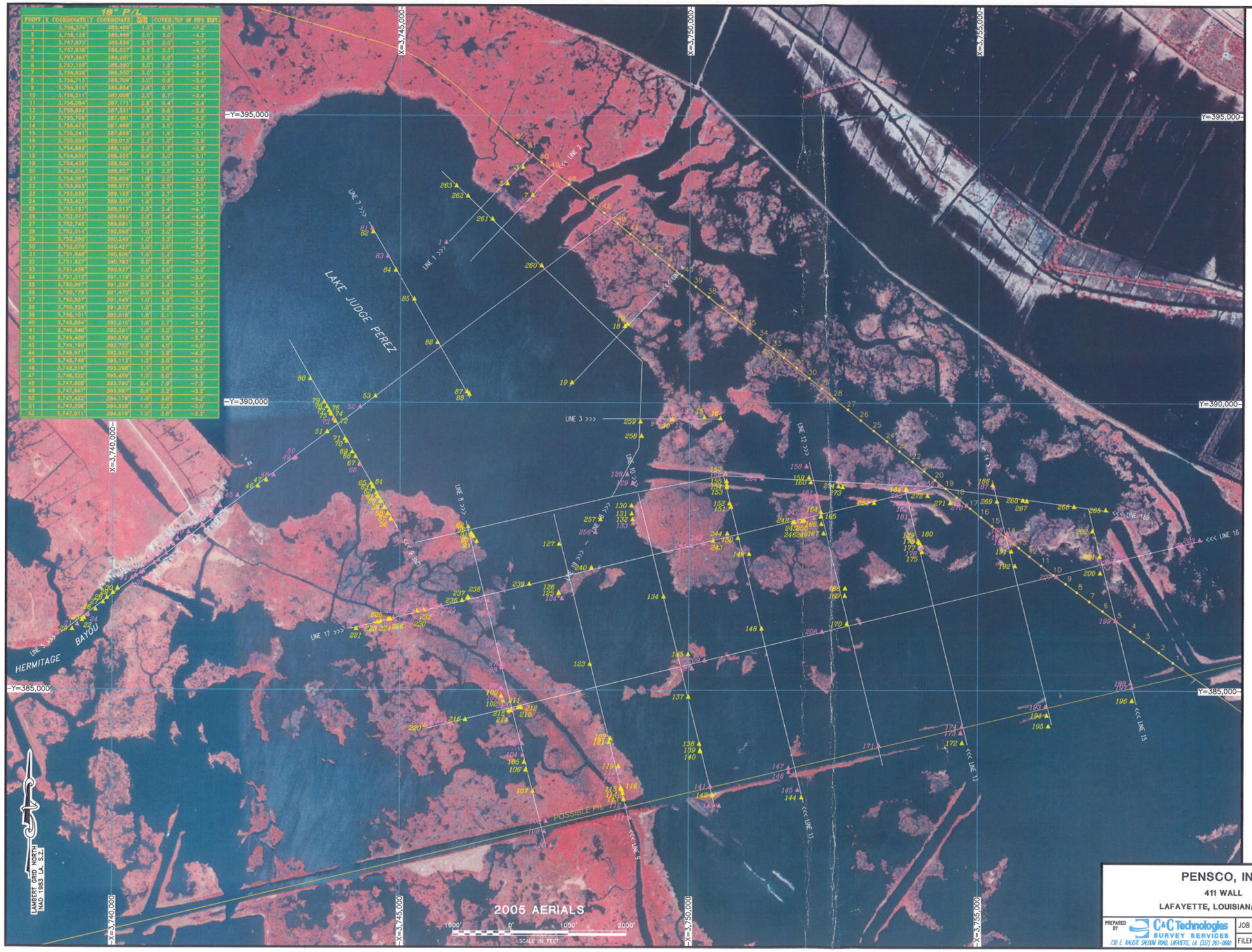
NO.	DATE	REVISION DESCRIPTION	BY

LAKE HERMITAGE MARSH CREATION
PLAQUEMINES PARISH, LOUISIANA
TOPOGRAPHIC & BATHYMETRIC SURVEY
STATE PROJECT BA-42

MISSISSIPPI RIVER SECTIONS

SIGMA CONSULTING GROUP, INC.

F:\0202\60912\018001\60912 River Plan.dwg (Mississippi River) Jun 13, 2007 - 4:12pm



18" P/L

POINT	X COORDINATE	Y COORDINATE	DEPTH	COVER	TOP OF PIPE ELEV.
1	3,758,374'	389,486'	1.5'	6.0'	-7.2'
2	3,758,129'	389,466'	2.0'	3.0'	-4.2'
3	3,757,870'	389,446'	2.5'	2.0'	-3.7'
4	3,757,618'	389,027'	2.5'	2.5'	-4.0'
5	3,757,393'	388,207'	2.5'	2.0'	-3.7'
6	3,757,158'	387,580'	3.0'	1.5'	-3.7'
7	3,756,928'	386,550'	3.0'	1.2'	-5.4'
8	3,756,713'	386,709'	3.0'	0.8'	-3.0'
9	3,756,516'	386,834'	2.5'	0.7'	-2.7'
10	3,756,311'	387,005'	2.5'	0.9'	-2.4'
11	3,756,094'	387,171'	2.8'	0.4'	-2.4'
12	3,755,892'	387,531'	2.5'	0.6'	-2.5'
13	3,755,706'	387,481'	1.8'	2.2'	-3.2'
14	3,755,476'	387,468'	0.5'	3.5'	-3.2'
15	3,755,241'	387,859'	2.0'	1.0'	-3.1'
16	3,755,022'	388,013'	2.5'	1.0'	-2.5'
17	3,754,863'	388,165'	2.3'	1.5'	-2.8'
18	3,754,630'	388,555'	0.8'	3.0'	-3.1'
19	3,754,438'	388,509'	1.5'	2.5'	-3.2'
20	3,754,234'	388,857'	1.3'	2.5'	-3.0'
21	3,754,097'	388,809'	1.8'	2.0'	-3.0'
22	3,753,853'	389,573'	1.5'	3.0'	-3.2'
23	3,753,636'	389,185'	1.5'	2.7'	-3.4'
24	3,753,423'	389,530'	1.8'	2.7'	-3.7'
25	3,753,197'	389,513'	2.5'	2.4'	-4.1'
26	3,752,972'	389,895'	2.8'	2.4'	-4.4'
27	3,752,745'	389,861'	2.8'	1.5'	-3.2'
28	3,752,514'	390,065'	1.0'	3.0'	-3.2'
29	3,752,290'	390,349'	1.0'	3.3'	-3.5'
30	3,752,070'	390,427'	2.0'	2.0'	-3.2'
31	3,751,848'	390,806'	1.8'	2.3'	-3.0'
32	3,751,627'	390,783'	0.0'	3.8'	-3.0'
33	3,751,458'	390,937'	1.0'	3.0'	-3.2'
34	3,751,315'	391,119'	0.8'	1.8'	-3.0'
35	3,750,997'	391,284'	0.8'	3.5'	-3.4'
36	3,750,779'	391,470'	0.0'	4.5'	-3.7'
37	3,750,557'	391,649'	1.0'	3.0'	-3.2'
38	3,750,329'	391,833'	1.8'	2.2'	-3.2'
39	3,750,101'	392,018'	1.8'	2.1'	-3.1'
40	3,749,884'	392,210'	1.5'	2.7'	-3.4'
41	3,749,640'	392,391'	1.0'	3.2'	-3.4'
42	3,749,409'	392,578'	1.0'	3.5'	-3.7'
43	3,749,196'	392,752'	0.8'	4.0'	-4.0'
44	3,748,971'	392,933'	1.2'	3.8'	-4.2'
45	3,748,748'	393,113'	1.5'	3.5'	-4.2'
46	3,748,519'	393,298'	1.3'	3.0'	-3.5'
47	3,748,332'	393,459'	1.0'	3.0'	-3.2'
48	3,747,898'	393,790'	0.4'	7.9'	-7.5'
49	3,747,667'	393,987'	0.8'	3.2'	-3.2'
50	3,747,432'	394,178'	1.0'	3.0'	-3.2'
51	3,747,208'	394,358'	1.5'	2.3'	-3.0'
52	3,747,011'	394,519'	1.0'	3.0'	-3.2'

UNIDENTIFIED MAGNETIC ANOMALIES

NUMBER	AMPLITUDE	DURATION	NUMBER	AMPLITUDE	DURATION	NUMBER	AMPLITUDE	DURATION
1	182	9	93	83	15	185	114	14
2	72	216	94	147	40	186	35	19
3	52	126	95	141	29	187	139	67
4	8660	165	96	118	34	188	252	52
5	4742	91	97	141	23	189	182	34
6	389	61	98	146	17	190	2671	52
7	95	73	99	374	49	191	14	7
8	3594	23	100	77	35	192	43	110
9	121	45	101	192	28	193	122	68
10	90	46	102	66	26	194	54	41
11	138	163	103	118	104	195	46	33
12	113	20	104	100	120	196	99	143
13	140	112	105	87	30	197	173	114
14	124	139	106	25	25	198	783	35
15	55	194	107	74	28	199	4294	114
16	45	163	108	247	21	200	21	10
17	51	39	109	642	168	201	93	220
18	54	53	110	174	32	202	25	34
19	76	13	111	13	15	203	193	95
20	40	23	112	115	160	204	156	110
21	100	27	113	247	33	205	182	52
22	23	14	114	14	19	206	397	84
23	30	25	115	30	14	207	2123	196
24	1518	44	116	43	20	208	1875	28
25	183	43	117	149	30	209	1335	31
26	24	44	118	120	12	210	27	20
27	59	75	119	37	12	211	21	27
28	46	50	120	103	20	212	80	36
29	10	12	121	77	16	213	107	22
30	49	52	122	89	98	214	79	41
31	214	60	123	61	28	215	94	35
32	113	87	124	104	20	216	93	47
33	161	170	125	9	8	217	171	38
34	130	66	126	38	11	218	213	28
35	271	76	127	56	35	219	104	53
36	213	56	128	305	1	220	51	18
37	339	214	129	100	28	221	94	73
38	194	76	130	50	63	222	143	140
39	149	90	131	20	42	223	48	30
40	321	117	132	22	11	224	39	43
41	1777	201	133	137	18	225	46	29
42	2119	461	134	84	17	226	69	23
43	476	283	135	11	8	227	126	21
44	103	161	136	115	138	228	149	43
45	156	41	137	73	17	229	119	52
46	48	21	138	23	31	230	73	30
47	73	27	139	10	9	231	140	25
48	118	31	140	19	25	232	81	19
49	299	71	141	132	114	233	166	34
50	389	103	142	39	8	234	112	85
51	65	42	143	239	21	235	100	25
52	124	19	144	76	23	236	60	38
53	66	16	145	3216	63	237	65	19
54	4030	89	146	668	59	238	47	10
55	150	16	147	171	99	239	88	42
56	81	18	148	87	26	240	28	13
57	58	9	149	82	627	241	111	111
58	76	13	150	31	108	242	114	28
59	74	11	151	57	38	243	72	90
60	26	11	152	38	40	244	61	71
61	65	11	153	39	11	245	39	10
62	30	20	154	48	9	246	28	13
63	12	8	155	8	9	247	109	79
64	8	11	156	146	10	248	55	17
65	6	11	157	33	17	249	60	17
66	403	20	158	112	90	250	59	17
67	21	24	159	35	77	251	153	51
68	51	27	160	35	35	252	86	15
69	36	61	161	179	11	253	112	89
70	20	50	162	101	26	254	160	139
71	19	13	163	112	37	255	2099	101
72	13	16	164	59	85	256	455	39
73	186	24	165	17	20	257	35	92
74	15	19	166	29	38	258	56	163
75	7	13	167	13	34	259	8	5
76	5	9	168	40	73	260	50	25
77	12	32	169	29	13	261	22	37
78	13	19	170	37	46	262	14	29
79	26	33	171	374	72	263	26	76
80	20	31	172	41	22	264	919	13
81	115	68	173	250	48	265	60	40
82	58	9	174	398	65	266	23	81
83	126	21	175	46	54	267	41	71
84	94	34	176	165	11	268	65	23
85	18	17	177	98	11	269	9	8
86	43	7	178	7	7	270	7573	138
87	58	20	179	19	20	271	46	130
88	30	21	180	11	9	272	24	15
89	34	38	181	663	40	273	15	14
90	21	24	182	569	7	274	35	12
91	12	16	183	104	13			
92	17	17	184	84	13			

PENSCO, INC.
411 WALL
LAFAYETTE, LOUISIANA, 70508

LAKE HERMITAGE MARSH CREATION
LDNR CONTRACT NO. 2503-05-44
MAGNETOMETER SURVEY
PLAQUEMINES PARISH, LOUISIANA

PREPARED BY C&C Technologies SURVEY SERVICES
730 E. KALISTE SALOOM ROAD, LAFAYETTE, LA (337) 261-0880

JOB NO. 2429 | DWG: REP | CHK: RJJ | REVISED | DATE: 10/9/2007

FILENAME: L:\PENSCO\07-2429\07-2429A.DWG

SHEET 1 OF 1

APPENDIX C

Geotechnical Boring Logs

LEGEND AND NOTES FOR LOG OF BORING AND TEST RESULTS

PP — Pocket penetrometer: Resistance in tons per square foot

SPT — Standard Penetration Test: Number of blows of a 140-lb hammer dropped 30 inches required to drive 2-in. O.D., 1.4-in. I.D. sampler a distance of 1 foot into the soil after first seating it 6 inches

SPLR — Type of Sampling: Shelby, SPT, Auger, No sample

SYMBOL — Clay, Silt, Sand, Peat/Humus, Shells, Stone/Gravel

Predominant type shown heavy; Modifying type shown light

USC — Unified Soil Classification

DENSITY — Unit weight in pounds per cubic foot

SHEAR TESTS

TYPE

- UC — Unconfined compression shear
- OB — Unconsolidated undrained triaxial compression shear on one specimen confined at the approximate overburden pressure
- UU — Unconsolidated undrained triaxial compression shear
- CU — Consolidated undrained triaxial compression shear
- DS — Direct shear

Ø — Angle of internal friction in degrees

c — Cohesion in pounds per square foot

ATTERBERG LIMITS

- LL — Liquid Limit
- PL — Plastic Limit
- PI — Plasticity Index

OTHER TESTS

- CON — Consolidation
- PD — Particle size distribution (sieve and/or hydrometer)
- k — Coefficient of permeability in centimeters per second
- SP — Swelling pressure in pounds per square foot

Other laboratory test results reported on separate figures

GENERAL NOTES

(1) If a ground water depth is shown on the boring log, these observations were made at the time of drilling and were measured below the existing ground surface. These observations are shown on the boring logs. However, ground water levels may vary due to seasonal fluctuations and other factors. If important to construction, the depth to ground water should be determined by those persons responsible for construction immediately prior to beginning work.

(2) While the individual logs of borings are considered to be representative of subsurface conditions at their respective locations on the dates shown, it is not warranted that they are representative of subsurface conditions at other locations and times.

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/12/07 **Boring:** RB-1 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0		20	X		Medium dense gray fine sand w/rocks & shell fragments	SP	1	0-1.5											
		14	X		Medium dense gray fine sand		2	2.5-4											
		22	X				3	5-6.5											
		25	X				4	7.5-9											PD
							4	8.0-9											PD
10		17	X				5	10-11.5											
		20	X				6	12.5-14											
		30	X		Dense gray fine sand	SP	7	18.5-20											PD
20							7	19.0-20											PD
		30	X				8	23.5-25											
		35	X				9	28.5-30											
30																			
		36	X		Dense gray clayey sand	SC	10	33.5-35											PD
							10	34.0-35											PD
		29	X				11	38.5-40											
40																			
50																			

Comments: Water depth = 45 feet
Latitude: 29° 35' 25.99"
Longitude: 89° 49' 45.51"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/13/07 **Boring:** RB-2 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0		18	X		Medium dense gray fine sand	SP	1	0-1.5											
		15	X				2	3-4.5											PD
		21	X				3	6-7.5											
10		20	X				4	9-10.5											PD
		7	X		Loose gray sand w/clay layers	SP	5	12-13.5											
					Medium dense gray fine sand	SP													
20		12	X				6	18.5-20											PD
		15	X				7	23.5-25											PD
30		18	X				8	28.5-30											
		36	X		Dense gray fine sand	SP	9	33.5-35											PD
40		32	X				10	38.5-40											
50																			

Comments: Water depth = 37 feet
Latitude: 29° 35'12.12"
Longitude: 89° 49'19.95"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/12/07 **Boring:** RB-3 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0		9	X		Loose gray fine sand w/shell fragments	SP	1	0-1.5											
		50=6"	X		Very dense gray fine sand w/trace of decayed wood	SP	2	3-4.5											PD
					Very dense gray fine sand	SP	2	3.5-4.5											PD
		30	X		Medium dense gray fine sand	SP	3	6-7.5											
10		26	X		Medium dense tan fine sand w/trace of silt & clay	SP-SM	4	9-10.5											PD
		24	X				5	12-13.5											
20		12	X		w/trace of decayed wood Medium dense gray fine sand w/silt & trace of decayed wood	SP-SM	6 6	18.5-20 19.0-20											PD PD
		24	X				7	24.5-26											
30		24	X		Medium dense tan fine sand w/trace of silt & clay	SP-SM	8	28.5-30											PD
		28	X		w/trace of organic matter		9	33.5-35											PD
40		27	X		Medium dense tan & gray fine sand w/silt & trace of clay	SP-SM	10	38.5-40											PD
50																			

Comments: Water depth = 55 feet
Latitude: 29° 34' 59.80"
Longitude: 89° 48' 52.70"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/24/07 **Boring:** 4 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft gray peat w/roots	Pt	1	0-1											
	0.25				Very soft gray silty clay w/trace of sand	CL	2	1-2											
	0.25						3	2-3	38	84	115	UC	--	196					
	0.25				Medium stiff gray clayey silt	ML	4	3-4											
	0.25						5	4-5	31	91	119	OB	0	670					
					Loose gray clayey sand	SC	6	5-6											
							7	6-7	31	89	116	OB	0	379					
							8	7-8											
	0.50				Very soft gray silty clay w/clay lenses	CL	9	8-9	55	66	102	UC	--	123	46	19	27		
10	0.50						10	9-10											
	0.50				Very soft gray clay w/sand & silt lenses	CH	11	10-11	47	73	108	UC	--	161					
	0.50						12	11-12											
	0.50						13	12-13											
	0.50						14	13-14											
	0.50						15	14-15	75	54	95	UC	--	187					
	0.50						16	15-16											
	0.50						17	16-17	69	58	97	UC	--	141					
	0.50						18	17-18											
	0.50						19	18-19											
20	0.50						20	19-20	70	57	96	UC	--	191					
					Loose gray sandy silt w/clay lenses	ML													
	0.50						21	24-25	27										-#200 = 86.2
					Very soft gray silty clay w/sand & silt lenses & pockets	CL													
30	0.50						22	29-30	32	90	119	UC	--	246					
					Soft gray silty clay w/silt pockets	CL													
	0.50						23	34-35	28										
					Soft gray silty clay	CL													
40																			
50																			

Comments: Latitude: 29° 34' 25.93"
Longitude: 89° 52' 4.70"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/24-25/07 **Boring:** 5 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft peat w/roots	Pt	1	0-1											
	0.25						2	1-2											
	0.25				Very soft gray clay w/peat & roots	CH	3	2-3											
	0.25						4	3-4	59	65	104	UC	--	46					
	0.25						5	4-5											
	0.25						6	5-6											
	0.25						7	6-7	49	73	108	UC	--	87					
	0.25				Very soft gray silty clay w/silt lenses	CL	8	7-8											
	0.25						9	8-9											
10	0.25						10	9-10	65	61	101	UC	--	56					
	0.25						11	10-11											
	0.25				Very soft gray clay	CH	12	11-12											
	0.25				w/silt pockets		13	12-13	49	72	108	UC	--	158					
	0.25						14	13-14											
	0.25						15	14-15											
	0.25						16	15-16	67	59	99	UC	--	106					
	0.25						17	16-17											
	0.25						18	17-18											
	0.25						19	18-19	74	55	95	UC	--	142					
20	0.25				w/shells		20	19-20											
	0.50				w/silt pockets		21	24-25	73	56	97	UC	--	167					
	0.50				w/trace of silt & silt pockets		22	28-29											
30																			
	0.50						23	34-35	47	73	107	UC	--	190					
40	0.50				w/silt pockets		24	39-40											
	0.50				Soft gray clay		25	44-45	64	62	102	UC	--	417					
50	0.50						26	49-50											

Comments: Latitude: 29° 33' 55.21"
Longitude: 89° 51' 33.80"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/24-25/07 **Boring:** 5 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
50					Soft gray clay	CH													
	0.50						27	54-55	72	57	97	UC	--	356					
60	0.50				w/silt pockets		28	59-60											
70																			
80																			
90																			
100																			

Comments: Latitude: 29° 33' 55.21"
Longitude: 89° 51' 33.80"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/25/07 **Boring:** 6 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft black peat w/roots	Pt	1	0-1											
	0.25						2	1-2											
	0.25						3	2-3											
	0.25						4	3-4											
	0.25				Very soft gray silty clay	CL	5	4-5											
	0.25						6	5-6											
	0.25						7	6-7	40	81	114	UC	--	83					
	0.25				w/silt pockets		8	7-8											
	0.25						9	8-9											
10	0.25						10	9-10	44	77	111	UC	--	82					
	0.25						11	10-11											
	0.25						12	11-12											
	0.25				Medium stiff gray silty clay	CL	13	12-13	30	92	120	OB	--	504					
	0.25						14	13-14											
	0.25						15	14-15											
	0.25				Very soft gray silty clay	CL	16	15-16	46	75	110	UC	--	101					
	0.25						17	16-17											
	0.25						18	17-18	70	58	99	UC	--	83					
	0.25						19	18-19											
20	0.25				Very soft gray clay w/sandy silt pockets	CH	20	19-20											
	0.50						21	24-25	85	51	94	UC	--	150					
30	0.50				w/silt pockets		22	29-30											
	0.50						23	34-35	64	62	101	UC	--	165					
40	0.50						24	39-40											
50																			

Comments: Latitude: 29° 33' 33.84"
Longitude: 89° 51' 34.62"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/26/07 **Boring:** 7 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft black peat w/roots	Pt	1	0-1											
	0.25				Soft gray silty clay	CL	2	1-2	33	89	118	UC	--	422					
	0.25						3	2-3											
	0.25						4	3-4											
	0.25						5	4-5	32	90	119	UC	--	441					
	0.25						6	5-6											
	0.25						7	6-7											
	0.25						8	7-8	32	90	119	UC	--	301					
	0.25						9	8-9											
10	0.25	3			Medium dense gray fine sand	SP	10	9-10	26	98	123	OB	--	529					
		2					11	10-11.5											
							12	11.5-13											
	0.25						13	13-14											
	0.25				Very soft gray clay w/silty sand pockets	CH	14	14-15	58	66	104	UC	--	76					
	0.25						15	15-16											
	0.25						16	16-17											
	0.25						17	17-18	73	57	99	UC	--	79					
	0.25						18	18-19											
20	0.25						19	19-20	96	47	92	UC	--	125					
					Very soft gray clay	CH													
	0.50						20	24-25	74	57	98	UC	--	133					
30	0.50						21	29-30											
	0.50				w/silt lenses		22	34-35	54	69	106	UC	--	217					
40	0.50						23	39-40											
50																			

Comments: Latitude: 29° 33' 14.23"
Longitude: 89° 51' 44.59"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/26/07 **Boring:** 8 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft black peat w/roots	Pt	1	0-1											
	0.25						2	1-2											
	0.25				Very soft gray sandy clay	CL	3	2-3											
	0.25						4	3-4	35	86	117	UC	--	52					
	0.25						5	4-5											
	0.25				Very soft gray silty clay	CL	6	5-6	37	84	116	UC	--	222					
	0.25				Medium stiff gray sandy silt w/clay	ML	7	6-7											
	0.25						8	7-8	25	100	124	OB	0	714	26	22	4		
	0.25						9	8-9											
10	0.25				Very soft gray sandy clay	CL	10	9-10											
	0.25						11	10-11	31	92	120	UC	--	225					
	0.25				Very soft gray clay	CH	12	11-12											
	0.25				w/trace of silt		13	12-13											
	0.25						14	13-14	46	76	110	UC	--	49					
	0.25						15	14-15											
	0.25				w/silt lenses		16	15-16											
	0.25				w/silt pockets		17	16-17	49	73	108	UC	--	117					
	0.25						18	17-18											
	0.25				w/trace of silt		19	18-19											
20	0.25				Very soft gray clay w/silt pockets	CH	20	19-20	69	59	100	UC	--	100					
	0.50						21	24-25											
30	0.50				Soft gray clay w/silt pockets & lenses	CH	22	29-30	51	70	105	UC	--	274					
	0.50				w/silt pockets		23	34-35											
					Soft gray sandy clay	CL													
40	0.50						24	39-40	36	85	115	UC	--	357					
					Soft gray clay	CH													
	0.50						25	44-45											
50							26	49-50	70	58	99	UC	--	425					

Comments: Latitude: 29° 32' 52.85"
Longitude: 89° 51' 22.81"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/26/07 **Boring:** 8 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
50					Soft gray clay w/silt pockets	CH													
	0.50						27	54-55	48	73	107	UC	--	403					
60	0.50						28	59-60	58	65	102	UC	--	328					
70																			
80																			
90																			
100																			

Comments: Latitude: 29° 32' 52.85"
Longitude: 89° 51' 22.81"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/25/07 **Boring:** 9 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft black peat w/roots	Pt	1	0-1											
	0.25						2	1-2											
	0.25						3	2-3											
	0.25						4	3-4											
	0.25				Very soft gray clay w/silt pockets & lenses	CH	5	4-5											
	0.25						6	5-6	96	47	92	UC	--	38					
	0.25						7	6-7											
	0.25						8	7-8											
	0.25						9	8-9											
10	0.25				Very soft gray silty clay	CL	10	9-10	36	86	116	UC	--	191					
	0.25						11	10-11											
	0.25						12	11-12											
	0.25						13	12-13	32	91	119	UC	--	333					
	0.25				Very soft gray clay w/silty sand layers & pockets	CH	14	13-14											
	0.25						15	14-15											
	0.25						16	15-16	55	68	105	UC	--	94					
	0.25						17	16-17											
	0.25						18	17-18											
	0.25						19	18-19	83	52	95	UC	--	58					
20	0.25				Very soft gray clay w/silt pockets	CH	20	19-20											
	0.50						21	24-25											
30	0.50						22	29-30	74	56	97	UC	--	170					
	0.50						23	34-35											
					Very soft gray silty clay	CL													
40	0.50						24	39-40	40	81	113	UC	--	178					
50																			

Comments: Latitude: 29° 33' 25.40"
Longitude: 89° 51' 9.34"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/30/07 **Boring:** 10 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0					Very soft black peat w/roots	Pt	1	0-1											
							2	1-2											
							3	2-3											
					Very soft gray organic clay w/decayed wood	OH	4	3-4	135	36	85	UC	--	38					
					Very soft gray silty clay	CL	5	4-5											
							6	5-6	38	83	115	UC	--	185	41	16	25		
							7	6-7											
					Dense gray silty sand	SM	8	7-8	28	95	121	OB	--	1634					
							9	8-9											
10							10	9-10	28	89	114	OB	--	405					
							11	10-11											
							12	11-11.17	29	92	119	OB	0	622	25	21	4		
					Soft gray silty clay	CL	13	12-13											
							14	13-14											
							15	14-15	30	91	118	OB	0	409					
					Very soft gray clay w/silty sand layers & pockets	CH	16	15-16	57	65	102	UC	--	114					
							17	16-17											
							18	17-18											
							19	18-19											
20							20	19-20											
					Soft gray sandy clay	CL													
	0.25						21	23-24											
					Dense gray silty sand w/clay lenses	SM													
	0.50						22	28-29	26	94	118	OB	0	1106	26	22	4		
30																			
	0.50						23	33-34											
	0.50				Loose gray silty sand w/sandy clay layers	SM	24	37-38	25	93	117	OB	0	469	25	21	4		
40																			
50																			

Comments: Latitude: 29° 33' 29.44"
Longitude: 89° 50' 26.29"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/27/07 **Boring:** 11 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0	0.25				Very soft black peat w/roots	Pt	1	0-1											
	0.25						2	1-2											
	0.25						3	2-3											
	0.25						4	3-4											
	0.25						5	4-5											
	0.25				Very soft gray sandy clay	CL	6	5-6											
	0.25						7	6-7	44	78	111	UC	--	128					
	0.25						8	7-8											
	0.25						9	8-9											
10	0.25						10	9-10	39										
	0.25						11	10-11											
	0.25				Very soft gray clay w/sandy silt layers	CH	12	11-12											
	0.25						13	12-13	58	66	104	UC	--	88					
	0.25				Very soft gray silty clay	CL	14	13-14											
	0.25						15	14-15	61	63	102	UC	--	83					
	0.25				Very soft gray clay w/silt layers	CH	16	15-16											
	0.25						17	16-17	64	62	102	UC	--	123					
	0.25						18	17-18											
	0.25						19	18-19	73	57	98	UC	--	129					
20	0.25						20	19-20											
	0.50						21	24-25	80	53	96	UC	--	133					
30	0.50						22	29-30											
					Medium dense gray sandy silt w/clay lenses & layers	ML													
	0.50						23	34-35	31	91	119	OB	0	787	25	21	4		
					Soft gray silty clay w/silt lenses	CL													
40	0.50						24	39-40											
	0.50						25	44-45											
					Soft gray clay w/silty sand lenses	CH													
50	0.50						26	49-50	61	63	102	UC	--	268					

Comments: Latitude: 29° 33' 10.55"
Longitude: 89° 51' 6.59"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/27/07 **Boring:** 11 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
50					Soft gray clay w/silty sand lenses	CH													
	0.50						27	54-55											
60	0.50				Soft gray clay		28	59-60	63	62	101	UC	--	452					
	0.50				w/silt pockets		29	64-65											
70	0.50				Medium stiff gray clay	CH	30	69-70	63	62	100	UC	--	783					
	0.50						31	74-75											
80	0.50				Soft gray clay	CH	32	79-80	60	63	100	UC	--	431					
	0.50						33	84-85											
90	0.50				Medium stiff gray clay	CH	34	89-90	55	67	103	UC	--	849					
	0.50						35	94-95											
100							36	99-100	55	66	102	UC	--	515					

Comments: Latitude: 29° 33' 10.55"
Longitude: 89° 51' 6.59"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/30/07 **Boring:** 12 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0					Very soft gray sandy clay	CL	1	0-1											
							2	1-2	35	86	116	OB	0	63	29	18	11		
					Medium stiff gray clayey silt	ML	3	2-3											
							4	3-4	28	94	120	OB	0	813					
							5	4-5											
							6	5-6	28	95	121	OB	0	740					
							7	6-7											
							8	7-8	33	89	118	OB	0	238	28	14	14		
							9	8-9	29	94	121	OB	0	313					-#200 = 83.5%
10					Very soft gray silty clay w/clay lenses	CL	10	9-10											
							11	10-11											
							12	11-12	47	72	105	OB	0	30					
							13	12-13											
					Very soft gray clay w/sandy silt lenses & layers	CH	14	13-14											
							15	14-15											
							16	15-16	50	70	105	OB	0	110	61	20	41		
							17	16-17											
							18	17-18											
							19	18-19	98	45	90	OB	0	112					
20					w/silt lenses		20	19-20											
							21	23-24	67	60	100	UC	--	125					
							22	28-29											
30					Soft gray silty clay w/silt layers	CL													
	0.25						23	33-34											
	0.25						24	38-39	48	69	103	OB	0	270					
40																			
50																			

Comments: Water Depth = 4 Feet
Latitude: 29° 33' 7.73"
Longitude: 89° 50' 10.91"

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

Ground Elev.: **Datum:** NAD83 **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/17/07 **Boring:** 13 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
0					6" Rocks & gravel	GP	1	0-0.5											
	2.25				Soft gray silty clay	CL	2	2-3											
	0.50				w/silt lenses		3	5-6	28	96	121	UC	--	444					
	0.50				w/silt pockets		4	8-9											
10	0.50				Very soft dark gray peat	Pt	5	11-12	218	24	75	UC	--	204					
	0.50				Very soft gray clay w/silt lenses & pockets	CH	6	14-15											
20	0.50						7	19-20	59	65	103	UC	--	197					
	0.50						8	24-25											
					Soft gray silty clay	CL													
30	0.50						9	29-30	38	83	115	UC	--	282					
	0.50						10	34-35											
40	0.50						11	39-40											
		15			Medium dense gray sandy silt w/clay pockets	ML	12	41-42.5											
		17					13	43.5-45											-#200 = 87.3%
		19					14	46-47.5											
50		18					15	48.5-50											

Comments: Latitude: 29° 34' 14.45"
Longitude: 89° 48' 15.45"

EUSTIS ENGINEERING COMPANY, INC.

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STATE OF LOUISIANA
LAKE HERMITAGE MARSH CREATION (BA-42)
PLAQUEMINES PARISH, LOUISIANA

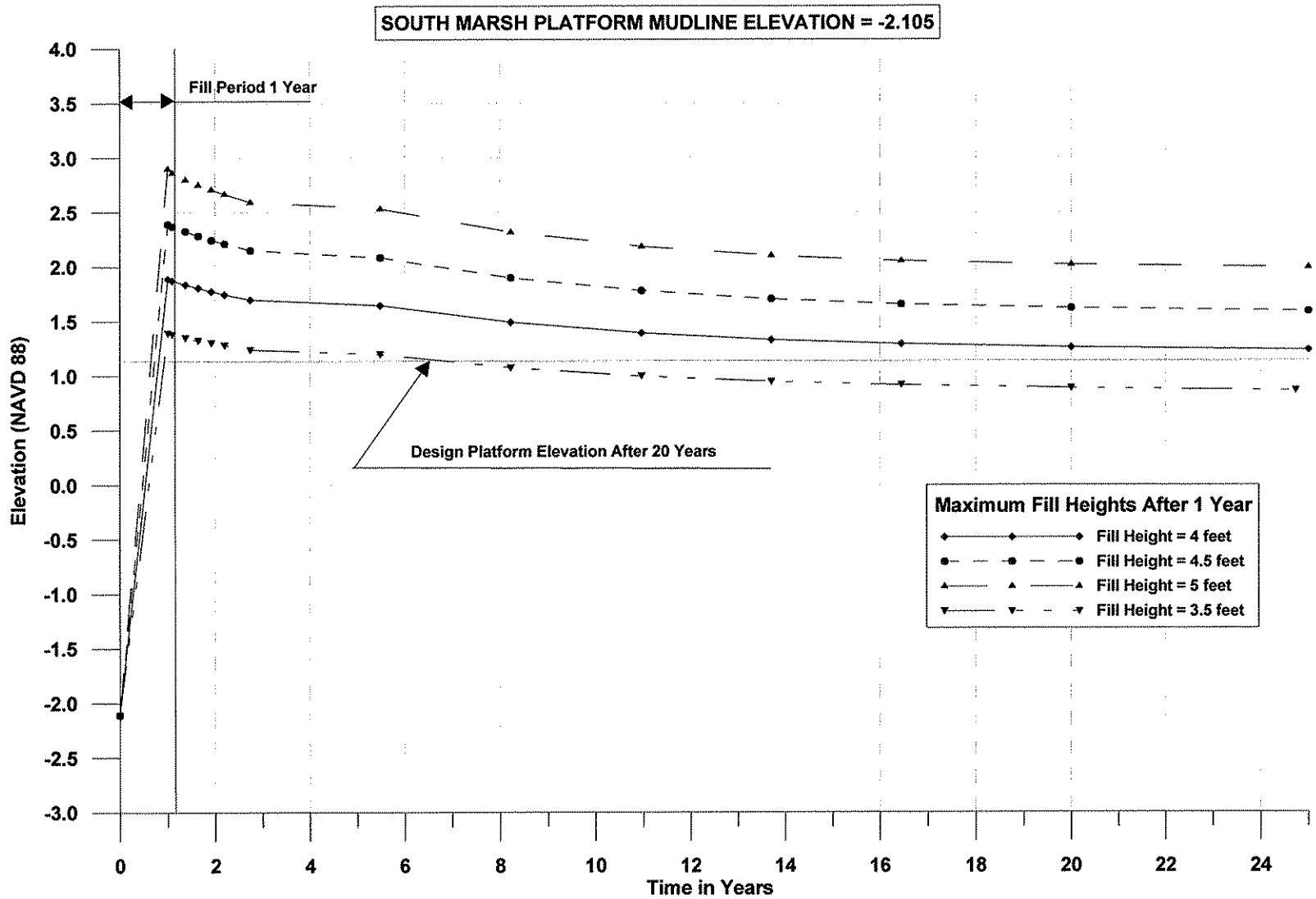
Ground Elev.: **Datum:** NAD83 **Gr. Water Depth:** **Job No.:** 19666 **Date Drilled:** 4/17/07 **Boring:** 13 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI		Other Tests
50					Medium dense gray silty sand	SM													
		19	X				16	53.5-55											
					Soft gray clay w/silt pockets	CH													
		3	X				17	58.8-60.3	50										
60																			
70																			
80																			
90																			
100																			

Comments: Latitude: 29° 34' 14.45"
Longitude: 89° 48' 15.45"

APPENDIX D

Eustis Engineering Services, LLC Geotechnical Figures

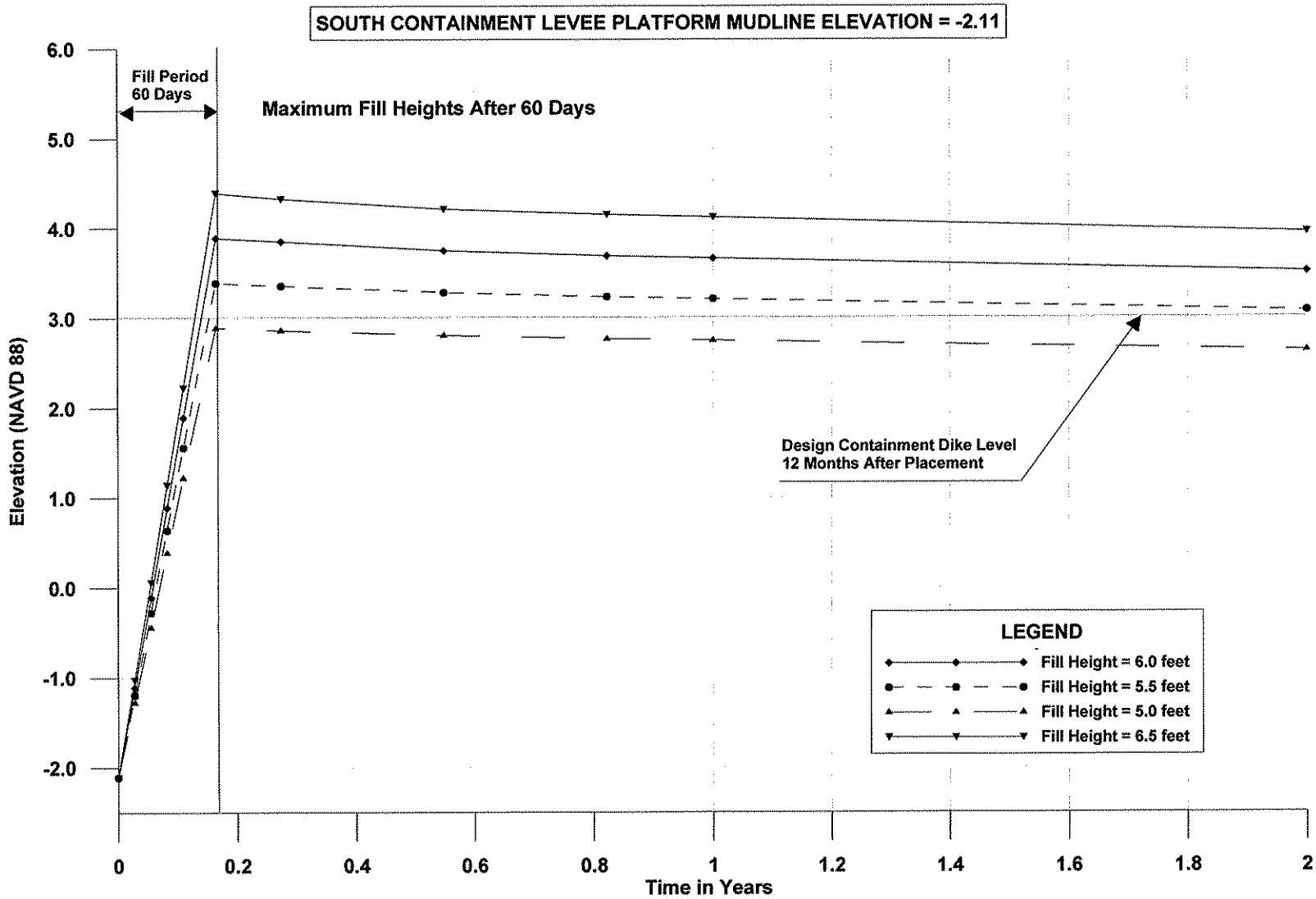


1. Settlements based on sand fill wet density = 115 pcf
2. Large Strain Analyses
3. Coefficient of consolidation constant for each stratum

EUSTIS ENGINEERING SERVICES, L.L.C.
GEOTECHNICAL ENGINEERS
3011 28th STREET METAIRIE, LOUISIANA

TIME SETTLEMENTS OF FOUNDATION + FILL
SOUTH MARSH PLATFORM
LAKE HERMITAGE
LAFOURCHE PARISH, LOUISIANA

OCTOBER 2007 EE 19666 FIGURE 8



1. Settlements based on dredged clay fill wet density = 100 pcf
2. Large Strain Analyses
3. Coefficient of consolidation constant for each stratum
4. Crest is 10 feet wide with 3H:1V slopes

EUSTIS ENGINEERING SERVICES, L.L.C.
GEOTECHNICAL ENGINEERS
3011 28th STREET METAIRIE, LOUISIANA

TIME SETTLEMENTS OF FOUNDATION + FILL
SOUTH CONTAINMENT DIKE
LAKE HERMITAGE
LAFOURCHE PARISH, LOUISIANA

OCTOBER 2007 EE 19666 FIGURE 11

I. TIDAL DATUM

A. Given:

1. Control Station Gage Data: NOAA Station #8761724 at Grand Isle, LA.
   i. Coordinates: 29°15'48"N, 89°57'24"W
   ii. Observation Period (19 year tidal epoch): 01/01/1985 to 12/31/2003

2. Subordinate Station Gage Data: LDNR Gage BA04-17 near Point a la Hache, LA
   i. Coordinates: 30°31'14.20"N 89°49'27.87"W
   ii. Observation Period: 8/13/97 to 6/22/00

B. Methodology/Calculations:

1. List of Variables:

   - MHW_{BA04} = observation period mean high water at subordinate station
   - MLW_{BA04} = observation period mean low water at subordinate station
   - MHW_{GI} = observation period mean high water at control station
   - MLW_{GI} = observation period mean low water at control station
   - MHW_C = 19 year mean high water at control station
   - MTL_C = 19 year mean tide level at control station
   - MLW_C= 19 year mean low water at control station
   - MR_C= 19 year mean tide range at control station
   - TL_C= mean tide level for the observation period at control station
   - R_C= mean tide range for the observation period at the control station
   - TL_S= mean tide level for the observation period at subordinate station
   - R_S= mean tide range for the observation period at subordinate station
   - MHW_S= 19 year mean high water at subordinate station
   - MTL_S= 19 year mean tide level at subordinate station
   - MLW_S= 19 year mean low water at subordinate station
   - MR_S= 19 year mean tide range at subordinate station

2. Calculations:

Variables Computed from Gage Data:

$MHW_{BA04} := 0.951455 \cdot ft$ $\quad$ $MHW_{GI} := 1.406438 \cdot ft$

$MLW_{BA04} := 0.475366 \cdot ft$ $\quad$ $MLW_{GI} := 0.485169 \cdot ft$

$MHW_C := 1.371592 \cdot ft$

$MLW_C := 0.318434 \cdot ft$

Calculated Tidal Datum:

$$TL_S := \frac{MHW_{BA04} + MLW_{BA04}}{2} \qquad \boxed{TL_S = 0.71\,ft}$$

$$R_S := MHW_{BA04} - MLW_{BA04} \qquad \boxed{R_S = 0.48\,ft}$$

$$TL_C := \frac{MHW_{GI} + MLW_{GI}}{2} \qquad \boxed{TL_C = 0.95\,ft}$$

$$R_C := MHW_{GI} - MLW_{GI} \qquad \boxed{R_C = 0.92\,ft}$$

$$MTL_C := \frac{MHW_C + MLW_C}{2} \qquad \boxed{MTL_C = 0.85\,ft}$$

$$MR_C := MHW_C - MLW_C \qquad \boxed{MR_C = 1.05\,ft}$$

$$MR_S := \frac{MR_C \cdot R_S}{R_C} \qquad \boxed{MR_S = 0.54\,ft}$$

$$MTL_S := TL_S + MTL_C - TL_C \qquad \boxed{MTL_S = 0.61\,ft}$$

$$MHW_S := MTL_S + \left(\frac{MR_S}{2}\right) \qquad \boxed{MHW_S = 0.88\,ft}$$

$$MLW_S := MTL_S - \left(\frac{MR_S}{2}\right) \qquad \boxed{MLW_S = 0.34\,ft}$$

II. WIND/WAVE CALCULATIONS

A. Wave Setup:

Setup is computed by comparing the water elevation data from the BA-04-17 station to the corresponding 90th percentile wind readings from the Belle Chase wind gage. The dates on which the 90th percentile wind occurred were extracted. Then, the water elevation readings from these dates were collected and imported into a spreadsheet. The average maximum of these corresponding water elevation readings was computed. The calculated Mean High Water elevation was then subtracted from this value to produce the wave setup. The following spreadsheet shows the setup calculation:

LAKE HERMITAGE MARSH CREATION (BA-42)

WATER/WIND DATA ASSOCIATED WITH 90%TILE WIND SPEED

DATE			WIND DATA @ BELLE CHASE 90% OCCURANCE		BA04-17 WATER LEVEL (NAVD88)	
YEAR	MONTH	DAY	DIR	SPEED (knots)	MAX (ft)	MIN (ft)
0	1	19	230	12	0.57	0.00
0	1	22	190	12	0.69	-0.24
0	2	11	200	12	0.36	0.01
0	2	12	200	12	0.51	-0.02
0	2	13	170	12	0.81	0.11
0	2	17	160	12	0.76	0.22
0	2	26	150	12	0.87	0.50
0	3	3	210	12	0.78	0.23
0	3	10	160	12	0.90	0.60
0	3	28	200	12	1.03	0.41
0	3	29	170	12	1.16	0.68
0	4	2	170	12	0.99	0.73
0	4	5	220	12	0.40	-0.06
0	4	6	220	12	0.65	0.19
0	4	8	330	12	0.75	-0.01
0	4	19	190	12	0.75	0.35
0	4	20	200	12	1.03	0.50
0	4	24	260	12	1.57	1.06
0	5	5	150	12	1.23	0.78
0	5	9	170	12	1.13	0.73
0	5	9	210	12	1.13	0.73
0	5	10	200	12	1.14	0.78
0	5	11	180	12	1.08	0.77
0	5	12	190	12	1.19	0.96
0	5	17	160	12	0.98	0.43
0	5	18	170	12	1.40	0.78
0	5	23	220	12	1.05	0.59
0	5	24	190	12	1.10	0.72
0	5	25	200	12	1.13	0.76
0	5	26	210	12	1.22	0.83
0	5	27	180	12	1.30	1.14
0	5	28	230	12	1.13	0.86
0	6	13	170	12	0.86	0.39
0	6	14	170	12	1.07	0.57

0	6	20	180	12	1.19	0.79
97	8	16	190	12	1.12	0.62
97	9	24	210	12	1.29	0.81
97	10	12	140	12	1.89	1.22
97	10	13	180	12	2.16	1.59
97	10	24	240	12	1.46	0.70
97	10	25	200	12	1.26	1.06
97	11	1	230	12	1.10	0.75
97	12	29	260	12	0.75	0.20
98	1	7	200	12	1.99	1.29
98	1	8	240	12	1.97	1.44
98	1	12	190	12	1.07	0.57
98	1	14	150	12	1.23	0.76
98	1	21	140	12	0.86	0.15
98	2	3	320	12	1.02	0.31
98	2	7	240	12	0.40	-0.16
98	2	15	220	12	0.57	-0.03
98	2	16	230	12	1.49	0.56
98	2	18	190	12	1.80	0.80
98	2	25	140	12	0.36	-0.03
98	3	7	200	12	1.41	0.95
98	3	8	210	12	1.94	1.45
98	3	9	290	12	1.83	0.78
98	3	15	150	12	0.28	0.09
98	3	17	170	12	1.36	0.65
98	3	23	210	12	0.67	0.20
98	3	24	170	12	0.73	0.33
98	3	25	180	12	0.85	0.48
98	3	26	150	12	0.79	0.51
98	3	28	160	12	1.06	0.89
98	3	30	140	12	1.37	0.88
98	3	31	180	12	1.83	1.12
98	4	2	170	12	1.33	0.85
98	4	3	230	12	1.51	1.01
98	4	8	200	12	1.28	0.92
98	4	12	180	12	0.52	0.05
98	4	15	180	12	1.17	0.74
98	4	18	200	12	1.44	0.97
98	4	25	150	12	0.76	0.23
98	4	25	170	12	0.76	0.23
98	4	27	150	12	1.15	0.78
98	4	28	150	12	1.42	0.81
98	5	3	220	12	1.14	0.76
98	5	6	180	12	1.19	0.88
98	5	9	210	12	1.51	0.87
98	5	22	200	12	1.12	0.94
98	5	23	200	12	1.31	0.89
98	6	2	230	12	1.03	0.82
98	6	4	230	12	1.41	0.87
98	6	5	210	12	1.43	1.19
98	6	11	220	12	1.42	0.95
98	6	12	210	12	1.30	0.97

98	6	14	230	12	1.28	0.75
98	6	15	230	12	1.36	1.09
98	6	16	210	12	1.30	1.10
98	6	17	190	12	1.18	0.94
98	6	18	180	12	1.10	0.86
98	6	26	140	12	1.50	0.95
98	6	27	170	12	1.58	1.09
98	6	28	200	12	1.50	1.06
98	7	2	200	12	0.87	0.50
98	7	3	200	12	0.94	0.65
98	7	10	160	12	0.77	0.48
98	7	13	230	12	0.84	0.35
98	7	24	170	12	0.92	0.56
98	9	13	200	12	2.48	1.91
98	9	20	210	12	2.27	2.01
98	11	2	180	12	1.75	1.49
98	11	10	180	12	1.24	0.50
98	12	3	140	12	0.63	0.13
98	12	6	170	12	0.92	0.48
98	12	7	190	12	1.05	0.61
98	12	19	220	12	0.72	0.36
99	1	6	180	12	0.36	-0.42
99	1	7	170	12	0.59	0.08
99	1	8	180	12	0.64	0.31
99	1	13	180	12	0.69	0.22
99	1	17	190	12	0.77	0.30
99	1	19	170	12	0.77	0.20
99	1	20	210	12	0.78	0.35
99	1	21	190	12	0.87	0.58
99	1	29	160	12	0.78	0.38
99	2	7	220	12	1.10	0.67
99	2	8	200	12	1.05	0.60
99	2	10	170	12	0.90	0.42
99	2	11	180	12	1.03	0.52
99	2	16	160	12	0.64	0.23
99	2	19	270	12	1.23	0.65
99	2	23	230	12	0.83	0.11
99	2	25	210	12	0.81	0.25
99	2	27	230	12	0.97	0.57
99	3	2	210	12	0.94	0.58
99	3	5	170	12	0.84	0.43
99	3	17	160	12	0.61	0.37
99	4	3	170	12	1.25	0.80
99	4	8	200	12	1.14	0.62
99	4	9	240	12	1.45	1.11
99	4	10	170	12	1.39	1.00
99	4	14	170	12	1.28	0.83
99	4	15	230	12	1.96	1.31
99	4	17	310	12	0.47	0.17
99	4	20	210	12	0.63	0.06
99	4	21	170	12	0.71	0.15
99	4	22	180	12	0.94	0.49

99	4	23	150	12	1.02	0.66
99	4	26	170	12	1.03	0.85
99	5	3	170	12	1.03	0.85
99	5	23	190	12	1.07	0.69
99	5	26	220	12	0.81	0.49
99	5	30	200	12	0.86	0.34
99	6	24	200	12	0.65	0.09
99	6	25	200	12	0.67	0.15
99	6	27	210	12	1.31	0.55
99	11	1	230	12	0.65	0.45
99	12	9	180	12	0.00	-0.50
99	12	12	200	12	0.05	-0.33
99	12	30	200	12	0.30	-0.18
				Average Max=	**1.06**	**ft**

SETUP **= MHW(ASSOCIATED WITH 90%TILE WIND SPEED) - MHW(1997-2000)**

= 1.06 ft - 0.88 ft = 0.18 ft 0.055 m

B. <u>Wave Hindcasting</u>:

1. 90th Percentile Wind Direction (clockwise from North), $\beta_o := 204$

2. 90th Percentile Wind Speed, $U_A := 6.26 \frac{m}{s}$

3. Mean High Water Elevation, $h_{MHW} := 0.27m$

4. Mean Low Water Elevation, $h_{MLW} := 0.1m$

5. Wave Setup (Mean High Water Elev. associated with 90% Windspeed), $WS := 0.055m$

6. Fetch (distance required for wave to develop) , $F_w := 2173m$

7. Depth of Fetch, $d_{fetch} := -1.40m$

therefore: $d_0 := |WS| + |d_{fetch}| + h_{MHW}$

$d_0 = 1.725m$

8. Limiting Wave Period (CEM Eq. II-2-39), $T_p := 9.78\left(\frac{d_0}{g}\right)^{0.5}$

$T_p = 4.102s$

9. Wave Period (estimated using CEM Fig. II-2-24), $T := 1.122s$

10. Deepwater Wavelength (CEM Eq. II-1-15), $L_o := \frac{g \cdot T^2}{2\pi}$

$L_o = 1.965\ m$

11. Deepwater Celerity (CEM Eq. II-1-14), $C_o := \frac{g \cdot T}{2\pi}$

$C_o = 1.751\ \frac{m}{s}$

*Since T<Tp, wave must be Shallow or Transitional

The following spreadsheet was used to estimate the wave height at each contour:

Contour	d	d/L_O	Wave	L	d/L	C_g	C	sinθ	Angle	K_r	K_s	H
(ft)	(m)		Type	(m)		(m/s)	(m/s)					(m)
-9	3.07	1.56	Transition	2.0	1.56	0.88	1.75	0	0	1.00	1.00	0.14
-8	2.76	1.41	Transition	2.0	1.41	0.88	1.75	0	0	1.00	1.00	0.14
-7	2.46	1.25	Transition	2.0	1.25	0.88	1.75	0	0	1.00	1.00	0.14
-6	2.15	1.10	Transition	2.0	1.10	0.88	1.75	0	0	1.00	1.00	0.14
-5	1.85	0.94	Transition	2.0	0.94	0.88	1.75	0	0	1.00	1.00	0.14
-4	1.54	0.79	Transition	2.0	0.79	0.88	1.75	0	0	1.00	1.00	0.14
-3	1.24	0.63	Transition	2.0	0.63	0.88	1.75	0	0	1.00	1.00	0.14
-2	0.93	0.48	Transition	2.0	0.48	0.90	1.75	0	0	1.00	0.99	0.14
-1	0.63	0.32	Transition	1.9	0.33	0.96	1.72	0	0	1.00	0.95	0.13
0	0.33	0.17	Transition	1.7	0.19	1.05	1.54	0	0	1.00	0.91	0.13
1	0.02	0.01	Shallow	0.5	0.04	0.45	0.45	0	0	1.00	1.40	0.01

Definition of Terms (from above spreadsheet):

Transitional Waves (0.4 < d/Lo < 0.5)

Wave Length (CEM Eq. II-1-11), $L = \frac{gT^2}{2\cdot\pi}\cdot\sqrt{\tanh\frac{4\cdot\pi^2\cdot d}{T^2\cdot g}}$

Group Celerity (CEM Eq. II-1-49), $C_g = \frac{1}{2}\left(\frac{L}{T}\right)\left(\frac{1+4\pi\frac{d}{L}}{\sinh\left(4\pi\frac{d}{L}\right)}\right)$

Celerity (CEM Eq. II-1-9), $C = \left(\frac{gT}{2\pi}\right)\tanh\left(2\pi\frac{d}{L}\right)$

Wave Height (CEM Eq. II-3-13), $H = H_o\cdot K_s\cdot K_r$

Shallow Water Waves (d/Lo < 0.4)

Wave Length (CEM Eq. II-1-52), $L = C\cdot T$

Group Celerity (CEM Eq. II-1-52), $C_g = \frac{L}{T}$

Celerity (CEM Eq. II-1-18) $C = \sqrt{g\cdot d}$

Wave Height, $H = 0.6d$

Shoaling and Refracting Coefficients (CEM Eq. II-3-14):

$$K_r = \left(\frac{1 - \sin^2\theta_o}{1 - \sin^2\theta_1} \right)^{\frac{1}{4}} \qquad K_s = \sqrt{\frac{\frac{C_o}{2}}{C_g}}$$

C. Wave Tranformation:

Absolute Wave Height, $H_{abs} = WS + h_{MHW} + \frac{H}{2}$

Contour (ft)	**h_{mhw} + Setup** (ft NAVD88)	**$H_{wave}/2$** (ft)	**Absolute Wave Height** (ft NAVD88)
-7	1.07	0.23	1.29
-6	1.07	0.23	1.29
-5	1.07	0.23	1.29
-4	1.07	0.23	1.29
-3	1.07	0.23	1.29
-2	1.07	0.23	1.29
-1	1.07	0.22	1.28
0	1.07	0.21	1.27
1	1.07	0.02	1.09

The point at which the Absolute Wave Height begins to show a significant decrease in magnitude indicates the contour that the waves will begin to break (between -1.0 and +1.0 NAVD 88).

III. FILL AREA DESIGN

A. Given:

1. Average Marsh Elevation: +1.2 ft. throughout entire project area (see Section 2.4 of the Design Report for additional details)

2. Cross Sectional Survey Data of Marsh Fill Sites: XYZ data for each fill area cross section.

3. Target Fill Elevations (see Section 6.1 of the Design Report for additional details):
   i. +2.0 ft. for both Marsh Creation Sites

4. Containment Dike Parameters (see Section 6.3 of the Design Report for additional details):
   i. Elevation = 1.0 ft. above target marsh creation elevation;
   ii. Side Slopes = 1(V):6(H)

B. Methodology:

1. Area Calculations: The cross-sectional areas of each marsh fill transect were calculated using the XYZ data mentioned above. Due to the large number of points involved with each BA-42 cross-section, the following simplified example is used to show the method of calculating cross-sectional areas:

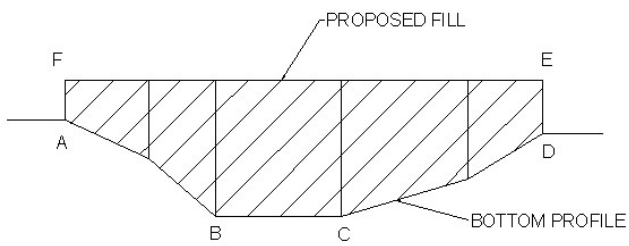


Figure 1

The area of this section can be obtained by incrementally computing the areas of each of the trapezoids that form the trapezoid ABCDEF shown in Figure 1. By treating the section as a traverse, fundamental survey methods can be utilized to calculate this area. These areas are calculated using the given data from the survey datasets with each point have a corresponding X, Y, and Z value. The incremental area calculations are carried out using the following formula:

$$A_i = \frac{1}{2} [D_i (Z_{i+1} - Z_{i-1})]$$

where: A_i = incremental area
D_i = cumulative distance from beginning of transect to point i
Z_{i+1} = elevation of previous point
Z_{i-1} = elevation of next point

The cumulative distance is computed by continuously summing the distance between each point, which is calculated with the distance formula:

$$L_i = [(X_2 - X_1)^2 + (Y_2 - Y_1)^2 + (Z_2 - Z_1)^2]^{1/2}$$

where: X = easting
Y = northing
Z = elevation

And

$$D_i = \sum L_i$$

The total area of the cross sections can then be obtained by summing each incremental area. Because these computations are so labor intensive, a spreadsheet was used for these area calculations.

2. Distance Between Cross Sections: Before the volume of the fill sites can be calculated, the distance between each cross section must be obtained. These distances represent the plan view area that each cross section will represent and were computed from the surveyor's CAD drawing.

3. Volume Calculations: The volume calculations for each cross section are computed by taking the product of the each cross-sectional area and its corresponding distance. The incremental volumes are then added together to get the total volume of the fill site. This is accomplished using the simple formulas shown below:

$$V_{xs} = (A_{xs})(d)$$

where: V_{xs} = Cross-sectional volume
A_{xs} = Cross-sectional area
d = Distance between cross-sections

$$V_{tot} = \sum V_{xs}$$

The volume calculations for each fill site are shown in Section C on the following pages:

C. Fill Area Design Volume Calculations:

1. Fill Site A

i. Cross-Sectional Area(ft^2): Distance (ft.):

$A_{110} := 2164.40 ft^2$ $d_{110} := 400 ft$

$A_{115} := 2900.42 ft^2$ $d_{115} := 500 ft$

$A_{120} := 5769.31 ft^2$ $d_{120} := 500 ft$

$A_{125} := 3540.70 ft^2$ $d_{125} := 500 ft$

$A_{130} := 3534.77 ft^2$ $d_{130} := 250 ft$

$A_{135} := 10217.19 ft^2$ $d_{135} := 750 ft$

$A_{140} := 11273.13 ft^2$ $d_{140} := 500 ft$

$A_{145} := 11422.79 ft^2$ $d_{145} := 500 ft$

$A_{150} := 12647.34 ft^2$ $d_{150} := 500 ft$

$A_{155} := 12024.28 ft^2$ $d_{155} := 500 ft$

$A_{160} := 12159.60 ft^2$ $d_{160} := 500 ft$

$A_{165} := 11027.23 ft^2$ $d_{165} := 500 ft$

$A_{170} := 10504.32 ft^2$ $d_{170} := 500 ft$

$A_{175} := 9623.29 ft^2$ $d_{175} := 500 ft$

$A_{180} := 6967.88 ft^2$ $d_{180} := 500 ft$

$A_{185} := 5335.35 ft^2$ $d_{185} := 750 ft$

ii. Calculated Volume (ft^3):

$V_{110} := A_{110} \cdot d_{110}$ $\quad V_{110} = 865760\ ft^3$

$V_{115} := A_{115} \cdot d_{115}$ $\quad V_{115} = 1450210\ ft^3$

$V_{120} := A_{120} \cdot d_{120}$ $\quad V_{120} = 2884655\ ft^3$

$V_{125} := A_{125} \cdot d_{125}$ $\quad V_{125} = 1770350\ ft^3$

$V_{130} := A_{130} \cdot d_{130}$ $\quad V_{130} = 883692.5\ ft^3$

$V_{135} := A_{135} \cdot d_{135}$ $\quad V_{135} = 7662892.5\ ft^3$

$V_{140} := A_{140} \cdot d_{140}$ $\quad V_{140} = 5636565\ ft^3$

$V_{145} := A_{145} \cdot d_{145}$ $\quad V_{145} = 5711395\ ft^3$

$V_{150} := A_{150} \cdot d_{150}$ $\quad V_{150} = 6323670\ ft^3$

$V_{155} := A_{155} \cdot d_{155}$ $\quad V_{155} = 6012140\ ft^3$

$V_{160} := A_{160} \cdot d_{160}$ $\quad V_{160} = 6079800\ ft^3$

$V_{165} := A_{165} \cdot d_{165}$ $\quad V_{165} = 5513615\ ft^3$

$V_{170} := A_{170} \cdot d_{170}$ $\quad V_{170} = 5252160\ ft^3$

$V_{175} := A_{175} \cdot d_{175}$ $\quad V_{175} = 4811645\ ft^3$

$V_{180} := A_{180} \cdot d_{180}$ $\quad V_{180} = 3483940\ ft^3$

$V_{185} := A_{185} \cdot d_{185}$ $\quad V_{185} = 4001512.5\ ft^3$

$$V_{MC1} := V_{110} + V_{115} + V_{120} + V_{125} + V_{130} + V_{135} + V_{140} + V_{145} + V_{150} + V_{155} + V_{160} + V_{165} \cdots + V_{170} + V_{175} + V_{180} + V_{185}$$

Total Volume for Marsh Creation Site #1, $\boxed{V_{MC1} = 2531259.35\ yd^3}$

2. Fill Site B

i. Cross-Sectional Area(ft^2): Distance (ft.):

$A_{70} := 1800.88 ft^2$ $d_{70} := 626 ft$

$A_{75} := 2732.39 ft^2$ $d_{75} := 500 ft$

$A_{80} := 6749.29 ft^2$ $d_{80} := 500 ft$

$A_{85} := 9593.50 ft^2$ $d_{85} := 444 ft$

$A_{90} := 10172.65 ft^2$ $d_{90} := 556 ft$

$A_{95} := 8371.48 ft^2$ $d_{95} := 500 ft$

$A_{100} := 7649.32 ft^2$ $d_{100} := 500 ft$

$A_{105} := 4864.01 ft^2$ $d_{105} := 500 ft$

$A_{110b} := 5130.75 ft^2$ $d_{110b} := 500 ft$

$A_{115b} := 3633.30 ft^2$ $d_{115b} := 500 ft$

$A_{120b} := 2396.57 ft^2$ $d_{120b} := 686 ft$

ii. Calculated Volume (ft^3):

$V_{70} := A_{70} \cdot d_{70}$ $\quad V_{70} = 1127350.88\ ft^3$

$V_{75} := A_{75} \cdot d_{75}$ $\quad V_{75} = 1366195.00\ ft^3$

$V_{80} := A_{80} \cdot d_{80}$ $\quad V_{80} = 3374645.00\ ft^3$

$V_{85} := A_{85} \cdot d_{85}$ $\quad V_{85} = 4259514.00\ ft^3$

$V_{90} := A_{90} \cdot d_{90}$ $\quad V_{90} = 5655993.40\ ft^3$

$V_{95} := A_{95} \cdot d_{95}$ $\quad V_{95} = 4185740.00\ ft^3$

$V_{100} := A_{100} \cdot d_{100}$ $\quad V_{100} = 3824660.00\ ft^3$

$V_{105} := A_{105} \cdot d_{105}$ $\quad V_{105} = 2432005.00\ ft^3$

$V_{110b} := A_{110b} \cdot d_{110b}$ $\quad V_{110b} = 2565375.00\ ft^3$

$V_{115b} := A_{115b} \cdot d_{115b}$ $\quad V_{115b} = 1816650.00\ ft^3$

$V_{120b} := A_{120b} \cdot d_{120b}$ $\quad V_{120b} = 1644047.02\ ft^3$

$$V_{MC2} := V_{70} + V_{75} + V_{80} + V_{85} + V_{90} + V_{95} + V_{100} + V_{105} + V_{110b} + V_{115b} + V_{120b}$$

Total Volume for Marsh Creation Site #2, $\boxed{V_{MC2} = 1194525.01\ yd^3}$

TOTAL BA-42 MARSH FILL VOLUME, $V_{MC\_TOT} := V_{MC1} + V_{MC2}$

$\boxed{V_{MC\_TOT} = 3725784.36\ yd^3}$

IV. CONTAINMENT DIKE DESIGN

A. Given (from Section 6.3 of the Design Report):

1. Crown Width: 5.0 ft.

2. Side Slope: 1(V):6(H)

3. Freeboard: 1.0 ft. above target marsh creation elevation

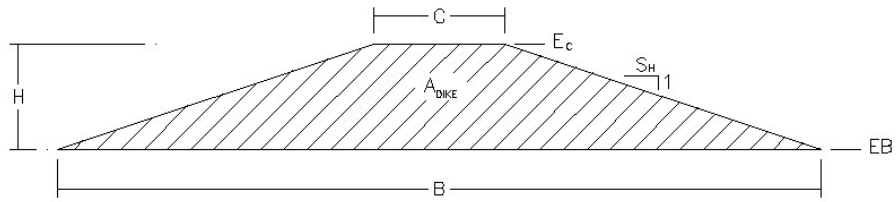
4. Containment Dike Crown Elevation:
   i. +3.0 ft. for both marsh creation sites

5. Containment Dike Length, L_{DIKE} (shown in table below; approximated with CAD):

Segment	Segment Length (ft.)	Avg. Base Elevation (ft. NAVD 88)
A1	972	-1.85
A2	5382	-1.27
A3	1824	0.94
A4	2269	-0.60
A5	2971	-0.26
A6	1727	0.39
A7	925	-0.77
A8	398	-2.55
A9	2202	-2.50
A10	1234	-1.06
B1	3511	-1.66
B2	133	-1.65
B3	659	-1.35
B4	1549	-1.68
B5	1484	-2.05
B6	755	1.00
B7	1545	-2.43
B8	1140	0.02
B9	764	-0.36
B10	1573	0.56
B11	216	-0.18
B12	261	-1.04
B13	776	-1.04

6. Survey Data: XYZ points from profiles taken at proposed containment dike locations (also shown in the table above).

B. <u>Methodology</u>:



where: H = Dike height
B = Base width
C = Crown width (5.0 ft.)
EB = Base elevation
E_C = Crown elevation
A_{DIKE} = Cross-sectional area of dike

1. <u>Base Elevation</u>: The survey profiles mentioned above were used to determine the base elevation at each containment site. The base elevation at each site was determined by averaging the water-bottom elevations of each containment segment.

2. <u>Dike Height</u>: The height of the dike is computed by simply subtracting the base elevation from the crown elevation (+3.0 NAVD 88) as shown in the following formula:

$$H = E_{CROWN} - E_{BASE}$$

3. <u>Base Width</u>: The base width is governed by the dike height, the crown width, and the horizontal component of the side slope, S_H (6.0 throughout project area) and is computed using the following formula:

$$B = 2(S_H H)+C$$

4. <u>Cross-Sectional Area</u>: The cross-sectional area of each containment dike differs from site to site and is governed by the base elevation (given in the survey data), dike height, and base width at the proposed location. Once these variables are determined, the area can be easily calculated by treating the dike section as a trapezoid as shown in the formula below:

$$A_{DIKE} = ½ [H(C+B)]$$

5. <u>Containment Dike Volume</u>: The volume of material required to construct each containment is computed by multiplying each dike area by its corresponding length

$$V_{DIKE} = A_{DIKE} * L_{DIKE}$$

C. **Containment Dike Design Calculations**:

1. Fill Site A

i. Fill Volume for Containment:

Constants:

-Crown Width, $C := 5.0ft$

-Horizontal Side Slope, $S_H := 6.0$

-Target Marsh Creation Elevation, $E_{MC} := 2.0ft$

-Crown Elevation, $E_c := E_{MC} + 1.0ft$

$$E_c = 3\ ft$$

a. Containment Segment 1 (A1)

-Segment Length (from CAD):

$$L_{A1} := 971.54ft$$

-Base Elevation (from survey data):

$$EB_{A1} := -1.85ft$$

-Segment Height:

$$H_{A1} := E_c - EB_{A1}$$

$$H_{A1} = 4.85\ ft$$

-Segment Base Width:

$$B_{A1} := 2\left(S_H \cdot H_{A1}\right) + C$$

$$B_{A1} = 63.2\ ft$$

-Cross Sectional Area:

$$A_{A1} := \frac{1}{2} H_{A1} \cdot \left(C + B_{A1}\right)$$

$$A_{A1} = 165.39\ ft^2$$

-Volume of Segment:

$$V_{A1} := A_{A1} \cdot L_{A1}$$

$$\boxed{V_{A1} = 5951.04\ yd^3}$$

b. <u>Containment Segment 2 (A2)</u>

-Segment Length (from CAD):

$$L_{A2} := 5381.71\,ft$$

-Base Elevation (from survey data):

$$EB_{A2} := -1.27\,ft$$

-Segment Height:

$$H_{A2} := E_c - EB_{A2}$$

$$H_{A2} = 4.27\ ft$$

-Segment Base Width:

$$B_{A2} := 2\left(S_H \cdot H_{A2}\right) + C$$

$$B_{A2} = 56.24\ ft$$

-Cross Sectional Area:

$$A_{A2} := \frac{1}{2} H_{A2} \cdot \left(C + B_{A2}\right)$$

$$A_{A2} = 130.75\ ft^2$$

-Volume of Segment:

$$V_{A2} := A_{A2} \cdot L_{A2}$$

$$\boxed{V_{A2} = 26060.91\ yd^3}$$

c. <u>Containment Segment 3 (A3)</u>

-Segment Length (from CAD):

$$L_{A3} := 1824.217\text{ft}$$

-Base Elevation (from survey data):

$$EB_{A3} := 0.94\text{ft}$$

-Segment Height:

$$H_{A3} := E_c - EB_{A3}$$

$$H_{A3} = 2.06\ \text{ft}$$

-Segment Base Width:

$$B_{A3} := 2\left(S_H \cdot H_{A3}\right) + C$$

$$B_{A3} = 29.72\ \text{ft}$$

-Cross Sectional Area:

$$A_{A3} := \frac{1}{2} H_{A3} \cdot \left(C + B_{A3}\right)$$

$$A_{A3} = 35.76\ \text{ft}^2$$

-Volume of Segment:

$$V_{A3} := A_{A3} \cdot L_{A3}$$

$$\boxed{V_{A3} = 2416.18\ \text{yd}^3}$$

d. <u>Containment Segment 4 (A4)</u>

-Segment Length (from CAD):

$$L_{A4} := 2269.16\,ft$$

-Base Elevation (from survey data):

$$EB_{A4} := -0.60\,ft$$

-Segment Height:

$$H_{A4} := E_c - EB_{A4}$$

$$H_{A4} = 3.6\ ft$$

-Segment Base Width:

$$B_{A4} := 2\left(S_H \cdot H_{A4}\right) + C$$

$$B_{A4} = 48.2\ ft$$

-Cross Sectional Area:

$$A_{A4} := \frac{1}{2} H_{A4} \cdot \left(C + B_{A4}\right)$$

$$A_{A4} = 95.76\ ft^2$$

-Volume of Segment:

$$V_{A4} := A_{A4} \cdot L_{A4}$$

$$\boxed{V_{A4} = 8047.95\ yd^3}$$

e. <u>Containment Segment 5 (A5)</u>

-Segment Length (from CAD):

$$L_{A5} := 2971.40\,ft$$

-Base Elevation (from survey data):

$$EB_{A5} := -0.26\,ft$$

-Segment Height:

$$H_{A5} := E_c - EB_{A5}$$

$$H_{A5} = 3.26\ ft$$

-Segment Base Width:

$$B_{A5} := 2\left(S_H \cdot H_{A5}\right) + C$$

$$B_{A5} = 44.12\ ft$$

-Cross Sectional Area:

$$A_{A5} := \frac{1}{2} H_{A5} \cdot \left(C + B_{A5}\right)$$

$$A_{A5} = 80.07\ ft^2$$

-Volume of Segment:

$$V_{A5} := A_{A5} \cdot L_{A5}$$

$$\boxed{V_{A5} = 8811.37\ yd^3}$$

f. <u>Containment Segment 6 (A6)</u>

-Segment Length (from CAD):

$$L_{A6} := 1726.91\,ft$$

-Base Elevation (from survey data):

$$EB_{A6} := 0.39\,ft$$

-Segment Height:

$$H_{A6} := E_c - EB_{A6}$$

$$H_{A6} = 2.61\ ft$$

-Segment Base Width:

$$B_{A6} := 2\left(S_H \cdot H_{A6}\right) + C$$

$$B_{A6} = 36.32\ ft$$

-Cross Sectional Area:

$$A_{A6} := \frac{1}{2} H_{A6} \cdot \left(C + B_{A6}\right)$$

$$A_{A6} = 53.92\ ft^2$$

-Volume of Segment:

$$V_{A6} := A_{A6} \cdot L_{A6}$$

$$\boxed{V_{A6} = 3448.87\ yd^3}$$

g. <u>Containment Segment 7 (A7)</u>

-Segment Length (from CAD):

$$L_{A7} := 924.80\text{ft}$$

-Base Elevation (from survey data):

$$EB_{A7} := -0.77\text{ft}$$

-Segment Height:

$$H_{A7} := E_c - EB_{A7}$$

$$H_{A7} = 3.77\ \text{ft}$$

-Segment Base Width:

$$B_{A7} := 2\left(S_H \cdot H_{A7}\right) + C$$

$$B_{A7} = 50.24\ \text{ft}$$

-Cross Sectional Area:

$$A_{A7} := \frac{1}{2} H_{A7} \cdot \left(C + B_{A7}\right)$$

$$A_{A7} = 104.13\ \text{ft}^2$$

-Volume of Segment:

$$V_{A7} := A_{A7} \cdot L_{A7}$$

$$\boxed{V_{A7} = 3566.56\ \text{yd}^3}$$

h. <u>Containment Segment 8 (A8)</u>

-Segment Length (from CAD):

$$L_{A8} := 397.70\text{ft}$$

-Base Elevation (from survey data):

$$EB_{A8} := -2.55\text{ft}$$

-Segment Height:

$$H_{A8} := E_c - EB_{A8}$$

$$H_{A8} = 5.55\ \text{ft}$$

-Segment Base Width:

$$B_{A8} := 2\left(S_H \cdot H_{A8}\right) + C$$

$$B_{A8} = 71.6\ \text{ft}$$

-Cross Sectional Area:

$$A_{A8} := \frac{1}{2} H_{A8} \cdot \left(C + B_{A8}\right)$$

$$A_{A8} = 212.56\ \text{ft}^2$$

-Volume of Segment:

$$V_{A8} := A_{A8} \cdot L_{A8}$$

$$\boxed{V_{A8} = 3131\,\text{yd}^3}$$

i. <u>Containment Segment 9 (A9)</u>

-Segment Length (from CAD):

$$L_{A9} := 2201.73\text{ft}$$

-Base Elevation (from survey data):

$$EB_{A9} := -2.50\text{ft}$$

-Segment Height:

$$H_{A9} := E_c - EB_{A9}$$

$$H_{A9} = 5.5\text{ ft}$$

-Segment Base Width:

$$B_{A9} := 2\left(S_H \cdot H_{A9}\right) + C$$

$$B_{A9} = 71\text{ ft}$$

-Cross Sectional Area:

$$A_{A9} := \frac{1}{2} H_{A9} \cdot \left(C + B_{A9}\right)$$

$$A_{A9} = 209\text{ ft}^2$$

-Volume of Segment:

$$V_{A9} := A_{A9} \cdot L_{A9}$$

$$\boxed{V_{A9} = 17043.02\text{ yd}^3}$$

j. Containment Segment 10 (A10)

-Segment Length (from CAD):

$$L_{A10} := 1234.38\,ft$$

-Base Elevation (from survey data):

$$EB_{A10} := -1.06\,ft$$

-Segment Height:

$$H_{A10} := E_c - EB_{A10}$$

$$H_{A10} = 4.06\ ft$$

-Segment Base Width:

$$B_{A10} := 2\left(S_H \cdot H_{A10}\right) + C$$

$$B_{A10} = 53.72\ ft$$

-Cross Sectional Area:

$$A_{A10} := \frac{1}{2} H_{A10} \cdot \left(C + B_{A10}\right)$$

$$A_{A10} = 119.2\ ft^2$$

-Volume of Segment:

$$V_{A10} := A_{A10} \cdot L_{A10}$$

$$\boxed{V_{A10} = 5449.63\ yd^3}$$

$$V_{DIKE\_FILL\_A} := V_{A1} + V_{A2} + V_{A3} + V_{A4} + V_{A5} + V_{A6} + V_{A7} + V_{A8} + V_{A9} + V_{A10}$$

$$\boxed{V_{DIKE\_FILL\_A} = 83926.54\ yd^3}$$

ii. Borrow Volume for Containment Dikes:

*A cut:fill ratio of 2.0:1 is used for mechanical dredging, CF_{MD}.
The borrow volume is computed by multiplying the fill volume by this value.

$$CF_{MD} := 2.0$$

$$V_{DIKE\_BORROW\_A} := V_{DIKE\_FILL\_A} \cdot CF_{MD}$$

$$V_{DIKE\_BORROW\_A} = 167853.08\ yd^3$$

iii. Cost per Linear Foot:

$$L_{TOT\_A} := L_{A1} + L_{A2} + L_{A3} + L_{A4} + L_{A5} + L_{A6} + L_{A7} + L_{A8} + L_{A9} + L_{A10}$$

$$L_{TOT\_A} = 19903.55\ ft$$

$$RATE_{VOL\_A} := \frac{V_{DIKE\_BORROW\_A}}{L_{TOT\_A}}$$

$$RATE_{VOL\_A} = 8.43\ \frac{yd^3}{ft}$$

Multiplying this value times an estimated mechanical dredging unit rate of $3.00/yd^3 yields a unit rate of $25.29/lin. ft. for containment dikes.

2. Fill Site B

i. Fill Volume for Containment:

Constants:

-Crown Width, $C := 5.0ft$

-Horizontal Side Slope, $S_H := 6.0$

-Target Marsh Creation Elevation, $E_{MC} := 2.0ft$

-Crown Elevation, $E_c := E_{MC} + 1.0ft$

$$E_c = 3\ ft$$

a. Containment Segment 1 (B1)

-Segment Length (from CAD):

$$L_{B1} := 3510.6808ft$$

-Base Elevation (from survey data):

$$EB_{B1} := -1.66ft$$

-Segment Height:

$$H_{B1} := E_c - EB_{B1}$$

$$H_{B1} = 4.66\ ft$$

-Segment Base Width:

$$B_{B1} := 2\left(S_H \cdot H_{B1}\right) + C$$

$$B_{B1} = 60.92\ ft$$

-Cross Sectional Area:

$$A_{B1} := \frac{1}{2} H_{B1} \cdot \left(C + B_{B1}\right)$$

$$A_{B1} = 153.59\ ft^2$$

-Volume of Segment:

$$V_{B1} := A_{B1} \cdot L_{B1}$$

$$\boxed{V_{B1} = 19971.04\ yd^3}$$

b. <u>Containment Segment 2 (B2)</u>

-Segment Length (from CAD):

$$L_{B2} := 132.9263\text{ft}$$

-Base Elevation (from survey data):

$$EB_{B2} := -1.65\text{ft}$$

-Segment Height:

$$H_{B2} := E_c - EB_{B2}$$

$$H_{B2} = 4.65\ \text{ft}$$

-Segment Base Width:

$$B_{B2} := 2\left(S_H \cdot H_{B2}\right) + C$$

$$B_{B2} = 60.8\ \text{ft}$$

-Cross Sectional Area:

$$A_{B2} := \frac{1}{2} H_{B2} \cdot \left(C + B_{B2}\right)$$

$$A_{B2} = 152.98\ \text{ft}^2$$

-Volume of Segment:

$$V_{B2} := A_{B2} \cdot L_{B2}$$

$$\boxed{V_{B2} = 753.18\ \text{yd}^3}$$

c. <u>Containment Segment 3 (B3)</u>

-Segment Length (from CAD):

$$L_{B3} := 659.11\text{ft}$$

-Base Elevation (from survey data):

$$EB_{B3} := -1.35\text{ft}$$

-Segment Height:

$$H_{B3} := E_c - EB_{B3}$$

$$H_{B3} = 4.35\ \text{ft}$$

-Segment Base Width:

$$B_{B3} := 2\left(S_H \cdot H_{B3}\right) + C$$

$$B_{B3} = 57.2\ \text{ft}$$

-Cross Sectional Area:

$$A_{B3} := \frac{1}{2} H_{B3} \cdot \left(C + B_{B3}\right)$$

$$A_{B3} = 135.28\ \text{ft}^2$$

-Volume of Segment:

$$V_{B3} := A_{B3} \cdot L_{B3}$$

$$\boxed{V_{B3} = 3302.51\ \text{yd}^3}$$

d. <u>Containment Segment 4 (B4)</u>

-Segment Length (from CAD):

$$L_{B4} := 1549.31\,ft$$

-Base Elevation (from survey data):

$$EB_{B4} := -1.68\,ft$$

-Segment Height:

$$H_{B4} := E_c - EB_{B4}$$

$$H_{B4} = 4.68\ ft$$

-Segment Base Width:

$$B_{B4} := 2\left(S_H \cdot H_{B4}\right) + C$$

$$B_{B4} = 61.16\ ft$$

-Cross Sectional Area:

$$A_{B4} := \frac{1}{2} H_{B4} \cdot \left(C + B_{B4}\right)$$

$$A_{B4} = 154.81\ ft^2$$

-Volume of Segment:

$$V_{B4} := A_{B4} \cdot L_{B4}$$

$$\boxed{V_{B4} = 8883.54\ yd^3}$$

e. <u>Containment Segment 5 (B5)</u>

-Segment Length (from CAD):

$$L_{B5} := 1483.77\,ft$$

-Base Elevation (from survey data):

$$EB_{B5} := -2.05\,ft$$

-Segment Height:

$$H_{B5} := E_c - EB_{B5}$$

$$H_{B5} = 5.05\ ft$$

-Segment Base Width:

$$B_{B5} := 2\left(S_H \cdot H_{B5}\right) + C$$

$$B_{B5} = 65.6\ ft$$

-Cross Sectional Area:

$$A_{B5} := \frac{1}{2} H_{B5} \cdot \left(C + B_{B5}\right)$$

$$A_{B5} = 178.27\ ft^2$$

-Volume of Segment:

$$V_{B5} := A_{B5} \cdot L_{B5}$$

$$\boxed{V_{B5} = 9796.45\ yd^3}$$

f. <u>Containment Segment 6 (B6)</u>

-Segment Length (from CAD):

$$L_{B6} := 754.69ft$$

-Base Elevation (from survey data):

$$EB_{B6} := 1.00ft$$

-Segment Height:

$$H_{B6} := E_c - EB_{B6}$$

$$H_{B6} = 2\ ft$$

-Segment Base Width:

$$B_{B6} := 2\left(S_H \cdot H_{B6}\right) + C$$

$$B_{B6} = 29\ ft$$

-Cross Sectional Area:

$$A_{B6} := \frac{1}{2} H_{B6} \cdot \left(C + B_{B6}\right)$$

$$A_{B6} = 34\ ft^2$$

-Volume of Segment:

$$V_{B6} := A_{B6} \cdot L_{B6}$$

$$\boxed{V_{B6} = 950.35\ yd^3}$$

g. <u>Containment Segment 7 (B7)</u>

-Segment Length (from CAD):

$$L_{B7} := 1545.12\,ft$$

-Base Elevation (from survey data):

$$EB_{B7} := -2.43ft$$

-Segment Height:

$$H_{B7} := E_c - EB_{B7}$$

$$H_{B7} = 5.43\ ft$$

-Segment Base Width:

$$B_{B7} := 2\left(S_H \cdot H_{B7}\right) + C$$

$$B_{B7} = 70.16\ ft$$

-Cross Sectional Area:

$$A_{B7} := \frac{1}{2} H_{B7} \cdot \left(C + B_{B7}\right)$$

$$A_{B7} = 204.06\ ft^2$$

-Volume of Segment:

$$V_{B7} := A_{B7} \cdot L_{B7}$$

$$\boxed{V_{B7} = 11677.64\,yd^3}$$

h. <u>Containment Segment 8 (B8)</u>

-Segment Length (from CAD):

$$L_{B8} := 1139.65\,ft$$

-Base Elevation (from survey data):

$$EB_{B8} := 0.02\,ft$$

-Segment Height:

$$H_{B8} := E_c - EB_{B8}$$

$$H_{B8} = 2.98\ ft$$

-Segment Base Width:

$$B_{B8} := 2\left(S_H \cdot H_{B8}\right) + C$$

$$B_{B8} = 40.76\ ft$$

-Cross Sectional Area:

$$A_{B8} := \frac{1}{2} H_{B8} \cdot \left(C + B_{B8}\right)$$

$$A_{B8} = 68.18\ ft^2$$

-Volume of Segment:

$$V_{B8} := A_{B8} \cdot L_{B8}$$

$$\boxed{V_{B8} = 2877.93\ yd^3}$$

i. <u>Containment Segment 9 (B9)</u>

-Segment Length (from CAD):

$$L_{B9} := 763.81\text{ft}$$

-Base Elevation (from survey data):

$$EB_{B9} := -0.36\text{ft}$$

-Segment Height:

$$H_{B9} := E_c - EB_{B9}$$

$$H_{B9} = 3.36\ \text{ft}$$

-Segment Base Width:

$$B_{B9} := 2\left(S_H \cdot H_{B9}\right) + C$$

$$B_{B9} = 45.32\ \text{ft}$$

-Cross Sectional Area:

$$A_{B9} := \frac{1}{2} H_{B9} \cdot \left(C + B_{B9}\right)$$

$$A_{B9} = 84.54\ \text{ft}^2$$

-Volume of Segment:

$$V_{B9} := A_{B9} \cdot L_{B9}$$

$$\boxed{V_{B9} = 2391.51\ \text{yd}^3}$$

j. <u>Containment Segment 10 (B10)</u>

-Segment Length (from CAD):

$$L_{B10} := 1572.65\,ft$$

-Base Elevation (from survey data):

$$EB_{B10} := 0.56\,ft$$

-Segment Height:

$$H_{B10} := E_c - EB_{B10}$$

$$H_{B10} = 2.44\ ft$$

-Segment Base Width:

$$B_{B10} := 2\left(S_H \cdot H_{B10}\right) + C$$

$$B_{B10} = 34.28\ ft$$

-Cross Sectional Area:

$$A_{B10} := \frac{1}{2} H_{B10} \cdot \left(C + B_{B10}\right)$$

$$A_{B10} = 47.92\ ft^2$$

-Volume of Segment:

$$V_{B10} := A_{B10} \cdot L_{B10}$$

$$\boxed{V_{B10} = 2791.26\,yd^3}$$

k. <u>Containment Segment 11 (B11)</u>

-Segment Length (from CAD):

$$L_{B11} := 216.32\text{ft}$$

-Base Elevation (from survey data):

$$EB_{B11} := -0.18\text{ft}$$

-Segment Height:

$$H_{B11} := E_c - EB_{B11}$$

$$H_{B11} = 3.18\ \text{ft}$$

-Segment Base Width:

$$B_{B11} := 2\left(S_H \cdot H_{B11}\right) + C$$

$$B_{B11} = 43.16\ \text{ft}$$

-Cross Sectional Area:

$$A_{B11} := \frac{1}{2} H_{B11} \cdot \left(C + B_{B11}\right)$$

$$A_{B11} = 76.57\ \text{ft}^2$$

-Volume of Segment:

$$V_{B11} := A_{B11} \cdot L_{B11}$$

$$\boxed{V_{B11} = 613.5\ \text{yd}^3}$$

l. Containment Segment 12 (B12)

-Segment Length (from CAD):

$$L_{B12} := 261.19\text{ft}$$

-Base Elevation (from survey data):

$$EB_{B12} := -1.04\text{ft}$$

-Segment Height:

$$H_{B12} := E_c - EB_{B12}$$

$$H_{B12} = 4.04\ \text{ft}$$

-Segment Base Width:

$$B_{B12} := 2\left(S_H \cdot H_{B12}\right) + C$$

$$B_{B12} = 53.48\ \text{ft}$$

-Cross Sectional Area:

$$A_{B12} := \frac{1}{2} H_{B12} \cdot \left(C + B_{B12}\right)$$

$$A_{B12} = 118.13\ \text{ft}^2$$

-Volume of Segment:

$$V_{B12} := A_{B12} \cdot L_{B12}$$

$$\boxed{V_{B12} = 1142.75\ \text{yd}^3}$$

k. <u>Containment Segment 13 (B13)</u>

-Segment Length (from CAD):

$$L_{B13} := 775.61\text{ft}$$

-Base Elevation (from survey data):

$$EB_{B13} := -1.04\text{ft}$$

-Segment Height:

$$H_{B13} := E_c - EB_{B13}$$

$$H_{B13} = 4.04\ \text{ft}$$

-Segment Base Width:

$$B_{B13} := 2\left(S_H \cdot H_{B13}\right) + C$$

$$B_{B13} = 53.48\ \text{ft}$$

-Cross Sectional Area:

$$A_{B13} := \frac{1}{2} H_{B13} \cdot \left(C + B_{B13}\right)$$

$$A_{B13} = 118.13\ \text{ft}^2$$

-Volume of Segment:

$$V_{B13} := A_{B13} \cdot L_{B13}$$

$$\boxed{V_{B13} = 3393.43\ \text{yd}^3}$$

$$V_{DIKE\_FILL\_B} := V_{B1} + V_{B2} + V_{B3} + V_{B4} + V_{B5} + V_{B6} + V_{B7} + V_{B8} + V_{B9} + V_{B10} + V_{B11} + V_{B12} + V_{B13}$$

$$\boxed{V_{DIKE\_FILL\_B} = 68545.07\ \text{yd}^3}$$

ii. Borrow Volume for Containment Dikes:

*A cut:fill ratio of 2.0:1 is used for mechanical dredging, CF_{MD}.
The borrow volume is computed by multiplying the fill volume by this value.

$$CF_{MD} := 2.0$$

$$V_{DIKE\_BORROW\_B} := V_{DIKE\_FILL\_B} \cdot CF_{MD}$$

$$V_{DIKE\_BORROW\_B} = 137090.15\ yd^3$$

iii. Cost per Linear Foot:

$$L_{TOT\_B} := L_{B1} + L_{B2} + L_{B3} + L_{B4} + L_{B5} + L_{B6} + L_{B7} + L_{B8} + L_{B9} + L_{B10} + L_{B11} + L_{B12} + L_{B13}$$

$$L_{TOT\_B} = 14364.84\ ft$$

$$RATE_{VOL\_B} := \frac{V_{DIKE\_BORROW\_B}}{L_{TOT\_B}}$$

$$RATE_{VOL\_B} = 9.54\ \frac{yd^3}{ft}$$

Multiplying this value times an estimated mechanical dredging unit rate of $3.00/yd^3 yields a unit rate of $28.62/lin. ft. for containment dikes.

IV. TERRACE DESIGN

A. Given (from Section 7.1 of the Design Report):

1. Crown Width: 10.0 ft.

2. Side Slope: 1(V):3(H)

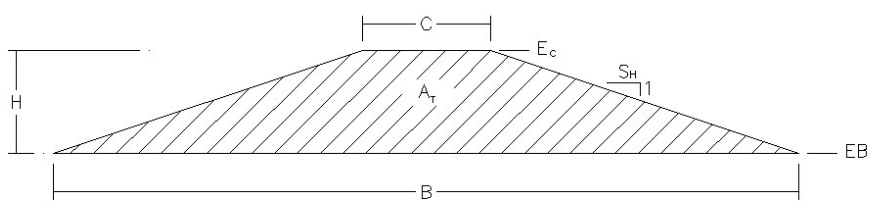
3. Crown Elevation: +3.5 ft. NAVD 88

4. Terrace Length, L_T (shown in table below; approximated with CAD):

Terrace	Avg. Base Elevation (ft. NAVD 88)	Terrace Length (ft.)
T1	-1.92	500
T2	-2.20	500
T3	-2.08	500
T4	-2.01	700
T5	-2.15	700
T6	-2.35	500
T7	-2.03	500
T8	-2.08	500
T9	-1.99	700
T10	-1.92	700
T11	-2.42	500
T12	-1.67	500
T13	-1.78	500

5. Survey Data: XYZ points from profiles taken at proposed containment dike locations (average base elevations shown in the table above)

B. Methodology:



where: H = Dike height
B = Base width
C = Crown width (5.0 ft.)
EB = Base elevation
E_C = Crown elevation
A_T = Cross-sectional area of dike

1. Base Elevation: The survey profiles mentioned above were used to determine the base elevation at each terrace. The base elevation at each site was determined by averaging the water-bottom elevations of each terrace.

2. Terrace Height: The height of the terrace is computed by simply subtracting the base elevation from the crown elevation (+3.0 NAVD 88) as shown in the following formula:

$$H = E_{CROWN} - E_{BASE}$$

3. Base Width: The base width is governed by the terrace height, the crown width, and the horizontal component of the side slope, S_H (6.0 throughout project area) and is computed using the following formula:

$$B = 2(S_H H)+C$$

4. Cross-Sectional Area: The cross-sectional area of each terrace differs from site to site and is governed by the base elevation (given in the survey data), terrace height, and base width at the proposed location. Once these variables are determined, the area can be easily calculated by treating the dike section as a trapezoid as shown in the formula below:

$$A_T = ½ [H(C+B)]$$

5. Terrace Volume: The volume of material required to construct each containment is computed by multiplying each dike area by its corresponding length

$$V_T = A_T * L_T$$

C. <u>Terrace Design Calculations</u>:

i. <u>Terrace Volume</u>:

-Crown Width, $C := 20.0\text{ft}$

-Horizontal Side Slope, $S_H := 3.0$

-Crown Elevation, $E_c := 3.5\text{ft}$

a. <u>Terrace T1</u>

-Segment Length (from CAD):

$$L_{T1} := 500\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T1} := -1.92\text{ft}$$

-Segment Height:

$$H_{T1} := E_c - EB_{T1}$$

$$H_{T1} = 5.42\ \text{ft}$$

-Segment Base Width:

$$B_{T1} := 2\left(S_H \cdot H_{T1}\right) + C$$

$$B_{T1} = 52.52\ \text{ft}$$

-Cross Sectional Area:

$$A_{T1} := \frac{1}{2} H_{T1} \cdot \left(C + B_{T1}\right)$$

$$A_{T1} = 196.53\ \text{ft}^2$$

-Volume of Segment:

$$V_{T1} := A_{T1} \cdot L_{T1}$$

$$\boxed{V_{T1} = 3639.43\ \text{yd}^3}$$

b. <u>Terrace T2</u>

-Segment Length (from CAD):

$$L_{T2} := 500\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T2} := -2.20\text{ft}$$

-Segment Height:

$$H_{T2} := E_c - EB_{T2}$$

$$H_{T2} = 5.7\ \text{ft}$$

-Segment Base Width:

$$B_{T2} := 2\left(S_H \cdot H_{T2}\right) + C$$

$$B_{T2} = 54.2\ \text{ft}$$

-Cross Sectional Area:

$$A_{T2} := \frac{1}{2} H_{T2} \cdot \left(C + B_{T2}\right)$$

$$A_{T2} = 211.47\ \text{ft}^2$$

-Volume of Segment:

$$V_{T2} := A_{T2} \cdot L_{T2}$$

$$\boxed{V_{T2} = 3916.11\ \text{yd}^3}$$

c. <u>Terrace T3</u>

-Segment Length (from CAD):

$$L_{T3} := 500\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T3} := -2.08\text{ft}$$

-Segment Height:

$$H_{T3} := E_c - EB_{T3}$$

$$H_{T3} = 5.58\ \text{ft}$$

-Segment Base Width:

$$B_{T3} := 2\left(S_H \cdot H_{T3}\right) + C$$

$$B_{T3} = 53.48\ \text{ft}$$

-Cross Sectional Area:

$$A_{T3} := \frac{1}{2} H_{T3} \cdot \left(C + B_{T3}\right)$$

$$A_{T3} = 205.01\ \text{ft}^2$$

-Volume of Segment:

$$V_{T3} := A_{T3} \cdot L_{T3}$$

$$\boxed{V_{T3} = 3796.47\ \text{yd}^3}$$

d. Terrace T4

-Segment Length (from CAD):

$$L_{T4} := 700\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T4} := -2.01\text{ft}$$

-Segment Height:

$$H_{T4} := E_c - EB_{T4}$$

$$H_{T4} = 5.51\ \text{ft}$$

-Segment Base Width:

$$B_{T4} := 2\left(S_H \cdot H_{T4}\right) + C$$

$$B_{T4} = 53.06\ \text{ft}$$

-Cross Sectional Area:

$$A_{T4} := \frac{1}{2} H_{T4} \cdot \left(C + B_{T4}\right)$$

$$A_{T4} = 201.28\ \text{ft}^2$$

-Volume of Segment:

$$V_{T4} := A_{T4} \cdot L_{T4}$$

$$\boxed{V_{T4} = 5218.38\ \text{yd}^3}$$

e. <u>Terrace T5</u>

-Segment Length (from CAD):

$$L_{T5} := 700\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T5} := -2.15\text{ft}$$

-Segment Height:

$$H_{T5} := E_c - EB_{T5}$$

$$H_{T5} = 5.65\ \text{ft}$$

-Segment Base Width:

$$B_{T5} := 2\left(S_H \cdot H_{T5}\right) + C$$

$$B_{T5} = 53.9\ \text{ft}$$

-Cross Sectional Area:

$$A_{T5} := \frac{1}{2} H_{T5} \cdot \left(C + B_{T5}\right)$$

$$A_{T5} = 208.77\ \text{ft}^2$$

-Volume of Segment:

$$V_{T5} := A_{T5} \cdot L_{T5}$$

$$\boxed{V_{T5} = 5412.49\ \text{yd}^3}$$

f. Terrace T6

-Segment Length (from CAD):

$$L_{T6} := 500ft$$

-Base Elevation (from survey data):

$$EB_{T6} := -2.35ft$$

-Segment Height:

$$H_{T6} := E_c - EB_{T6}$$

$$H_{T6} = 5.85\ ft$$

-Segment Base Width:

$$B_{T6} := 2\left(S_H \cdot H_{T6}\right) + C$$

$$B_{T6} = 55.1\ ft$$

-Cross Sectional Area:

$$A_{T6} := \frac{1}{2} H_{T6} \cdot \left(C + B_{T6}\right)$$

$$A_{T6} = 219.67\ ft^2$$

-Volume of Segment:

$$V_{T6} := A_{T6} \cdot L_{T6}$$

$$\boxed{V_{T6} = 4067.92\ yd^3}$$

g. <u>Terrace T7</u>

-Segment Length (from CAD):

$$L_{T7} := 500\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T7} := -2.03\text{ft}$$

-Segment Height:

$$H_{T7} := E_c - EB_{T7}$$

$$H_{T7} = 5.53\ \text{ft}$$

-Segment Base Width:

$$B_{T7} := 2\left(S_H \cdot H_{T7}\right) + C$$

$$B_{T7} = 53.18\ \text{ft}$$

-Cross Sectional Area:

$$A_{T7} := \frac{1}{2} H_{T7} \cdot \left(C + B_{T7}\right)$$

$$A_{T7} = 202.34\ \text{ft}^2$$

-Volume of Segment:

$$V_{T7} := A_{T7} \cdot L_{T7}$$

$$\boxed{V_{T7} = 3747.09\ \text{yd}^3}$$

h. <u>Terrace T8</u>

-Segment Length (from CAD):

$$L_{T8} := 500\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T8} := -2.08\text{ft}$$

-Segment Height:

$$H_{T8} := E_c - EB_{T8}$$

$$H_{T8} = 5.58\ \text{ft}$$

-Segment Base Width:

$$B_{T8} := 2\left(S_H \cdot H_{T8}\right) + C$$

$$B_{T8} = 53.48\ \text{ft}$$

-Cross Sectional Area:

$$A_{T8} := \frac{1}{2} H_{T8} \cdot \left(C + B_{T8}\right)$$

$$A_{T8} = 205.01\ \text{ft}^2$$

-Volume of Segment:

$$V_{T8} := A_{T8} \cdot L_{T8}$$

$$\boxed{V_{T8} = 3796.47\ \text{yd}^3}$$

i. <u>Terrace T9</u>

-Segment Length (from CAD):

$$L_{T9} := 700\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T9} := -1.99\text{ft}$$

-Segment Height:

$$H_{T9} := E_c - EB_{T9}$$

$$H_{T9} = 5.49\ \text{ft}$$

-Segment Base Width:

$$B_{T9} := 2\left(S_H \cdot H_{T9}\right) + C$$

$$B_{T9} = 52.94\ \text{ft}$$

-Cross Sectional Area:

$$A_{T9} := \frac{1}{2} H_{T9} \cdot \left(C + B_{T9}\right)$$

$$A_{T9} = 200.22\ \text{ft}^2$$

-Volume of Segment:

$$V_{T9} := A_{T9} \cdot L_{T9}$$

$$\boxed{V_{T9} = 5190.9\,\text{yd}^3}$$

j. <u>Terrace T10</u>

-Segment Length (from CAD):

$$L_{T10} := 700\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T10} := -1.92\text{ft}$$

-Segment Height:

$$H_{T10} := E_c - EB_{T10}$$

$$H_{T10} = 5.42\ \text{ft}$$

-Segment Base Width:

$$B_{T10} := 2\left(S_H \cdot H_{T10}\right) + C$$

$$B_{T10} = 52.52\ \text{ft}$$

-Cross Sectional Area:

$$A_{T10} := \frac{1}{2} H_{T10} \cdot \left(C + B_{T10}\right)$$

$$A_{T10} = 196.53\ \text{ft}^2$$

-Volume of Segment:

$$V_{T10} := A_{T10} \cdot L_{T10}$$

$$\boxed{V_{T10} = 5095.2\ \text{yd}^3}$$

k. <u>Terrace T11</u>

-Segment Length (from CAD):

$$L_{T11} := 500\text{ft}$$

-Base Elevation (from survey data):

$$EB_{T11} := -2.42\text{ft}$$

-Segment Height:

$$H_{T11} := E_c - EB_{T11}$$

$$H_{T11} = 5.92\ \text{ft}$$

-Segment Base Width:

$$B_{T11} := 2\left(S_H \cdot H_{T11}\right) + C$$

$$B_{T11} = 55.52\ \text{ft}$$

-Cross Sectional Area:

$$A_{T11} := \frac{1}{2} H_{T11} \cdot \left(C + B_{T11}\right)$$

$$A_{T11} = 223.54\ \text{ft}^2$$

-Volume of Segment:

$$V_{T11} := A_{T11} \cdot L_{T11}$$

$$\boxed{V_{T11} = 4139.61\ \text{yd}^3}$$

l. Terrace T12

-Segment Length (from CAD):

$$L_{T12} := 500ft$$

-Base Elevation (from survey data):

$$EB_{T12} := -1.67ft$$

-Segment Height:

$$H_{T12} := E_c - EB_{T12}$$

$$H_{T12} = 5.17\ ft$$

-Segment Base Width:

$$B_{T12} := 2\left(S_H \cdot H_{T12}\right) + C$$

$$B_{T12} = 51.02\ ft$$

-Cross Sectional Area:

$$A_{T12} := \frac{1}{2} H_{T12} \cdot \left(C + B_{T12}\right)$$

$$A_{T12} = 183.59\ ft^2$$

-Volume of Segment:

$$V_{T12} := A_{T12} \cdot L_{T12}$$

$$\boxed{V_{T12} = 3399.75\ yd^3}$$

m. Terrace T13

-Segment Length (from CAD):

$$L_{T13} := 500ft$$

-Base Elevation (from survey data):

$$EB_{T13} := -1.78ft$$

-Segment Height:

$$H_{T13} := E_c - EB_{T13}$$

$$H_{T13} = 5.28\ ft$$

-Segment Base Width:

$$B_{T13} := 2\left(S_H \cdot H_{T13}\right) + C$$

$$B_{T13} = 51.68\ ft$$

-Cross Sectional Area:

$$A_{T13} := \frac{1}{2} H_{T13} \cdot \left(C + B_{T13}\right)$$

$$A_{T13} = 189.24\ ft^2$$

-Volume of Segment:

$$V_{T13} := A_{T13} \cdot L_{T13}$$

$$\boxed{V_{T13} = 3504.36\ yd^3}$$

$$V_{TERRACE\_FILL} := V_{T1} + V_{T2} + V_{T3} + V_{T4} + V_{T5} + V_{T6} + V_{T7} + V_{T8} + V_{T9} + V_{T10} \cdots + V_{T11} + V_{T12} + V_{T13}$$

$$\boxed{V_{TERRACE\_FILL} = 54924.17\ yd^3}$$

ii. Borrow Volume for Terraces:

*A cut:fill ratio of 2.0 is used for mechanical dredging, CF_{MD}.
The borrow volume is computed by multiplying the fill volume by this value.

$$CF_{MD} := 2.0$$

$$V_{TERRACE\_BORROW} := V_{TERRACE\_FILL} \cdot CF_{MD}$$

$$V_{TERRACE\_BORROW} = 109848.34\ yd^3$$

iii. Cost per Linear Foot:

$$L_{TOT} := L_{T1} + L_{T2} + L_{T3} + L_{T4} + L_{T5} + L_{T6} + L_{T7} + L_{T8} + L_{T9} + L_{T10} + L_{T11} \cdots + L_{T12} + L_{T13}$$

$$L_{TOT} = 7300\ ft$$

$$RATE_{VOL} := \frac{V_{TERRACE\_BORROW}}{L_{TOT}}$$

$$RATE_{VOL} = 15.05\ \frac{yd^3}{ft}$$

Multiplying this value times an estimated mechanical dredging unit rate of $3.00/yd^3 yields a unit rate of $45.15/lin. ft. for terraces.

VI. SHORELINE RESTORATION DESIGN

A. Given:

1. Desired Protection/Restoration Elevation (@ year 20): +2.33 ft. NAVD 88

2. Cross Sectional Survey Data of Marsh Fill Sites: XYZ data for each fill area cross section.

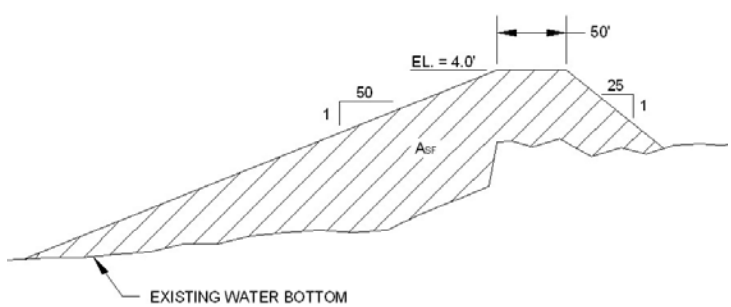
3. Sand Fill Parameters (see Section 8.2 of the Design Report for additional details):
   i. Elevation = +4.0 ft. NAVD 88
   ii. Lake Side Slope = 1(V):50(H)
   iii. Marsh Side Slope = 1(V):25(H)
   iv. Crown Width = 50 ft.

4. The following table lists the coordinates of each section template, the section areas, and the length that each section represents. This data was computed with CAD and used to calculate the Shoreline Restoration volume.

Section (Sta)	Shorline Restoration Template Coordinates (NAD 83, State Plane, ft)								Section Area (ft^2)	Section Length (ft)
	Lakeside Toe		Lakeside Crown		Marshside Crown		Marshside Toe			
	X	Y	X	Y	X	Y	X	Y		
300+00	3,749,147	388,714	3,749,539	389,214	3,749,589	389,214	3,749,805	388,727	4377.80	277.38
305+00	3,749,217	389,214	3,749,539	389,214	3,749,589	389,214	3,749,664	389,214	1008.54	381.90
310+00	3,749,122	389,712	3,749,478	389,714	3,749,529	389,710	3,749,609	389,714	1266.05	401.58
315+00	3,749,214	390,214	3,749,627	390,213	3,749,678	390,210	3,749,763	390,213	1243.73	861.61
325+00	3,748,840	390,782	3,749,098	391,010	3,749,133	391,049	3,749,221	391,120	1281.78	608.08
330+00	3,748,564	391,211	3,748,830	391,442	3,748,870	391,474	3,748,922	391,524	1163.13	504.28
335+00	3,748,192	391,550	3,748,470	391,792	3,748,512	391,825	3,748,580	391,888	1207.81	528.51
340+00	3,748,059	392,094	3,748,319	392,325	3,748,352	392,362	3,748,414	392,410	962.98	530.83
345+00	3,747,685	392,431	3,747,936	392,654	3,747,973	392,687	3,748,027	392,734	1034.01	377.17
355+00	3,746,860	393,036	3,747,097	393,247	3,747,136	393,281	3,747,193	393,331	1028.93	412.38
360+00	3,746,460	393,350	3,746,699	393,564	3,746,739	393,597	3,746,793	393,643	1015.82	508.40
365+00	3,746,049	393,654	3,746,296	393,873	3,746,340	393,912	3,746,402	393,968	1047.39	368.88

B. Methodology:

1. Area Calculations: A typical sand fill polygon is shown below. Using the XYZ data from the survey cross sections, these polygons were individually plotted in CAD. From there, the area of each section was obtained.



2. Distance Between Cross Sections: Before the volume of the sand fill can be calculated, the distance between each cross section must be obtained. These distances represent the plan view area that each cross section will represent and were computed from the surveyor's CAD drawing.

3. <u>Volume Calculations</u>: The volume calculations for each cross section are computed by taking the product of the each cross-sectional area and its corresponding distance. The incremental volumes are then added together to get the total volume of the fill site. This is accomplished using the simple formulas shown below:

$$V_{xs} = (A_{xs})(d)$$

where: V_{xs} = Cross-sectional volume
A_{xs} = Cross-sectional area
d = Distance between cross-sections

$$V_{tot} = \sum V_{xs}$$

The volume calculations for each fill site are shown in Section C on the following pages:

C. **Shoreline Restoration Design:**

1. Survey Data

i. Cross-Sectional Area(ft^2): Distance (ft.):

$A_{300.60} := 4377.80 ft^2$ $d_{300.60} := 277.38 ft$

$A_{305} := 1008.54 ft^2$ $d_{305} := 488.28 ft$

$A_{310} := 1266.05 ft^2$ $d_{310} := 401.58 ft$

$A_{315} := 1243.73 ft^2$ $d_{315} := 861.61 ft$

$A_{325} := 1281.78 ft^2$ $d_{325} := 608.08 ft$

$A_{330} := 1163.13 ft^2$ $d_{330} := 504.28 ft$

$A_{335} := 1207.81 ft^2$ $d_{335} := 528.51 ft$

$A_{340} := 962.98 ft^2$ $d_{340} := 530.83 ft$

$A_{345} := 1034.00 ft^2$ $d_{345} := 377.17 ft$

$A_{355} := 1028.93 ft^2$ $d_{355} := 412.38 ft$

$A_{360} := 1015.82 ft^2$ $d_{360} := 508.40 ft$

$A_{365} := 1047.39 ft^2$ $d_{365} := 368.88 ft$

ii. Calculated Volume (ft^3):

$V_{300.60} := A_{300.60} \cdot d_{300.60}$ $V_{300.60} = 1214314.164\ ft^3$

$V_{305} := A_{305} \cdot d_{305}$ $V_{305} = 492449.911\ ft^3$

$V_{310} := A_{310} \cdot d_{310}$ $V_{310} = 508420.359\ ft^3$

$V_{315} := A_{315} \cdot d_{315}$ $V_{315} = 1071610.205\ ft^3$

$V_{325} := A_{325} \cdot d_{325}$ $V_{325} = 779424.782\ ft^3$

$V_{330} := A_{330} \cdot d_{330}$ $V_{330} = 586543.196\ ft^3$

$V_{335} := A_{335} \cdot d_{335}$ $V_{335} = 638339.663\ ft^3$

$V_{340} := A_{340} \cdot d_{340}$ $V_{340} = 511178.673\ ft^3$

$V_{345} := A_{345} \cdot d_{345}$ $V_{345} = 389993.78\ ft^3$

$V_{355} := A_{355} \cdot d_{355}$ $V_{355} = 424310.153\ ft^3$

$V_{360} := A_{360} \cdot d_{360}$ $V_{360} = 516442.888\ ft^3$

$V_{365} := A_{365} \cdot d_{365}$ $V_{365} = 386361.223\ ft^3$

$$V_{SR} := V_{300.60} + V_{305} + V_{310} + V_{315} + V_{325} + V_{330} + V_{335} + V_{340} + V_{345} + V_{355} + V_{360} + V_{365}$$

Total Volume for Shoreline Restoration, $V_{SR} = 278495.89\ yd^3$

VII. BORROW SITE DESIGN

A. Given:

1. Fill Volume for Marsh Creation: V_{MC} = 3,725,874.36 yd^3 (see Section II)

2. Fill Volume for Shoreline Restoration: V_{SR} = 278,495.89 yd^3 (see Section VI)

3. Cut:Fill Ratios:

   i. For Marsh Creation, CF_{MC} = 1.3
   ii. For Shoreline Restoration, CF_{SR} = 2.0

4. Maximum cut elevation for the Mississippi River Borrow Site: -66.0 NAVD 88

5. Cross Sectional Survey Data of Borrow Sites: XYZ data for each fill borrow site cross section.

6. The following table lists the areas of each river section and the length that each section represents. This data was computed with CAD and used to calculate the Available Volume in the Permitted Borrow Site.

Section (Sta)	Section Area (ft^2)	Length (ft)
B	4,234.86	1,180.24
C	7,058.65	799.85
D	10,047.73	805.13
E	12,718.68	801.41
F	15,738.10	800.18
G	19,663.96	800.68
H	23,999.12	800.01
I	27,068.19	804.01
J	26,558.73	802.75
K	24,018.13	799.62
L	18,755.86	801.83
M	14,917.03	806.50
N	7,135.14	401.51

B. Methodology:

1. Required Borrow Volume, VI: The borrow volume needed to fill the marsh creation/nourishment sites to the target elevation was computed by simply taking the product of the Fill Volume and the Cut:Fill Ratio:

$$VI = VF * CF$$

2. Available Volume in Permitted Borrow Site: To ensure that the permitted borrow site will produce enough material to fill the marsh creation/nourishment sites to the target fill elevations (a volume greater than (or equal to) the Required Borrow Volume), the volume of the Permitted Borrow Site was calculated. The cross-sectional area of each borrow site transect was computed with a similar method as the fill area cross-sectional areas using the XYZ survey data for the borrow sites (see Section II, "Area Calculations"). Once each cross-sectional area was computed, the volume was calculated using the formulas below:

$$V_{xs} = (A_{xs})(d)$$

where: V_{xs} = Cross-sectional volume
A_{xs} = Cross-sectional area
d = Distance between cross-sections

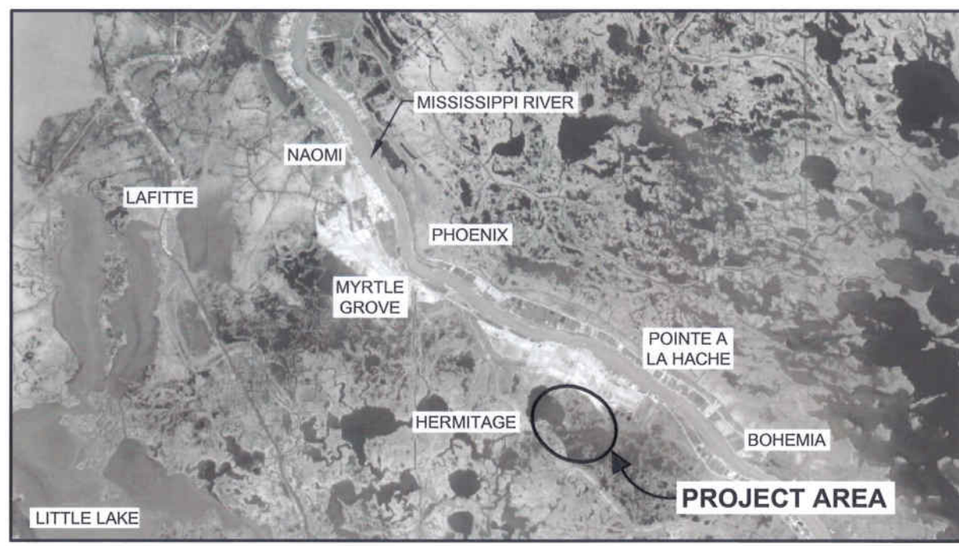
$$V_{PB} = \sum V_{xs}$$

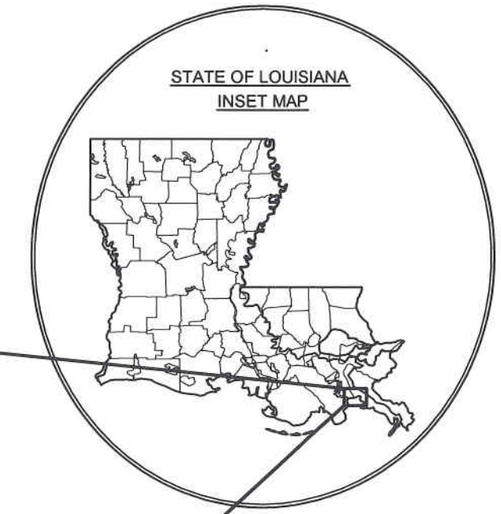
This volume was then compared to the Required Borrow Volume to ensure that the Permitted Borrow site contains a sufficient quantity of borrow material.

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION

LAKE HERMITAGE MARSH CREATION
BA-42
PLAQUEMINES PARISH
FINAL DESIGN DRAWINGS

INDEX TO SHEETS





FEDERAL PROJECT SPONSOR

OCPR CHIEF - CHRISTOPHER KNOTTS, P.E.

OCPR ENGINEER ADMINISTRATOR - STEVE MEUNIER, P.E.

OCPR ENGINEER MANAGER - MAURY CHATELLIER, P.E

OCPR PROJECT ENGINEER - RUDY SIMONEAUX, E.I.

TYPE OF CONSTRUCTION

CLASSIFICATION III (HEAVY CONSTRUCTION)
SHORELINE RESTORATION AND MARSH CREATION

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU | DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

TITLE SHEET
DATE: OCTOBER 2008
SHEET 1 OF 25

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GENERAL NOTES

1. ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). ALL HORIZONTAL COORDINATES ARE GIVEN IN THE NORTH AMERICAN DATUM OF 1983 (NAD 83).

2. THE SURVEY DATA SHOWN ON THE PLANS IS BASED ON THE SURVEYS PERFORMED BETWEEN 02-06-2007 AND 04-12-2007 BY SIGMA CONSULTING GROUP, LLC FOR LDNR. ESTIMATED DESIGN QUANTITIES SHOWN ARE FOR BIDDING PURPOSES AND WERE BASED ON THESE SURVEYS. QUANTITIES WERE CALCULATED USING THE AVERAGE AREA METHOD (APPENDIX E OF THE PRELIMINARY DESIGN REPORT).

3. THE LDNR SECONDARY MONUMENTS "876 1602 C TIDAL" AND "BA04C-SM-0"1 SHALL BE USED FOR HORIZONTAL AND VERTICAL CONTROL DURING ALL CONSTRUCTION SURVEYS. THE LOCATIONS OF THESE MONUMENTS ARE SHOWN ON SHEET 3. THE DATA SHEETS ARE LOCATED IN APPENDIX A OF THE PRELIMINARY DESIGN REPORT.

4. THE MARSH CREATION SITES, TERRACE FIELD, SHORELINE RESTORATION ALIGNMENTS, AND BORROW SITE MAY BE REVISED BY THE LDNR CONSTRUCTION ENGINEER AT THE TIME OF CONSTRUCTION TO REFLECT CHANGES IN FIELD CONDITIONS.

5. THE GEOTECHNICAL INVESTIGATION AND ANALYSIS WERE PERFORMED FROM APRIL 12, 2007 TO APRIL 30, 2007 BY EUSTIS ENGINEERING SERVICES, LLC. THE LOCATIONS OF THE SOIL BORINGS ARE SHOWN ON PAGE 4, PAGE 5, AND PAGE 6 OF THE PLANS. THE SOIL BORING LOGS ARE LOCATED IN APPENDIX C OF THE PRELIMINARY DESIGN REPORT.

6. MEAN HIGH WATER (MHW) AND MEAN LOW WATER (MLW) WERE CALCULATED FROM THE LDNR GAGE BA04-17 LOCATED NEAR POINTE A LA HACHE, LA. ELEVATIONS ARE REFERENCED TO NAVD 88, US FEET. MHW=0.88' AND MLW =0.34'. DETAILS OF THIS ANALYSIS ARE SHOWN APPENDIX E OF THE PRELIMINARY DESIGN REPORT.

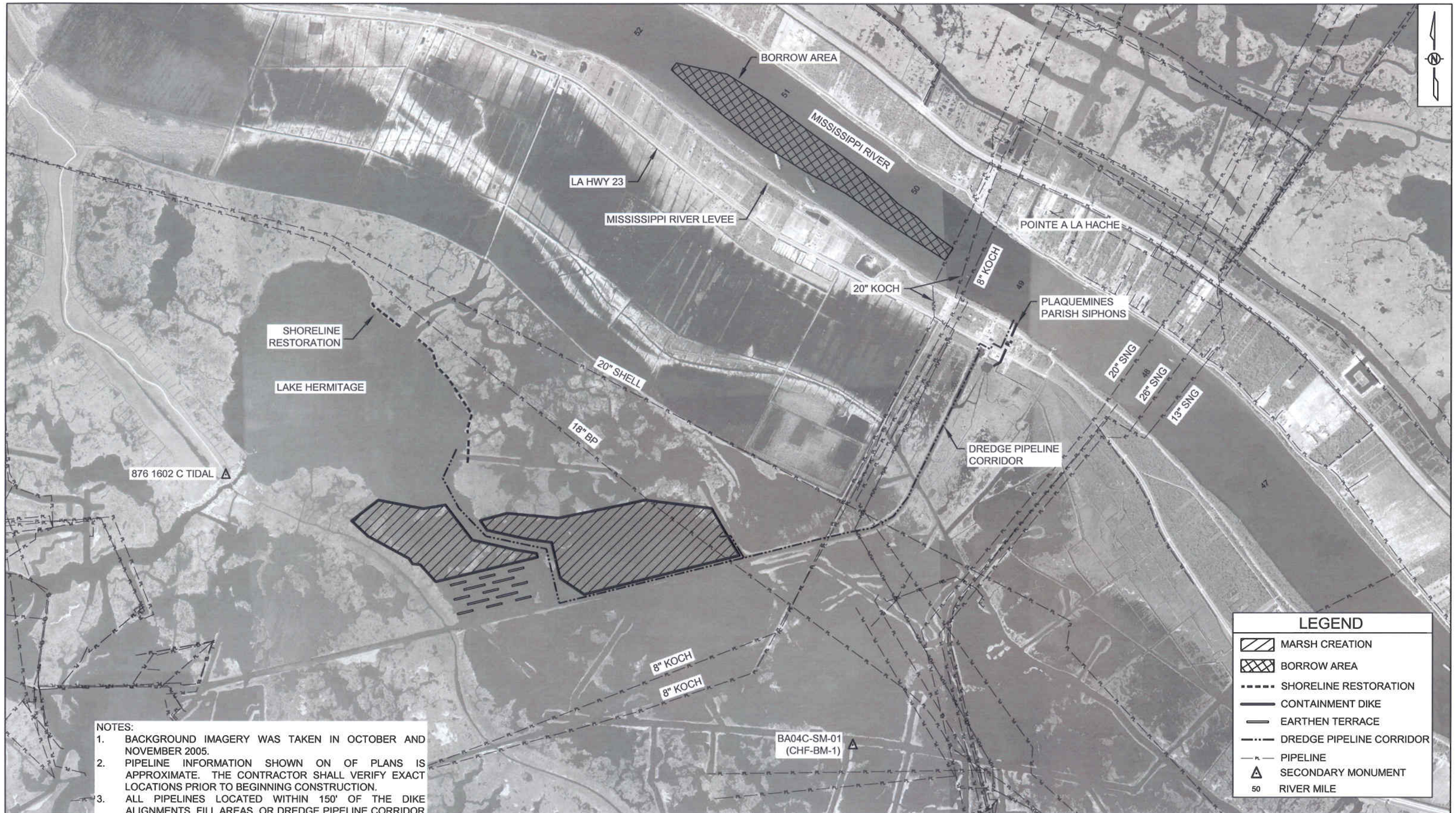
SUMMARY OF ESTIMATED QUANTITIES

BASE BID

ITEM No.	DESCRIPTION	UNIT	ESTIMATED QUANTITY
1	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	1
2	CONSTRUCTION SURVEYS	LUMP SUM	1
3	GRADE STAKES	EACH	84
4	HYDRAULIC DREDGING FOR MARSH CREATION*	CUBIC YARD	3,725,784
5	HYDRAULIC DREDGING FOR SHORELINE RESTORATION*	CUBIC YARD	278,496
6	SHAPING/GRADING FOR SHORELINE RESTORATION	LUMP SUM	1
7	EARTHEN CONTAINMENT DIKES**	LINEAR FOOT	34,268
8	EARTHEN TERRACES	LINEAR FOOT	7,300
9	SETTLEMENT PLATES	EACH	4
10	JACK AND BORE (HIGHWAY 23)	LINEAR FOOT	150
11	JACKING PIT	LUMP SUM	1

*HYDRAULIC DREDGING QUANTITIES FOR MARSH CREATION AND SHORELINE RESTORATION ARE BASED ON IN PLACE VOLUME.

**THE LINEAR FEET OF CONTAINMENT DIKES WAS ESTIMATED FOR CONSTRUCTION USING AERIAL PHOTOGRAPHY, FIELD SURVEYS, AND AUTOCAD. THE OWNER RESERVES THE RIGHT TO REQUEST ADDITIONAL DIKES BE BUILT FOR CONSTRUCTION AT THE CONTRACTOR'S BID PRICE/LINEAR FOOT.



NOTES:

1. BACKGROUND IMAGERY WAS TAKEN IN OCTOBER AND NOVEMBER 2005.
2. PIPELINE INFORMATION SHOWN ON OF PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, FILL AREAS, OR DREDGE PIPELINE CORRIDOR SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

PROJECT LAYOUT

DATE: OCTOBER 2008
SHEET 3 OF 25

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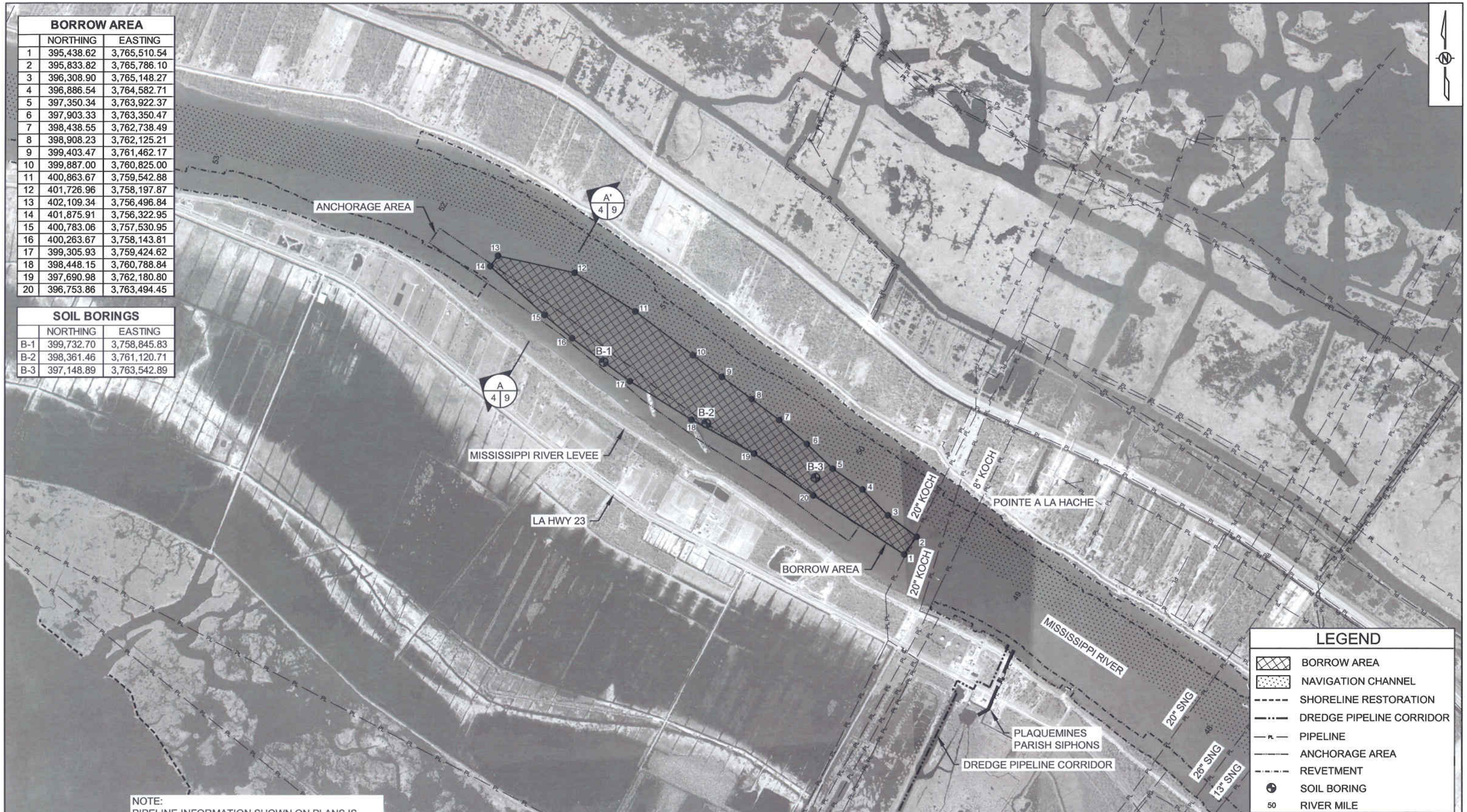
BORROW AREA

	NORTHING	EASTING
1	395,438.62	3,765,510.54
2	395,833.82	3,765,786.10
3	396,308.90	3,765,148.27
4	396,886.54	3,764,582.71
5	397,350.34	3,763,922.37
6	397,903.33	3,763,350.47
7	398,438.55	3,762,738.49
8	398,908.23	3,762,125.21
9	399,403.47	3,761,462.17
10	399,887.00	3,760,825.00
11	400,863.67	3,759,542.88
12	401,726.96	3,758,197.87
13	402,109.34	3,756,496.84
14	401,875.91	3,756,322.95
15	400,783.06	3,757,530.95
16	400,263.67	3,758,143.81
17	399,305.93	3,759,424.62
18	398,448.15	3,760,788.84
19	397,690.98	3,762,180.80
20	396,753.86	3,763,494.45

SOIL BORINGS

	NORTHING	EASTING
B-1	399,732.70	3,758,845.83
B-2	398,361.46	3,761,120.71
B-3	397,148.89	3,763,542.89



NOTE:
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LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

BORROW AREA LAYOUT

DATE: OCTOBER 2008
SHEET 4 OF 25

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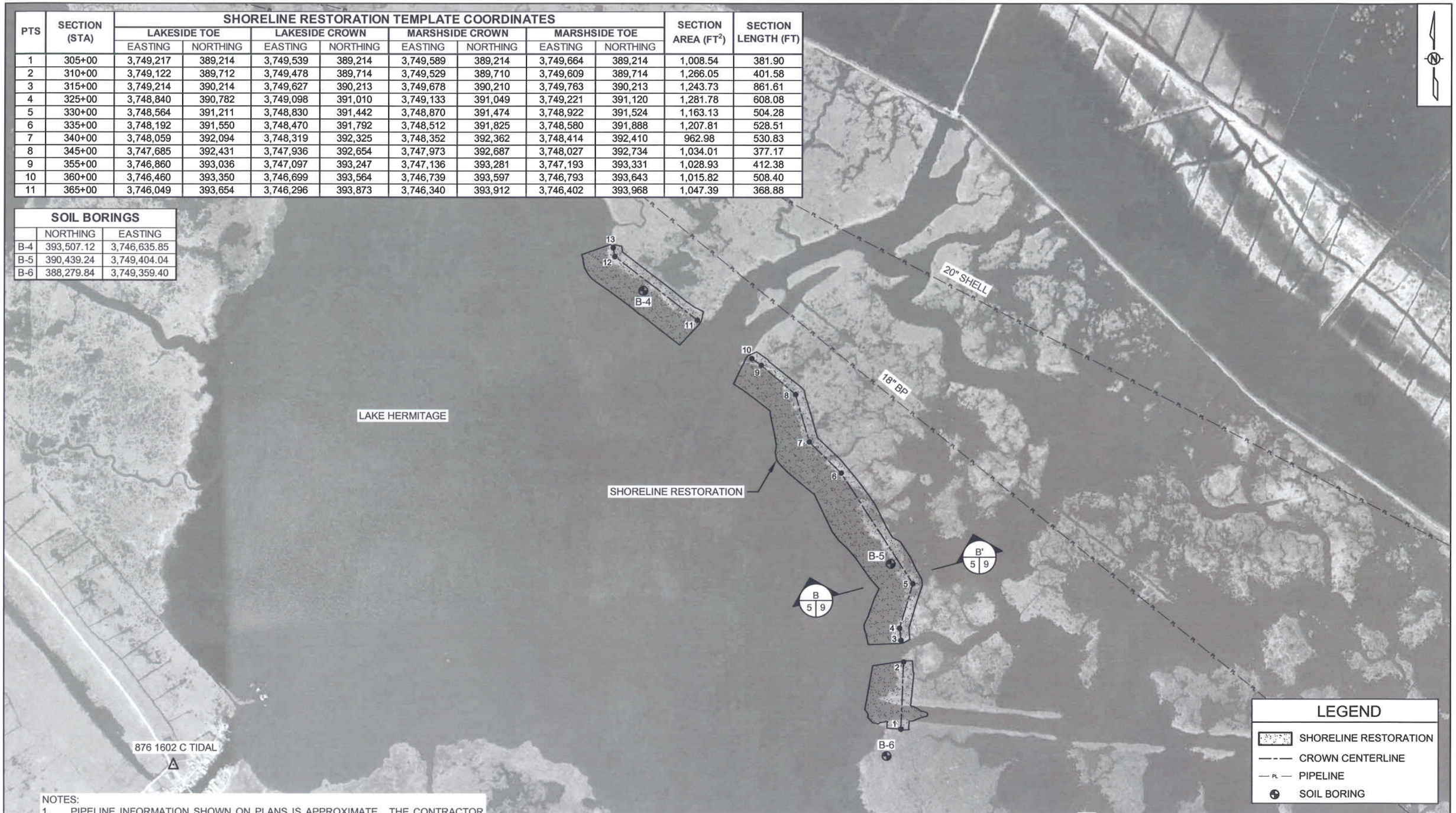
PTS	SECTION (STA)	SHORELINE RESTORATION TEMPLATE COORDINATES								SECTION AREA (FT^2)	SECTION LENGTH (FT)
		LAKESIDE TOE		LAKESIDE CROWN		MARSHSIDE CROWN		MARSHSIDE TOE			
		EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING		
1	305+00	3,749,217	389,214	3,749,539	389,214	3,749,589	389,214	3,749,664	389,214	1,008.54	381.90
2	310+00	3,749,122	389,712	3,749,478	389,714	3,749,529	389,710	3,749,609	389,714	1,266.05	401.58
3	315+00	3,749,214	390,214	3,749,627	390,213	3,749,678	390,210	3,749,763	390,213	1,243.73	861.61
4	325+00	3,748,840	390,782	3,749,098	391,010	3,749,133	391,049	3,749,221	391,120	1,281.78	608.08
5	330+00	3,748,564	391,211	3,748,830	391,442	3,748,870	391,474	3,748,922	391,524	1,163.13	504.28
6	335+00	3,748,192	391,550	3,748,470	391,792	3,748,512	391,825	3,748,580	391,888	1,207.81	528.51
7	340+00	3,748,059	392,094	3,748,319	392,325	3,748,352	392,362	3,748,414	392,410	962.98	530.83
8	345+00	3,747,685	392,431	3,747,936	392,654	3,747,973	392,687	3,748,027	392,734	1,034.01	377.17
9	355+00	3,746,860	393,036	3,747,097	393,247	3,747,136	393,281	3,747,193	393,331	1,028.93	412.38
10	360+00	3,746,460	393,350	3,746,699	393,564	3,746,739	393,597	3,746,793	393,643	1,015.82	508.40
11	365+00	3,746,049	393,654	3,746,296	393,873	3,746,340	393,912	3,746,402	393,968	1,047.39	368.88

SOIL BORINGS		
	NORTHING	EASTING
B-4	393,507.12	3,746,635.85
B-5	390,439.24	3,749,404.04
B-6	388,279.84	3,749,359.40



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1000' 500' 0' 1000' 2000'

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617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SHORELINE PROTECTION LAYOUT
DATE: OCTOBER 2008
SHEET 5 OF 25

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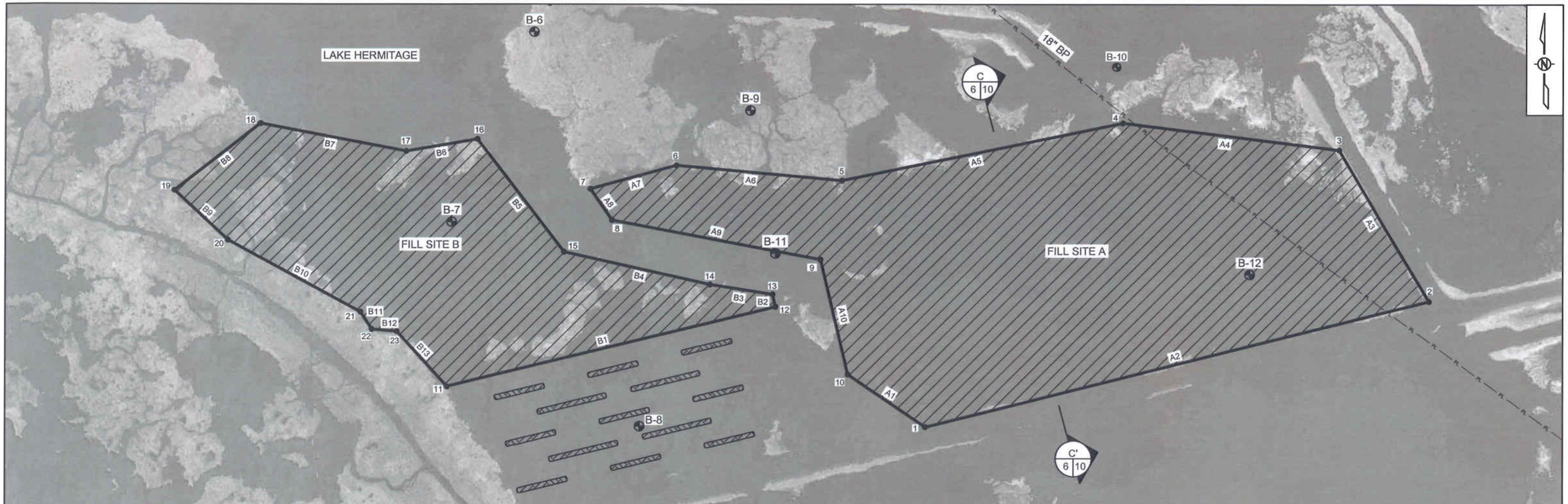

EARTHEN CONTAINMENT DIKES

SEGMENT	AVG. BASE ELEVATION	AVG. HEIGHT (FT.)	SEGMENT LENGTH (FT.)	FILL VOLUME (YD^3)	BORROW VOLUME (YD^3)
A1	-1.85	4.85	972	5951	11902
A2	-1.27	4.27	5382	26061	52122
A3	0.94	2.06	1824	2416	4832
A4	-0.60	3.60	2269	8048	16096
A5	-0.26	3.26	2971	8811	17623
A6	0.39	2.61	1727	3449	6898
A7	-0.77	3.77	925	3567	7133
A8	-2.55	5.55	398	3131	6262
A9	-2.50	5.50	2202	17043	34086
A10	-1.06	4.06	1234	5450	10899
B1	-1.66	4.66	3511	19971	39942
B2	-1.65	4.65	133	753	1506
B3	-1.35	4.35	659	3303	6605
B4	-1.68	4.68	1549	8884	17767
B5	-2.05	5.05	1484	9796	19593
B6	1.00	2.00	755	950	1901
B7	-2.43	5.43	1545	11678	23355
B8	0.02	2.98	1140	2878	5756
B9	-0.36	3.36	764	2392	4783
B10	0.56	2.44	1573	2791	5583
B11	-0.18	3.18	216	614	1227
B12	-1.04	4.04	261	1143	2286
B13	-1.04	4.04	776	3393	6787

FILL SITE 1 - 352 ACRES

	NORTHING	EASTING
1	384,144.79	3,753,420.89
2	385,460.01	3,758,639.42
3	387,043.30	3,757,708.63
4	387,324.31	3,755,464.42
5	386,720.74	3,752,554.97
6	386,880.80	3,750,835.49
7	386,634.12	3,749,944.20
8	386,306.70	3,750,169.94
9	385,893.77	3,752,332.61
10	384,693.03	3,752,618.81

FILL VOLUME = 2,531,259 CY.
BORROW VOLUME = 3,290,637 CY.

FILL SITE 2 - 182 ACRES

11	384,564.82	3,748,457.30
12	385,401.83	3,751,864.74
13	385,531.33	3,751,834.75
14	385,633.71	3,751,183.63
15	385,974.49	3,749,672.27
16	387,154.24	3,748,772.39
17	387,028.22	3,748,028.30
18	387,317.30	3,746,510.46
19	386,616.33	3,745,611.87
20	386,096.52	3,746,171.52
21	385,345.24	3,747,553.11
22	385,164.09	3,747,671.34
23	385,140.46	3,747,931.46

FILL VOLUME = 1,194,525 CY.
BORROW VOLUME = 1,552,883 CY.

NOTES:
1. PIPELINE INFORMATION SHOWN ON THE PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY PIPELINE LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
2. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, FILL AREAS, OR DREDGE PIPELINE CORRIDOR SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.
3. CALCULATIONS FOR THE CONTAINMENT DIKE AND FILL SITE VOLUMES ARE SHOWN IN APPENDIX E OF THE FINAL DESIGN REPORT.

SOIL BORINGS

B-6	388,279.84	3,749,359.40
B-7	386,287.82	3,748,504.41
B-8	384,153.08	3,750,455.67
B-9	387,456.14	3,751,602.81
B-10	387,913.52	3,755,399.17
B-11	385,959.35	3,751,865.05
B-12	385,738.43	3,756,785.99

LEGEND

- MARSH CREATION
- TERRACING
- CONTAINMENT DIKE
- PL — PIPELINE
- SOIL BORING

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

MARSH CREATION AREA LAYOUT

DATE: OCTOBER 2008
SHEET 6 OF 25

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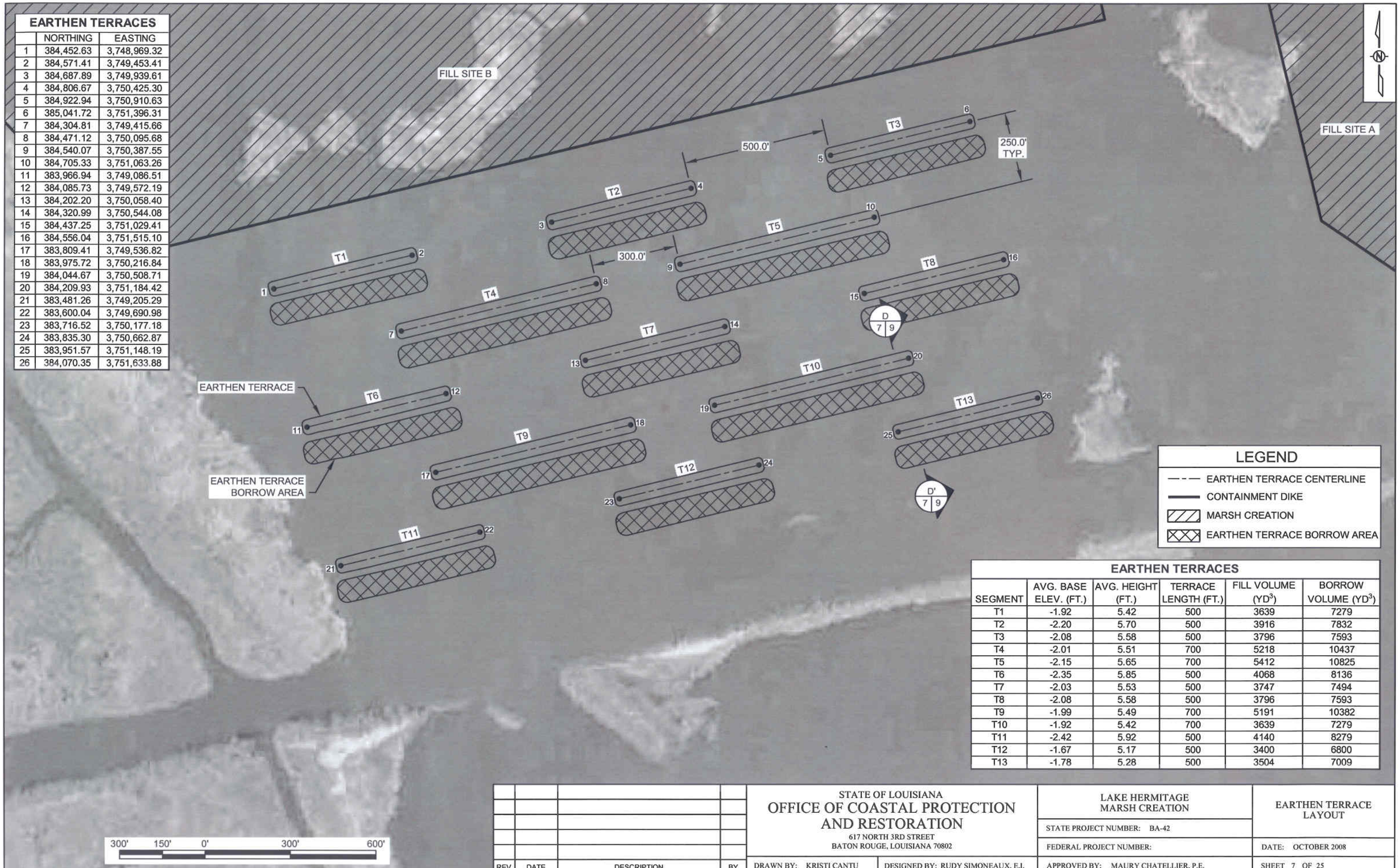

EARTHEN TERRACES

	NORTHING	EASTING
1	384,452.63	3,748,969.32
2	384,571.41	3,749,453.41
3	384,687.89	3,749,939.61
4	384,806.67	3,750,425.30
5	384,922.94	3,750,910.63
6	385,041.72	3,751,396.31
7	384,304.81	3,749,415.66
8	384,471.12	3,750,095.68
9	384,540.07	3,750,387.55
10	384,705.33	3,751,063.26
11	383,966.94	3,749,086.51
12	384,085.73	3,749,572.19
13	384,202.20	3,750,058.40
14	384,320.99	3,750,544.08
15	384,437.25	3,751,029.41
16	384,556.04	3,751,515.10
17	383,809.41	3,749,536.82
18	383,975.72	3,750,216.84
19	384,044.67	3,750,508.71
20	384,209.93	3,751,184.42
21	383,481.26	3,749,205.29
22	383,600.04	3,749,690.98
23	383,716.52	3,750,177.18
24	383,835.30	3,750,662.87
25	383,951.57	3,751,148.19
26	384,070.35	3,751,633.88

EARTHEN TERRACES

SEGMENT	AVG. BASE ELEV. (FT.)	AVG. HEIGHT (FT.)	TERRACE LENGTH (FT.)	FILL VOLUME (YD^3)	BORROW VOLUME (YD^3)
T1	-1.92	5.42	500	3639	7279
T2	-2.20	5.70	500	3916	7832
T3	-2.08	5.58	500	3796	7593
T4	-2.01	5.51	700	5218	10437
T5	-2.15	5.65	700	5412	10825
T6	-2.35	5.85	500	4068	8136
T7	-2.03	5.53	500	3747	7494
T8	-2.08	5.58	500	3796	7593
T9	-1.99	5.49	700	5191	10382
T10	-1.92	5.42	700	3639	7279
T11	-2.42	5.92	500	4140	8279
T12	-1.67	5.17	500	3400	6800
T13	-1.78	5.28	500	3504	7009

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

EARTHEN TERRACE LAYOUT

DATE: OCTOBER 2008
SHEET 7 OF 25

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NOTES:
1. BACKGROUND IMAGERY WAS TAKEN IN OCTOBER AND NOVEMBER 2005.
2. PIPELINE INFORMATION SHOWN ON OF PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, FILL AREAS, OR DREDGE PIPELINE CORRIDOR SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

UTILITY LAYOUT

DATE: OCTOBER 2008
SHEET 8 OF 25

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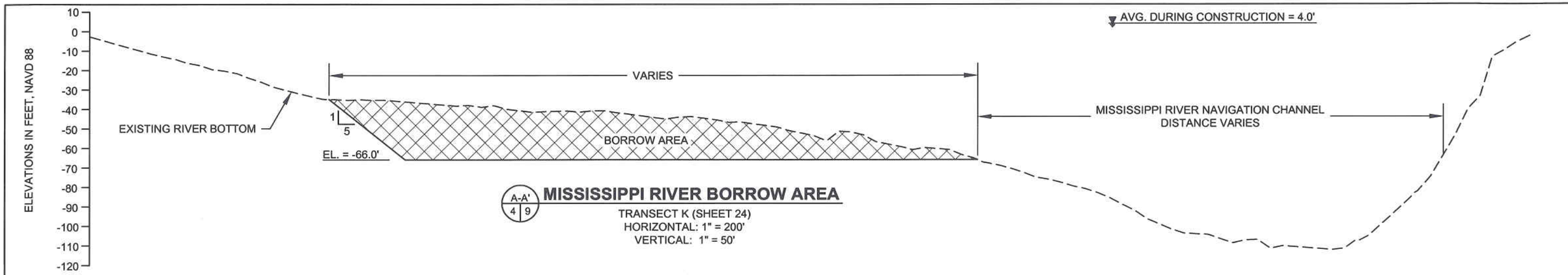
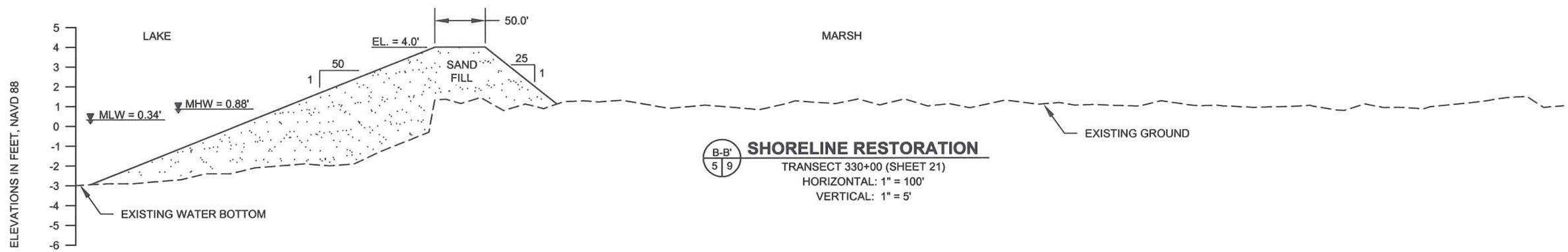


A-A' 4 | 9

MISSISSIPPI RIVER BORROW AREA

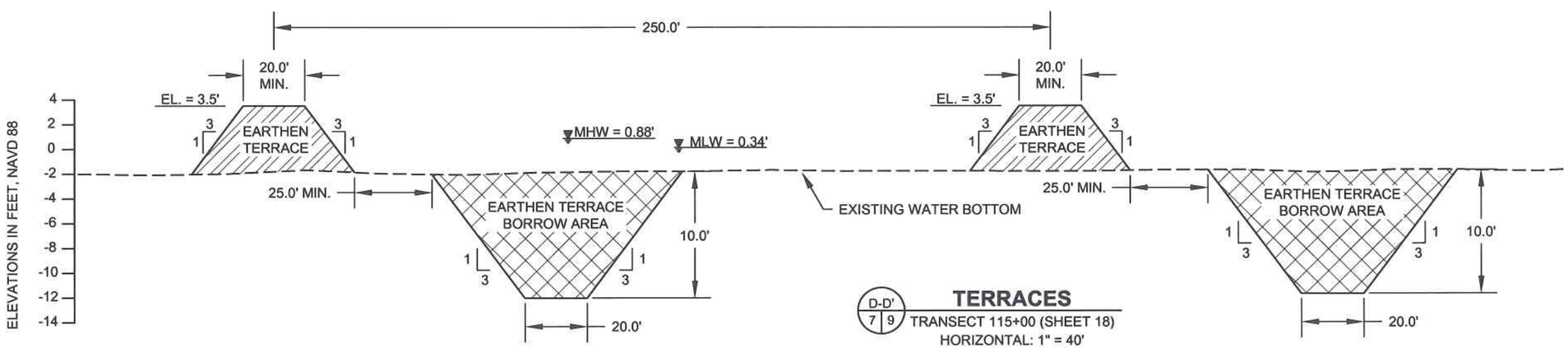
TRANSECT K (SHEET 24)
HORIZONTAL: 1" = 200'
VERTICAL: 1" = 50'



B-B' 5 | 9

SHORELINE RESTORATION

TRANSECT 330+00 (SHEET 21)
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 5'



D-D' 7 | 9

TERRACES

TRANSECT 115+00 (SHEET 18)
HORIZONTAL: 1" = 40'
VERTICAL: 1" = 10'

LEGEND

- BORROW AREA
- SAND FILL
- EARTHEN TERRACE
- WOVEN GEOTEXTILE FABRIC
- EXISTING WATER BOTTOM

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU | DESIGNED BY: RUDY SIMONEAUX | APPROVED BY: MAURY CHATELLIER, P.E.

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42

FEDERAL PROJECT NUMBER:

TYPICAL SECTIONS

DATE: OCTOBER 2008

SHEET 9 OF 25

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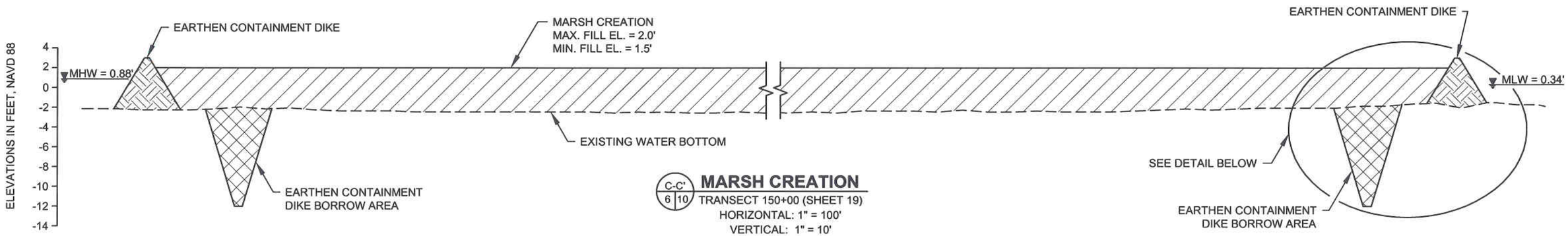
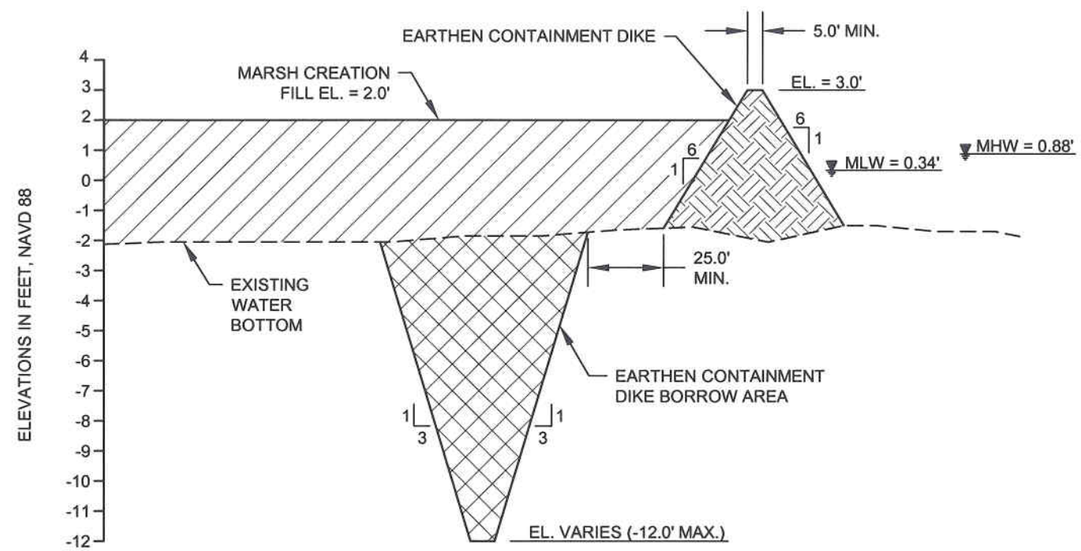


C-C' 6 10 **MARSH CREATION**
TRANSECT 150+00 (SHEET 19)
HORIZONTAL: 1" = 100'
VERTICAL: 1" = 10'



EARTHEN CONTAINMENT DIKE DETAIL
HORIZONTAL: 1" = 50'
VERTICAL: 1" = 5'

LEGEND
EXISTING GROUND/WATER BOTTOM
MARSH CREATION (FILL)
EARTHEN CONTAINMENT DIKE
BORROW AREA

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

TYPICAL SECTIONS
DATE: OCTOBER 2008
SHEET 10 OF 25

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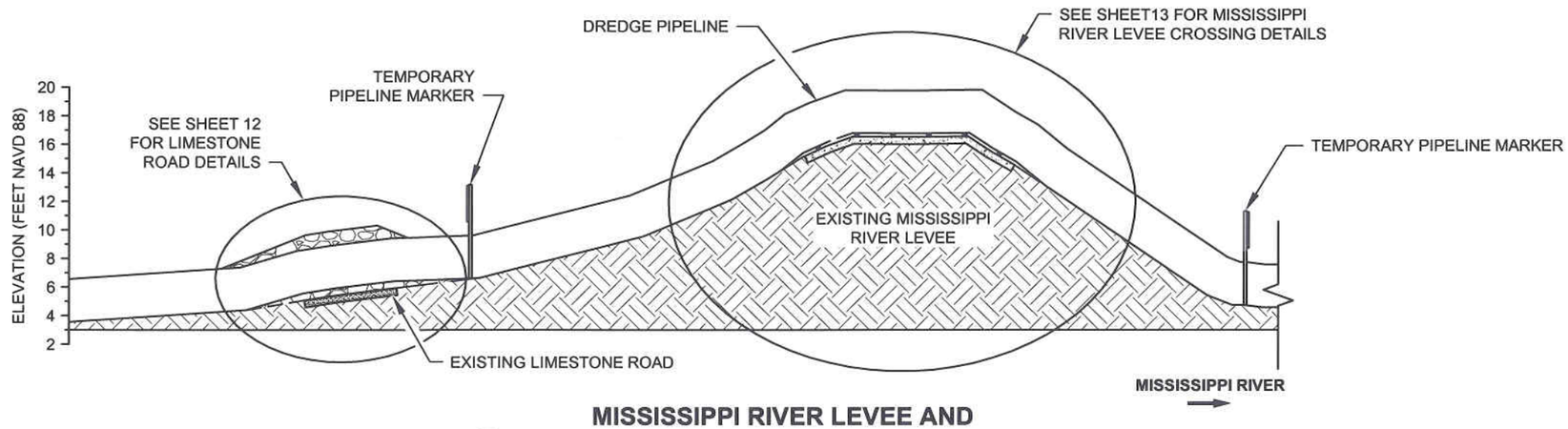
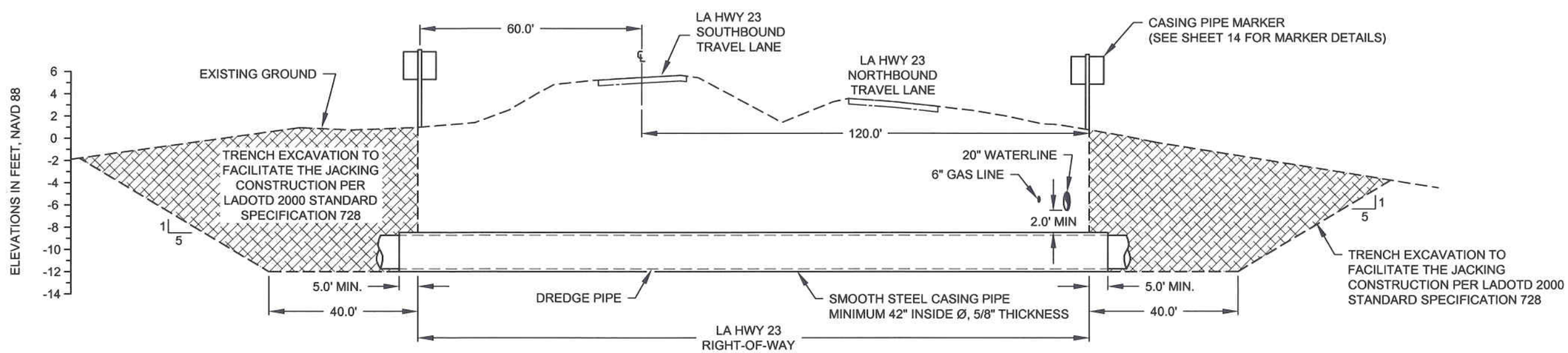


MISSISSIPPI RIVER LEVEE AND ADJACENT LIMESTONE ROAD CROSSING

E-E' 8 | 11

HORIZONTAL: 1" = 20'
VERTICAL: 1" = 10'



HIGHWAY CROSSING

F-F' 8 | 11

HORIZONTAL: 1" = 30'
VERTICAL: 1" = 10'

NOTES:

1. THE CONTRACTOR SHALL JACK THE MINIMUM 42" STEEL CASING PIPE UNDER THE LOUISIANA HIGHWAY 23 RIGHT-OF-WAY IN ACCORDANCE WITH LADOTD 2000 STANDARD SPECIFICATION 728. CASING PIPE DIAMETER SHALL BE NO GREATER THAN 48".
2. THE CASING PIPE SHALL BE MADE OF SMOOTH WALL WELDED CARBON STEEL PIPE CONFORMING TO ASTM A139, GRADE B HAVING A MINIMUM YIELD STRENGTH OF 36,000 PSI. CASING PIPE SHALL BE COATED WITH COAL TAR EPOXY-POLYAMIDE PAINT, IN ACCORDANCE WITH THE LADOTD 2000 STANDARD SPECIFICATION 1008.04.

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

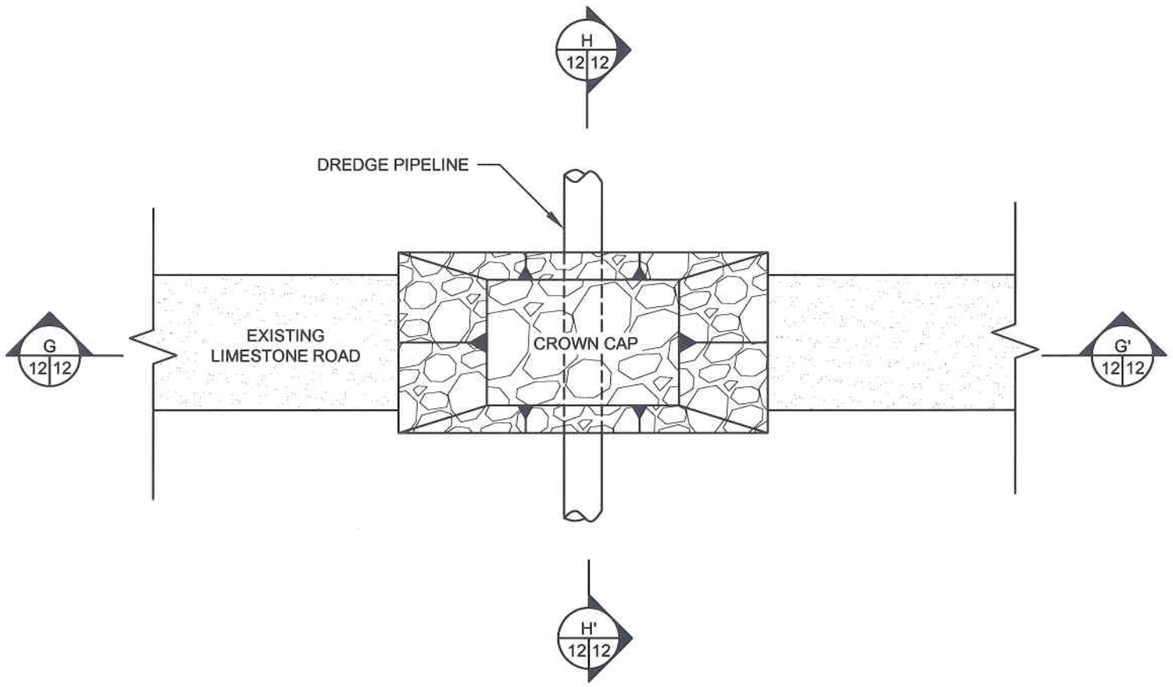
LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: LUKE LEBAS, P.E.

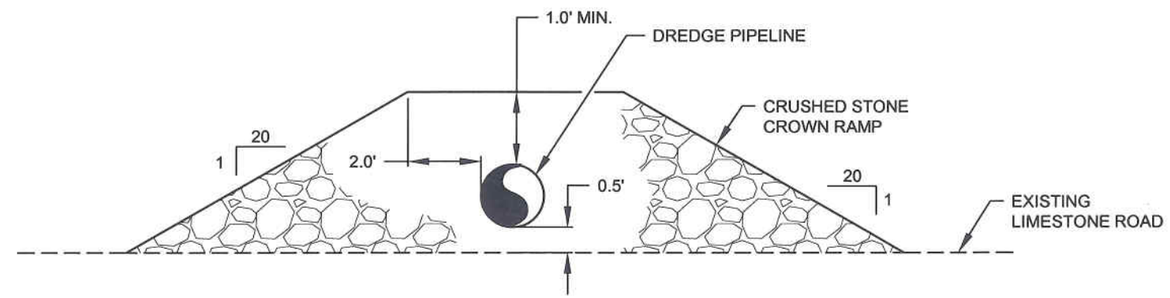
MISSISSIPPI RIVER LEVEE AND HIGHWAY CROSSING SECTIONS

DATE: OCTOBER 2008
SHEET 11 OF 25

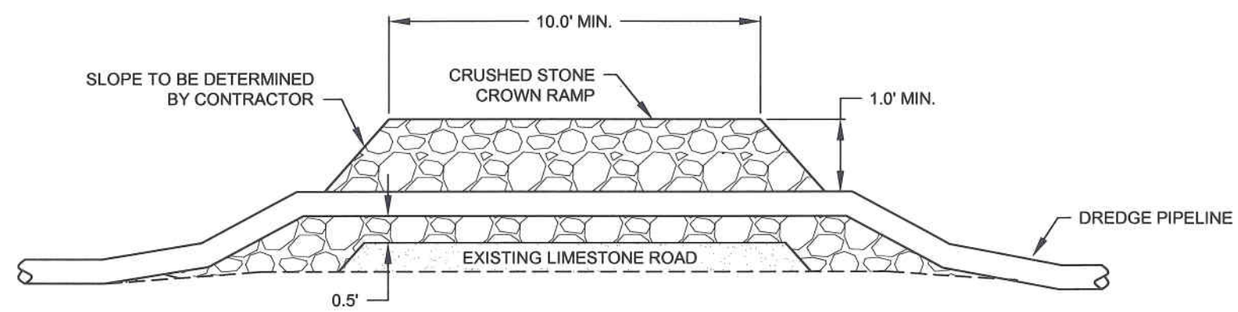
G:\Users\Autocad\BASINS\BA\BA-42 Lake Hermitage\Plans\11 REVISED MR Levee Crossing.dwg



GRAVEL ROAD CROSSING
PLAN VIEW
NOT TO SCALE



SECTION G-G'
NOT TO SCALE



SECTION H-H'
NOT TO SCALE

NOTES:
1. THE CROWN RAMP OVER THE DREDGE PIPELINE CROSSINGS SHALL CONSIST OF CRUSHED STONE FOR FULL WIDTH (10' MINIMUM) AND LENGTH OF RAMP. THE CRUSHED STONE MATERIAL SHALL CONFORM TO LADOTD 2000 STANDARD SPECIFICATION 1003.04 (a).
2. TEMPORARY PIPELINE MARKERS INDICATING OWNER, CONTENTS, AND ADDRESS FOR CONTACTING OWNER SHALL BE PLACED AND MAINTAINED AT EACH TOE OF THE LEVEE NEAR DREDGE PIPELINE.
3. ALL COSTS ASSOCIATED WITH DREDGE PIPELINE CROSSING CONSTRUCTION SHALL BE PAID PER BID ITEM NUMBER 1 "MOBILIZATION AND DEMOBILIZATION".
4. SEE SECTION TS-1.6 OF THE SPECIFICATIONS FOR INFORMATION REGARDING DREDGE PIPELINE CROSSINGS.

LIMESTONE ROAD CROSSING

REV.	DATE	DESCRIPTION	BY

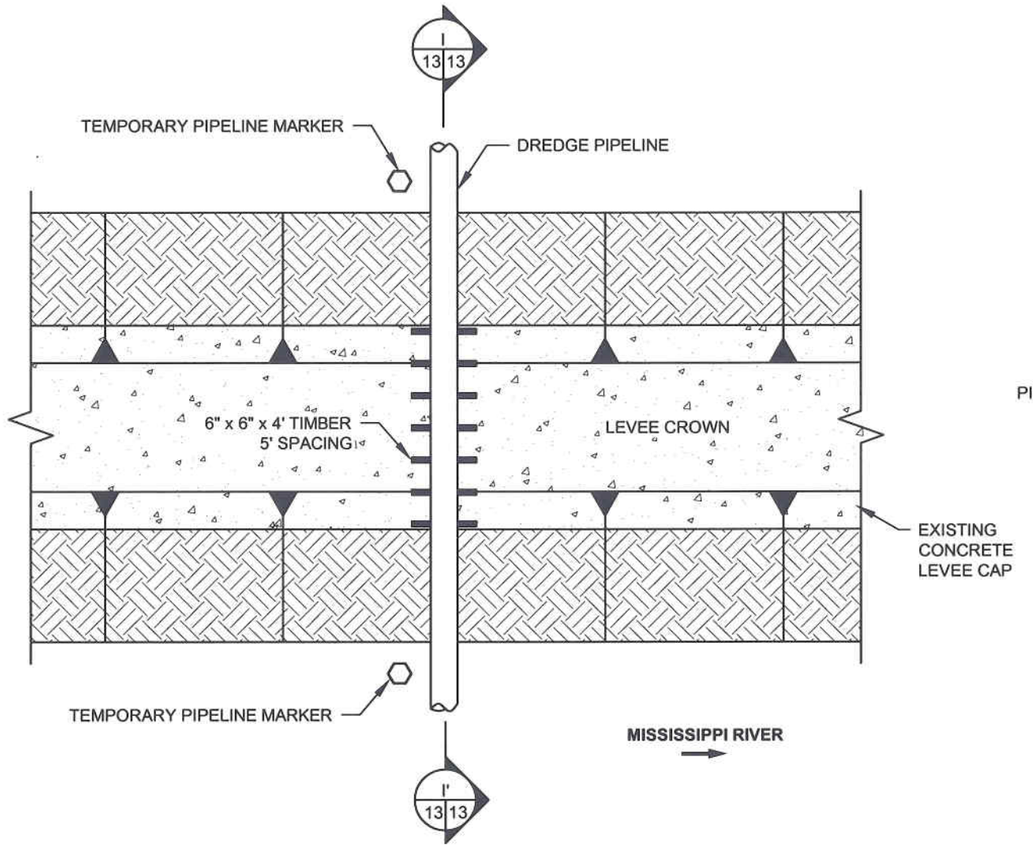
STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

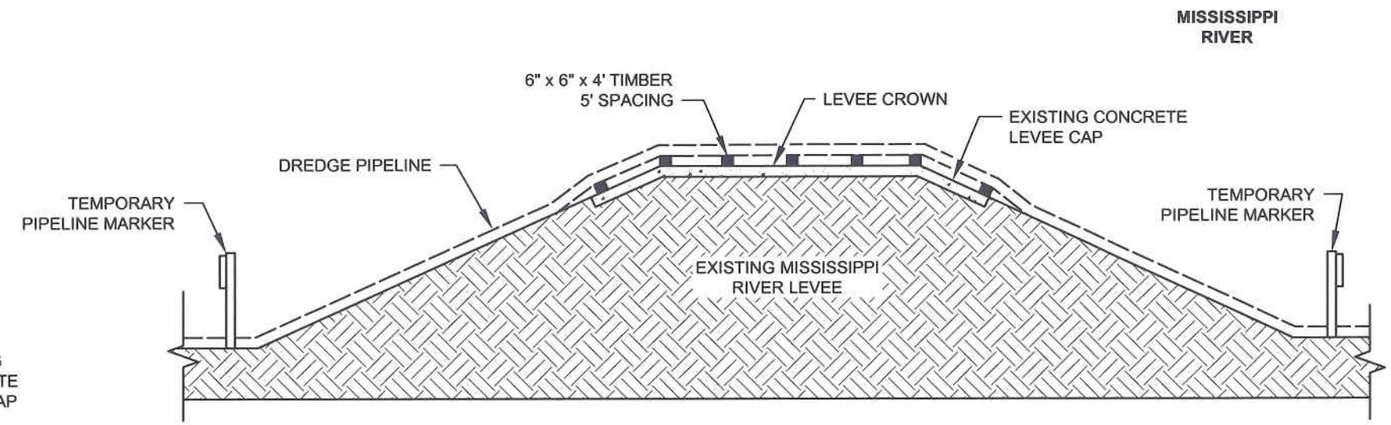
LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

LIMESTONE ROAD CROSSING DETAILS
DATE: NOVEMBER 2008
SHEET 12 OF 25

G:\Users\Autocad\BASINS\BA\BA-42 Lake Hermitage\Plans\12 Limestone Road Detail.dwg



MISSISSIPPI RIVER LEVEE
PLAN VIEW
NOT TO SCALE



SECTION I-I'
NOT TO SCALE

NOTES:
1. TEMPORARY PIPELINE MARKERS INDICATING OWNER, CONTENTS, AND ADDRESS FOR CONTACTING OWNER SHALL BE PLACED AND MAINTAINED AT EACH TOE OF THE LEVEE NEAR THE DREDGE PIPELINE.
2. ALL COSTS ASSOCIATED WITH DREDGE PIPELINE CROSSING CONSTRUCTION SHALL BE PAID PER BID ITEM NUMBER 1 "MOBILIZATION AND DEMOBILIZATION".
3. SEE SECTION TS-1.6 OF THE SPECIFICATIONS FOR INFORMATION REGARDING DREDGE PIPELINE CROSSINGS.

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-39
FEDERAL PROJECT NUMBER: BA-39
APPROVED BY: MUARY CHATELLIER, P.E.

MISSISSIPPI RIVER LEVEE CROSSING DETAILS
DATE: NOVEMBER 2008
SHEET 13 OF 25

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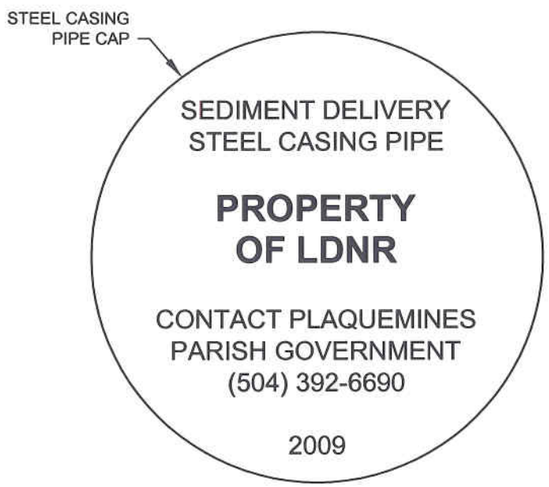
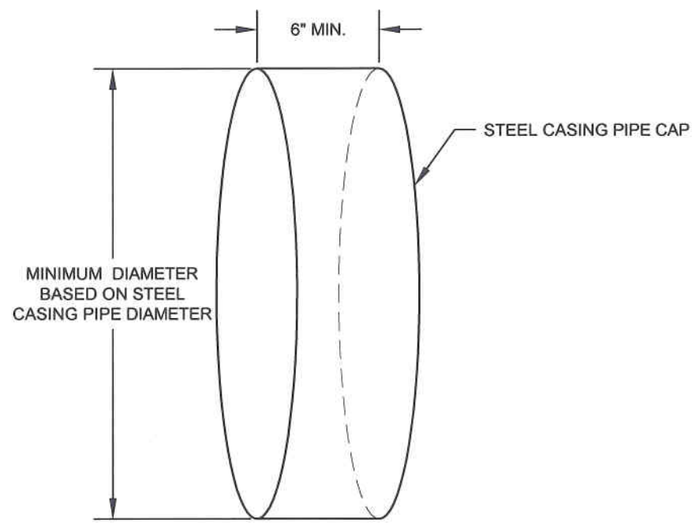


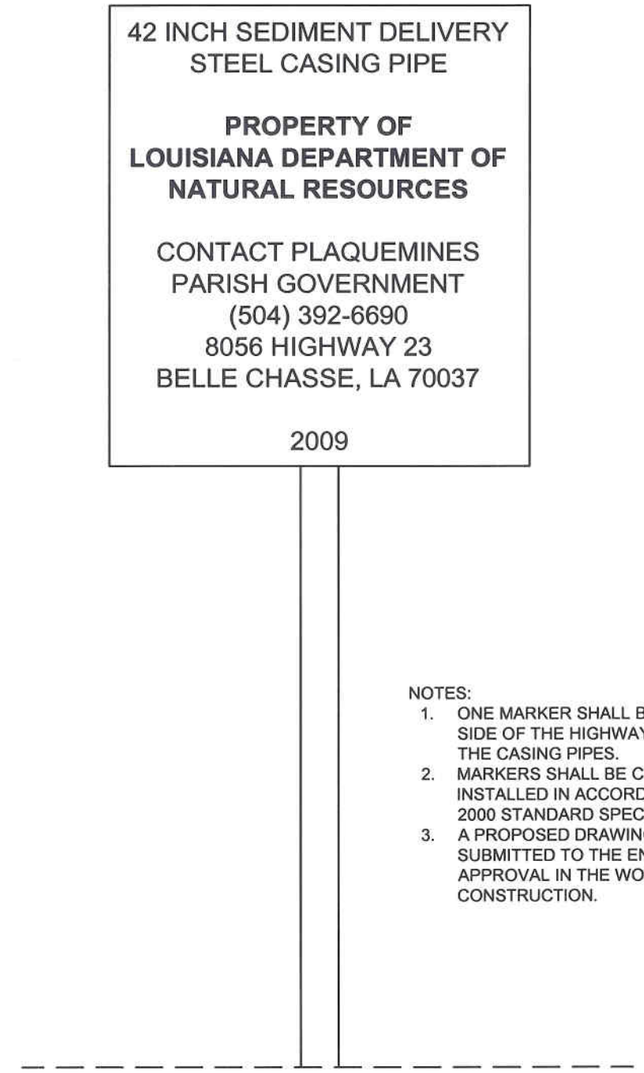


CASING PIPE CAP DETAIL

NOT TO SCALE

NOTES:

1. STEEL CASING PIPE CAPS SHALL BE 1/2" THICK AND SHALL BE COATED WITH COAL TAR EPOXY-POLYAMIDE PAINT, IN ACCORDANCE WITH THE LADOTD 2000 STANDARD SPECIFICATION 1008.04.
2. CAPS SHALL BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION SPECIFICATIONS AFTER DREDGING OPERATIONS ARE COMPLETE, MARSH FILL ELEVATION HAS BEEN ACCEPTED, AND DREDGE SLURRY PIPELINE HAS BEEN REMOVED. CAPS SHALL BE WELDED TO CASING PIPE AND SHALL BE WATER TIGHT.



NOTES:

1. ONE MARKER SHALL BE PLACED ON EACH SIDE OF THE HIGHWAY AT EACH END OF THE CASING PIPES.
2. MARKERS SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH LADOTD 2000 STANDARD SPECIFICATION 729.
3. A PROPOSED DRAWING SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL IN THE WORK PLAN PRIOR TO CONSTRUCTION.

CASING PIPE MARKER DETAIL

NOT TO SCALE

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

CASING PIPE CAP AND MARKER DETAILS
DATE: OCTOBER 2008
SHEET 14 OF 25

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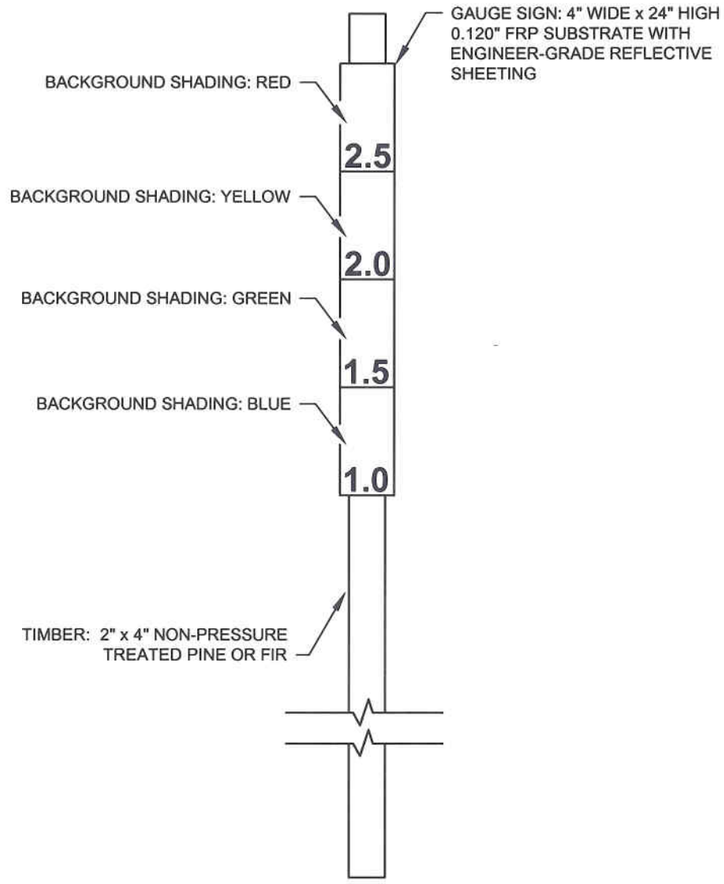
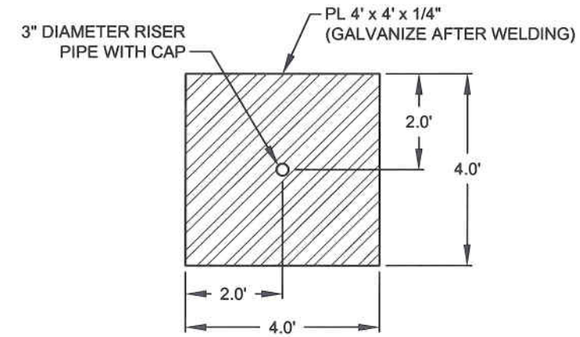
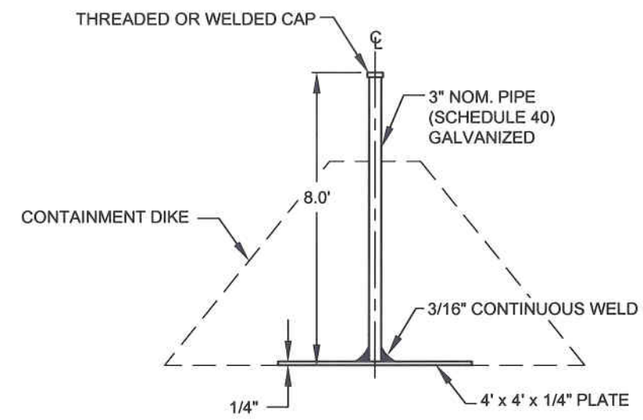
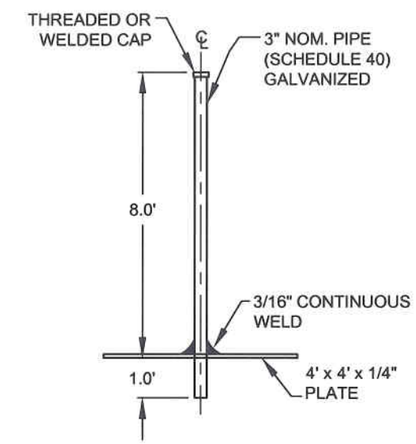


GRADE STAKE
NOT TO SCALE





SHORELINE RESTORATION SETTLEMENT PLATE
NOT TO SCALE



MARSH CREATION SETTLEMENT PLATE
NOT TO SCALE

GRADE STAKE NOTES:

1. THE SIGNS SHALL HAVE THE DIMENSIONS, NUMBERING , AND SHADING AS SHOWN.
2. THE GAUGE SIGN SHALL BE CONSTRUCTED OF 0.120" THICK FIBERGLASS REINFORCED PLASTIC (FRP) WHICH HAS BEEN UV STABILIZED FOR OUTDOOR WEATHERABILIY. THE FRP MATERIAL SHALL BE WHITE OR GRAY IN COLOR AND BE TOTALLY DIELECTRIC AND NON-CONDUCTIVE. THE FRP MATERIAL STRENGTH AND IMPACT RESISTANCE SHOULD NOT BE APPRECIABLY AFFECTED OVER A TEMPERATURE RANGE OF -65 TO + 212 DEGREES FAHRENHEIT.
3. THE MARSH FILL GRADE STAKES SHALL HAVE ELEVATION DELINEATIONS FOR MINIMUM AND MAXIMUM ELEVATIONS.
4. GRADE STAKE LOCATIONS ARE SHOWN ON SHEET 16.

SETTLEMENT PLATE NOTES:

1. SETTLEMENT PLATES SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
2. LOCATION AND ELEVATION WILL BE RECORDED DURING AS-BUILT SURVEY.

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE
MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

DETAILS

DATE: OCTOBER 2008
SHEET 15 OF 25

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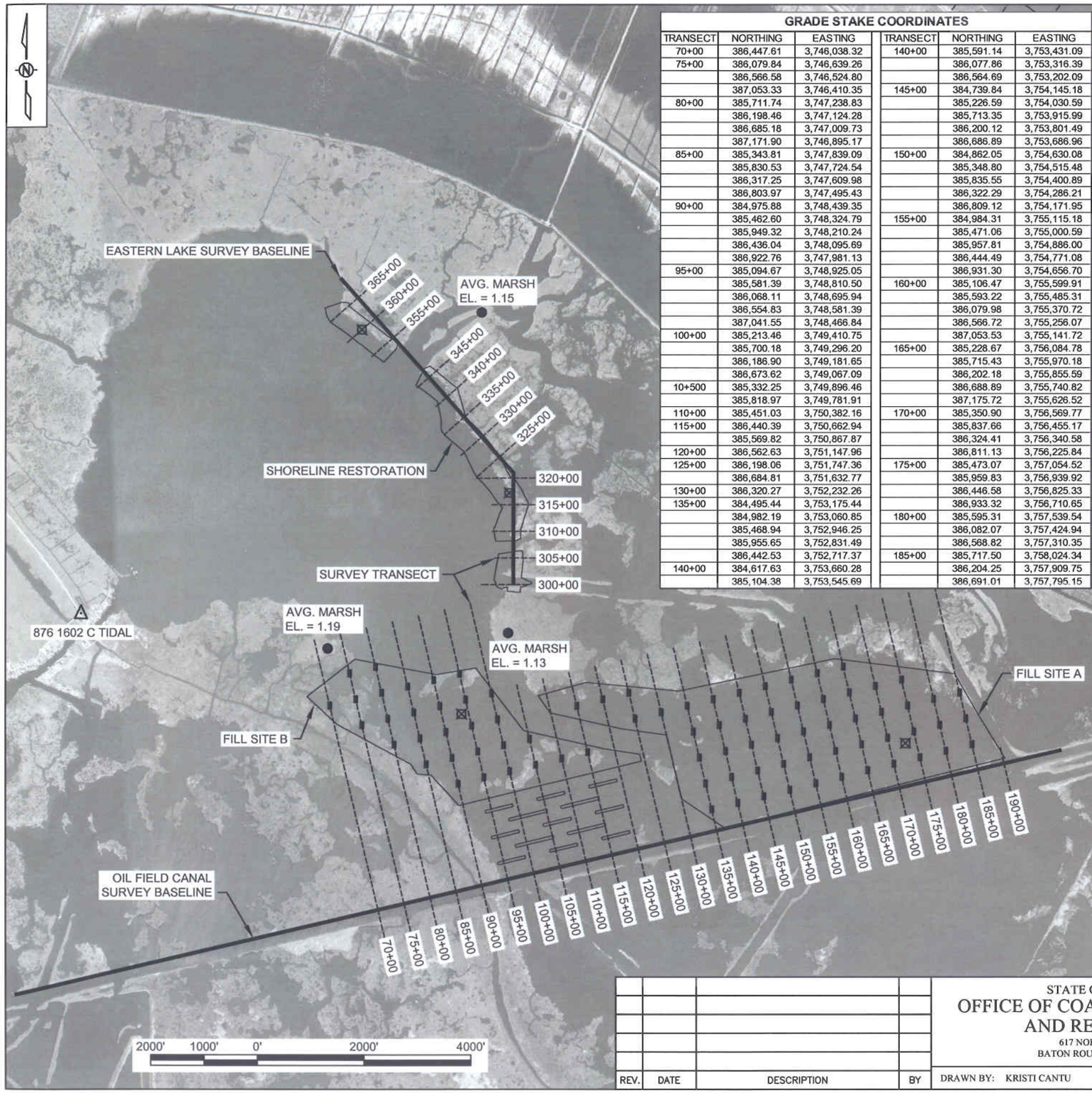

GRADE STAKE COORDINATES

TRANSECT	NORTHING	EASTING	TRANSECT	NORTHING	EASTING
70+00	386,447.61	3,746,038.32	140+00	385,591.14	3,753,431.09
75+00	386,079.84	3,746,639.26		386,077.86	3,753,316.39
	386,566.58	3,746,524.80		386,564.69	3,753,202.09
	387,053.33	3,746,410.35	145+00	384,739.84	3,754,145.18
80+00	385,711.74	3,747,238.83		385,226.59	3,754,030.59
	386,198.46	3,747,124.28		385,713.35	3,753,915.99
	386,685.18	3,747,009.73		386,200.12	3,753,801.49
	387,171.90	3,746,895.17		386,686.89	3,753,686.96
85+00	385,343.81	3,747,839.09	150+00	384,862.05	3,754,630.08
	385,830.53	3,747,724.54		385,348.80	3,754,515.48
	386,317.25	3,747,609.98		385,835.55	3,754,400.89
	386,803.97	3,747,495.43		386,322.29	3,754,286.21
90+00	384,975.88	3,748,439.35		386,809.12	3,754,171.95
	385,462.60	3,748,324.79	155+00	384,984.31	3,755,115.18
	385,949.32	3,748,210.24		385,471.06	3,755,000.59
	386,436.04	3,748,095.69		385,957.81	3,754,886.00
	386,922.76	3,747,981.13		386,444.49	3,754,771.08
95+00	385,094.67	3,748,925.05		386,931.30	3,754,656.70
	385,581.39	3,748,810.50	160+00	385,106.47	3,755,599.91
	386,068.11	3,748,695.94		385,593.22	3,755,485.31
	386,554.83	3,748,581.39		386,079.98	3,755,370.72
	387,041.55	3,748,466.84		386,566.72	3,755,256.07
100+00	385,213.46	3,749,410.75		387,053.53	3,755,141.72
	385,700.18	3,749,296.20	165+00	385,228.67	3,756,084.78
	386,186.90	3,749,181.65		385,715.43	3,755,970.18
	386,673.62	3,749,067.09		386,202.18	3,755,855.59
10+500	385,332.25	3,749,896.46		386,688.89	3,755,740.82
	385,818.97	3,749,781.91		387,175.72	3,755,626.52
110+00	385,451.03	3,750,382.16	170+00	385,350.90	3,756,569.77
115+00	386,440.39	3,750,662.94		385,837.66	3,756,455.17
	385,569.82	3,750,867.87		386,324.41	3,756,340.58
120+00	386,562.63	3,751,147.96		386,811.13	3,756,225.84
125+00	386,198.06	3,751,747.36	175+00	385,473.07	3,757,054.52
	386,684.81	3,751,632.77		385,959.83	3,756,939.92
130+00	386,320.27	3,752,232.26		386,446.58	3,756,825.33
135+00	384,495.44	3,753,175.44		386,933.32	3,756,710.65
	384,982.19	3,753,060.85	180+00	385,595.31	3,757,539.54
	385,468.94	3,752,946.25		386,082.07	3,757,424.94
	385,955.65	3,752,831.49		386,568.82	3,757,310.35
	386,442.53	3,752,717.37	185+00	385,717.50	3,758,024.34
140+00	384,617.63	3,753,660.28		386,204.25	3,757,909.75
	385,104.38	3,753,545.69		386,691.01	3,757,795.15

NOTES:
1. GRADE STAKES SHALL BE INSTALLED IN APPROXIMATE INTERVALS OF 500' ALONG THE TRANSECTS IN THE FILL AREAS.
2. GRADE STAKE DETAILS ARE SHOWN ON SHEET 14.

LEGEND

- BASELINE
- SURVEY TRANSECT
- GRADE STAKE
- SETTLEMENT PLATE
- SECONDARY MONUMENT
- AVG. MARSH ELEVATION

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX, E.I.

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SURVEY LAYOUT

DATE: OCTOBER 2008
SHEET 16 OF 25

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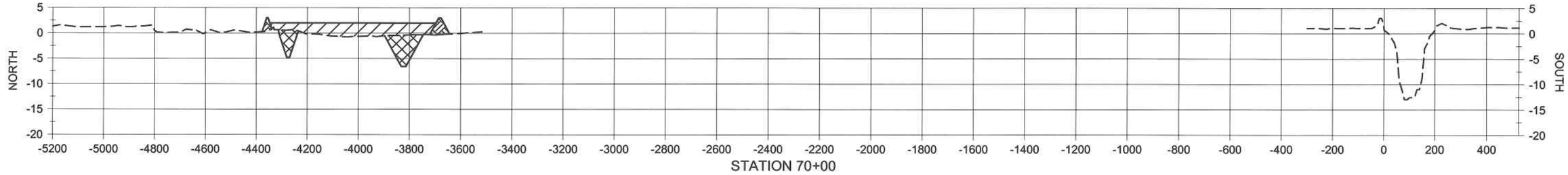

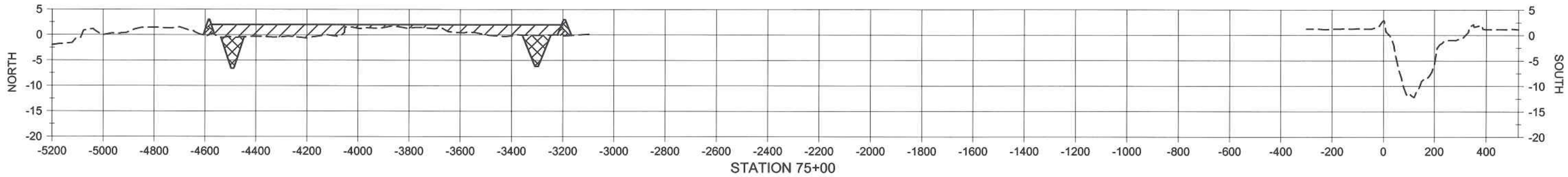

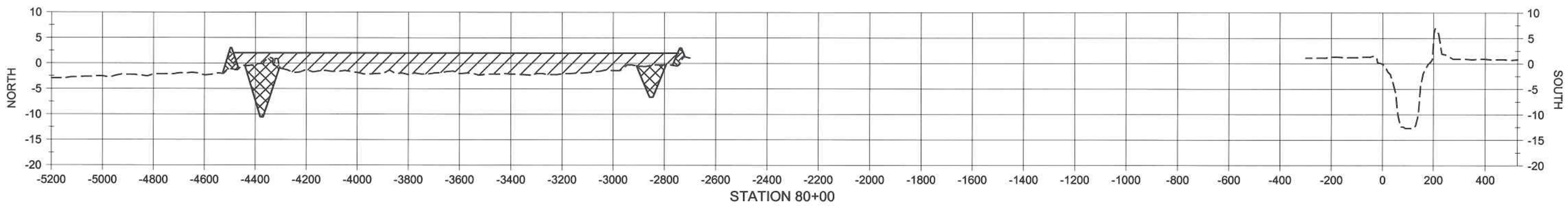

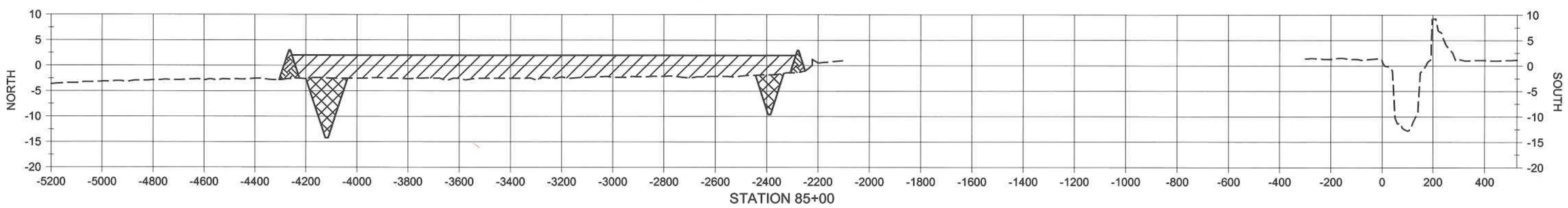

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

HORIZONTAL GRAPHIC SCALE
400' 200' 0 400' 800'
20' 10' 0 20' 40'
VERTICAL GRAPHIC SCALE

LEGEND

- EXISTING BOTTOM
- EARTHEN CONTAINMENT DIKE
- MARSH CREATION
- BORROW AREA

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS
DATE: OCTOBER 2008
SHEET 17 OF 25

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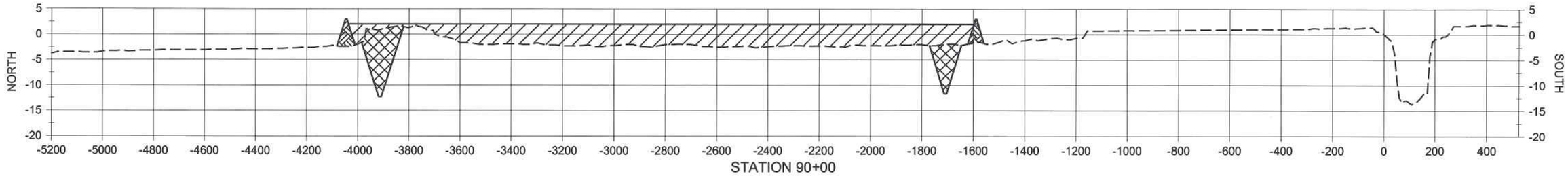
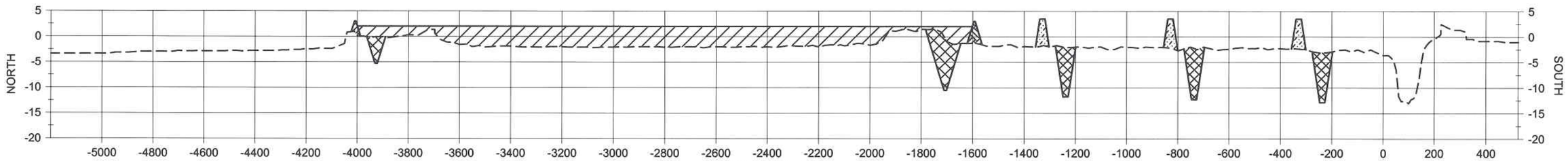


STATION 90+00



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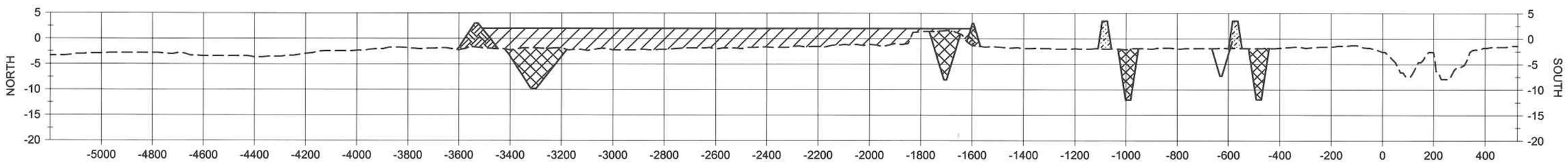

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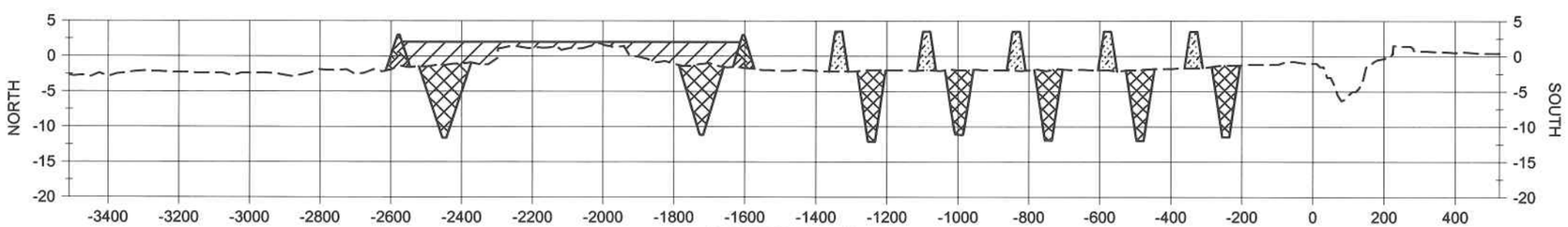

STATION 105+00

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- EXISTING BOTTOM
- EARTHEN CONTAINMENT DIKE
- MARSH CREATION
- EARTHEN TERRACE
- BORROW AREA

HORIZONTAL GRAPHIC SCALE
400' 200' 0 400' 800'
20' 10' 0 20' 40'
VERTICAL GRAPHIC SCALE

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS

DATE: OCTOBER 2008
SHEET 18 OF 25

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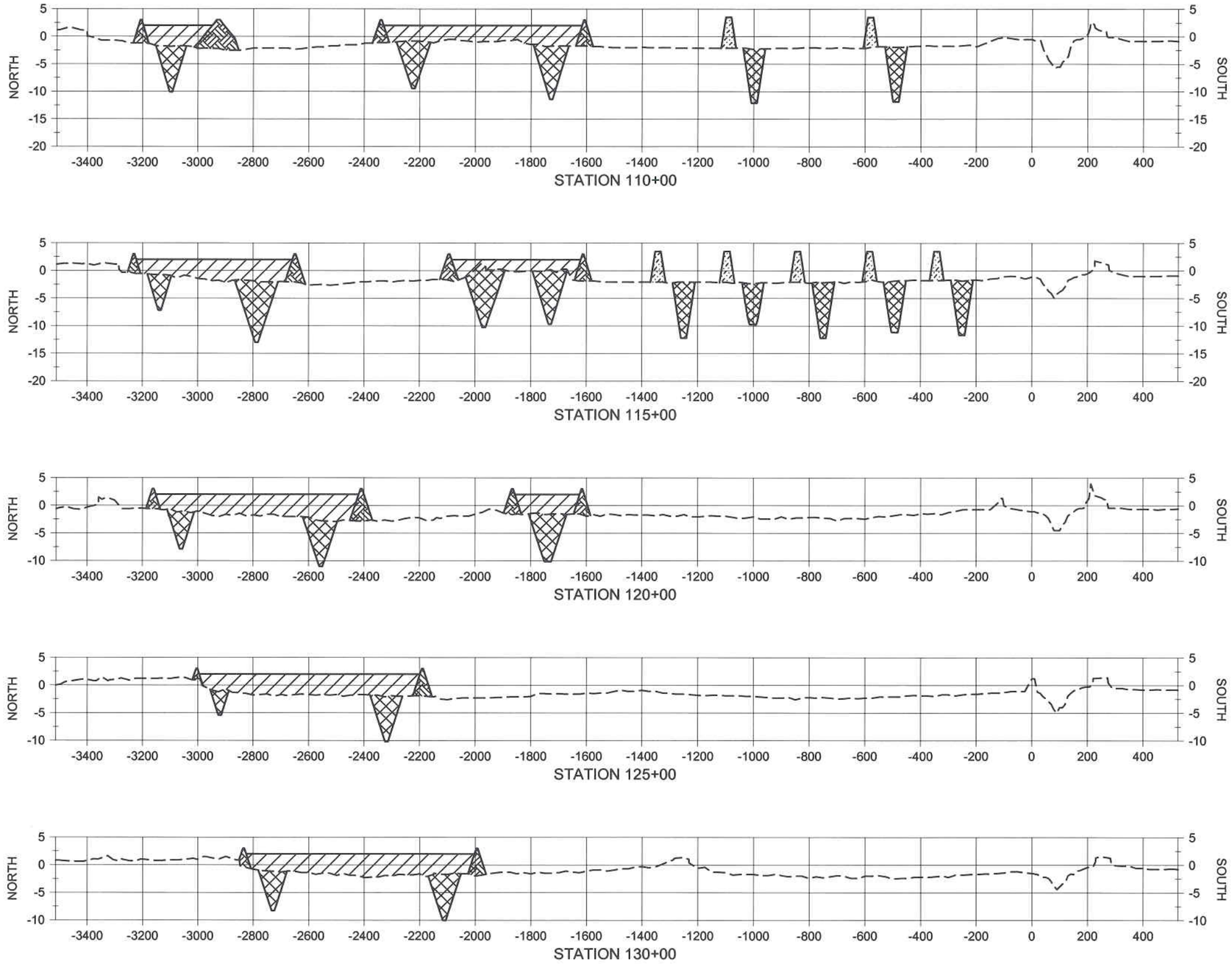

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- EXISTING BOTTOM
- EARTHEN CONTAINMENT DIKE
- MARSH CREATION
- EARTHEN TERRACE
- BORROW AREA

HORIZONTAL GRAPHIC SCALE
400' 200' 0 400' 800'
20' 10' 0 20' 40'
VERTICAL GRAPHIC SCALE

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS

DATE: OCTOBER 2008
SHEET 19 OF 25

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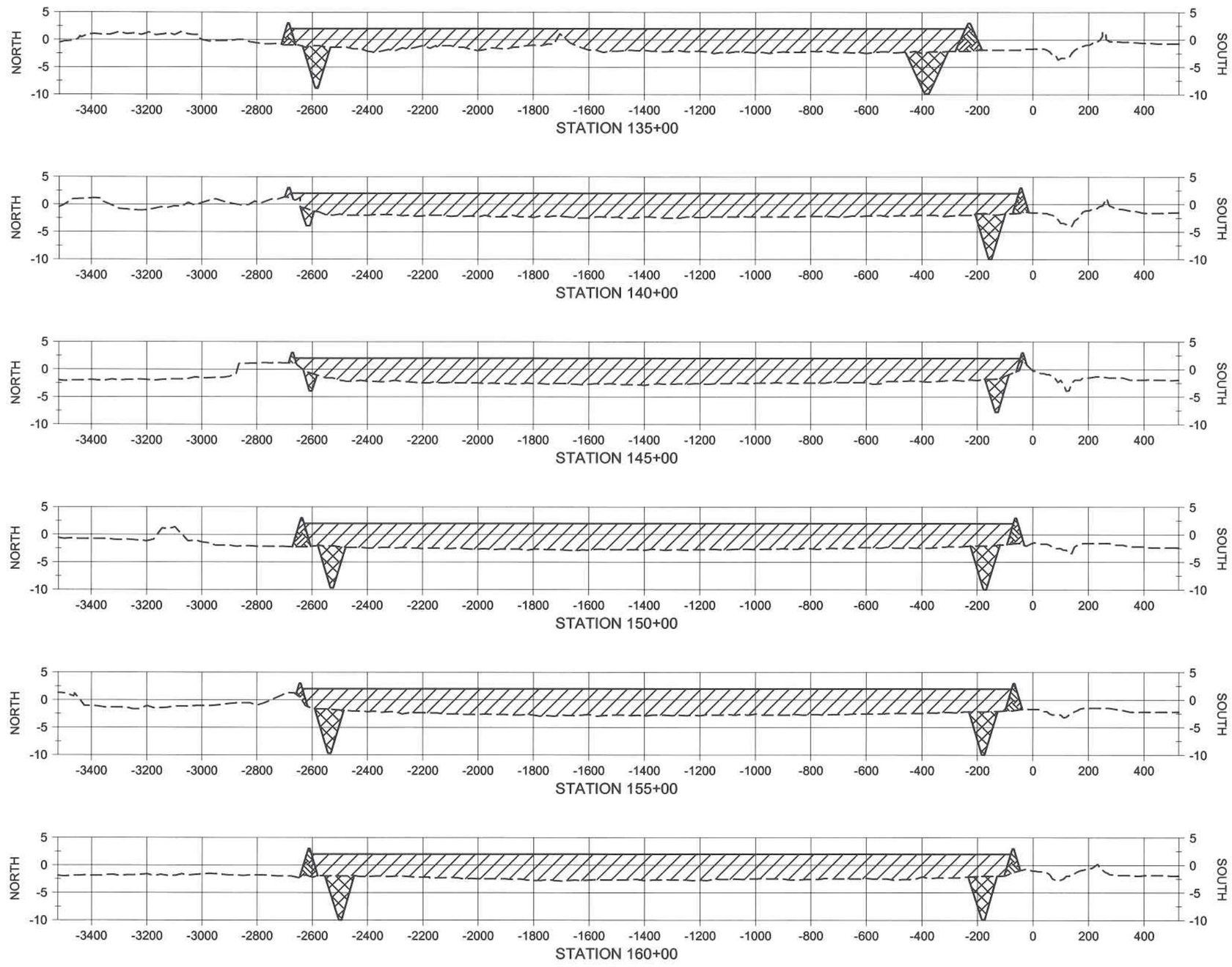

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- EXISTING BOTTOM
- EARTHEN CONTAINMENT DIKE
- MARSH CREATION
- BORROW AREA

HORIZONTAL GRAPHIC SCALE
400' 200' 0 400' 800'
20' 10' 0 20' 40'
VERTICAL GRAPHIC SCALE

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS

DATE: OCTOBER 2008
SHEET 20 OF 25

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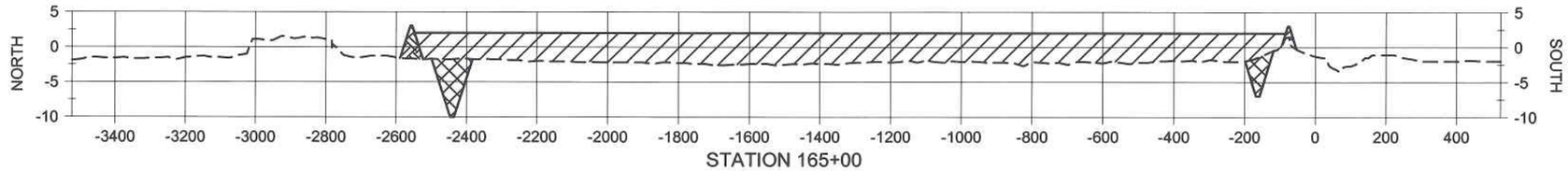
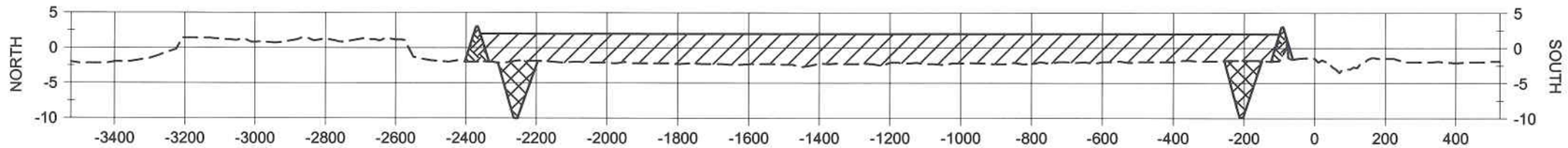


STATION 165+00



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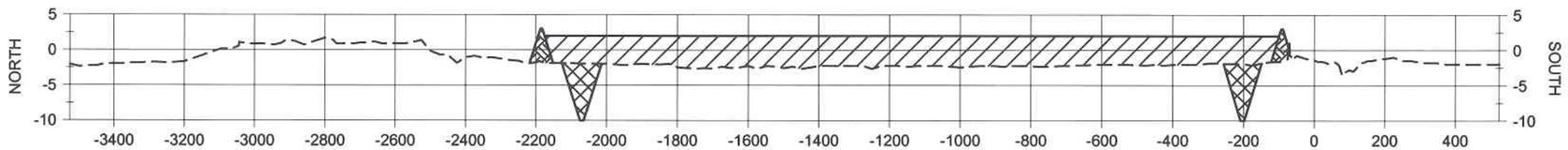

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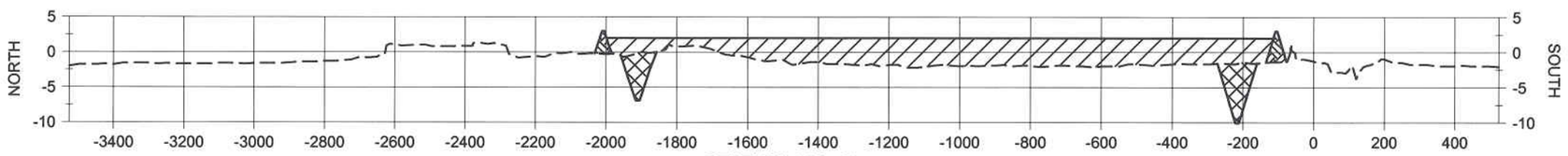

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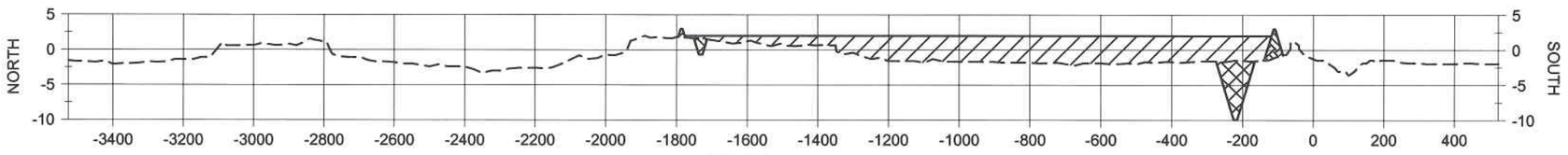
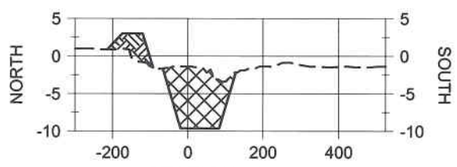


STATION 185+00



STATION 190+00

HORIZONTAL GRAPHIC SCALE

400' 200' 0 400' 800'

20' 10' 0 20' 40'

VERTICAL GRAPHIC SCALE

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- EXISTING BOTTOM
- EARTHEN CONTAINMENT DIKE
- MARSH CREATION
- BORROW AREA

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42

FEDERAL PROJECT NUMBER:

APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS

DATE: OCTOBER 2008

SHEET 21 OF 25

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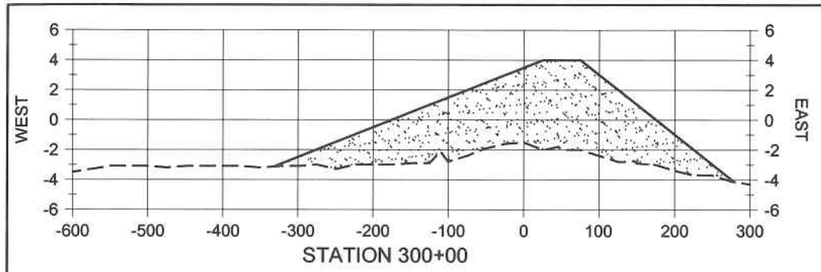

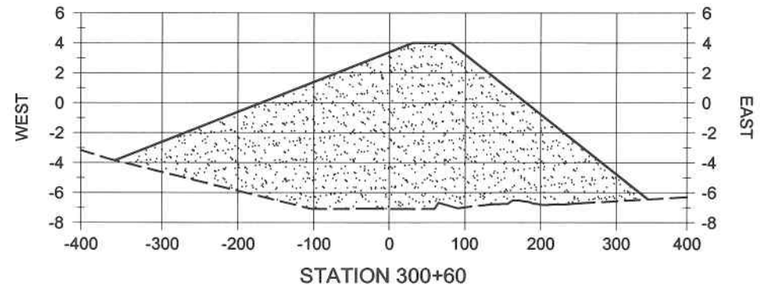

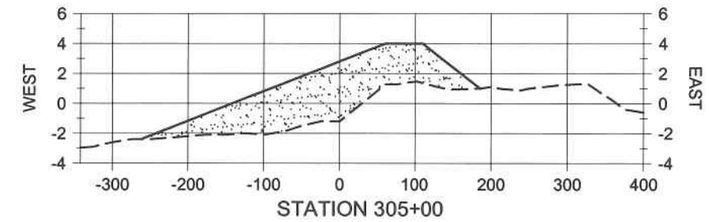

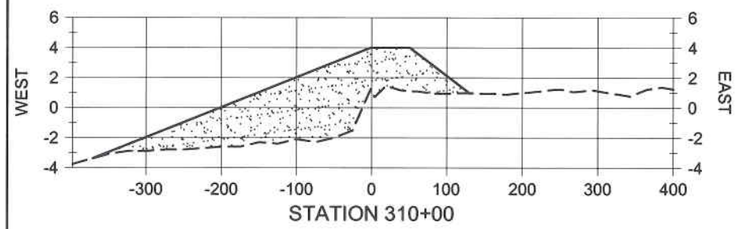

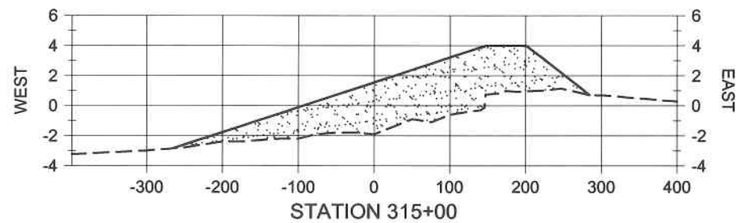

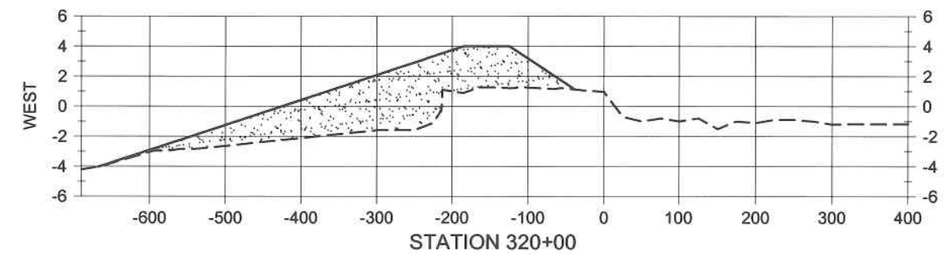

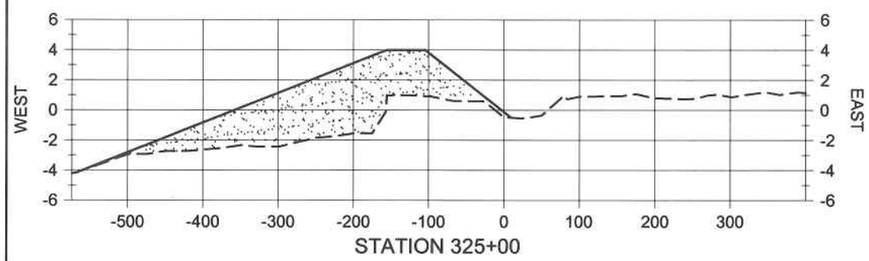

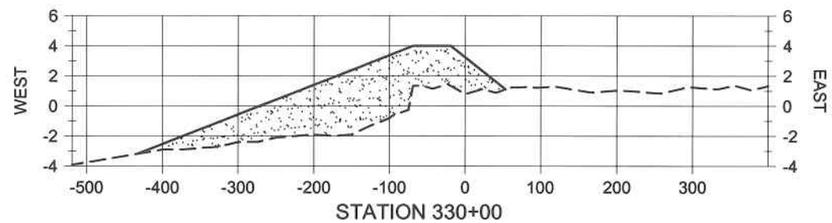

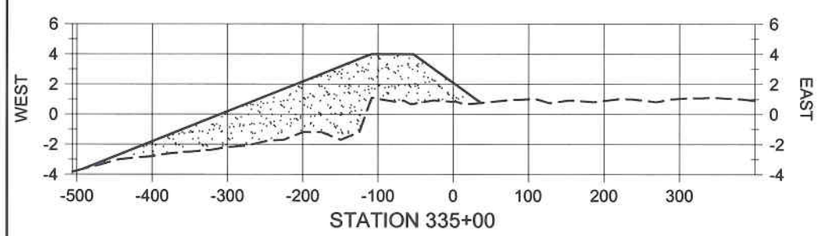

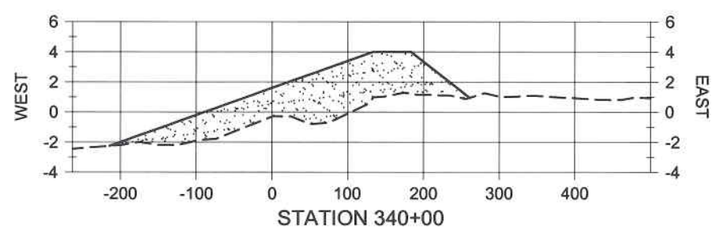

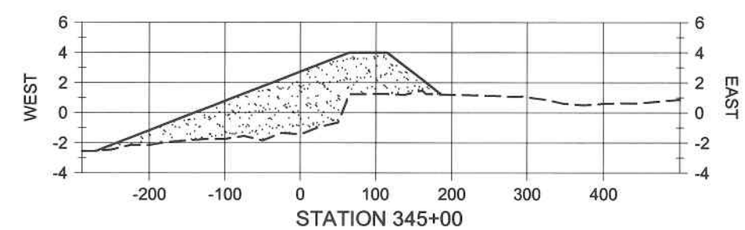

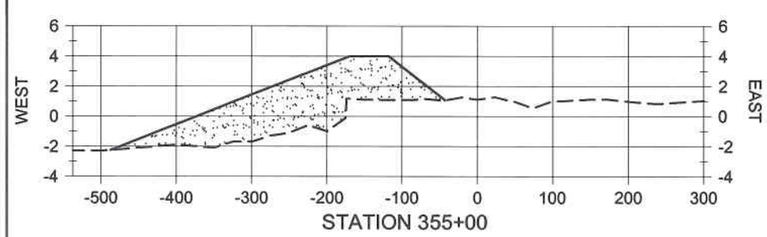

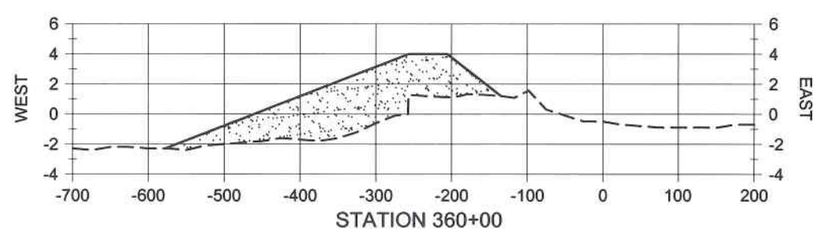

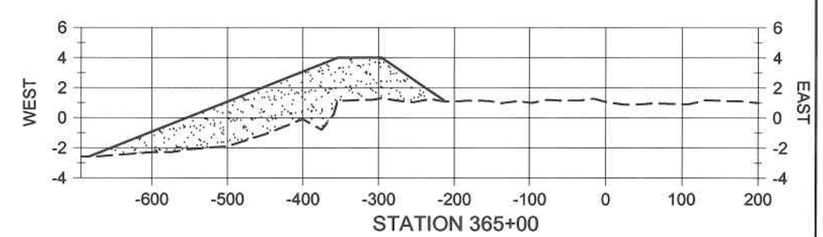

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

HORIZONTAL GRAPHIC SCALE
200' 100' 0 200' 400'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND

- – – – EXISTING BOTTOM
- SHORELINE PROTECTION

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS

DATE: OCTOBER 2008
SHEET 22 OF 25

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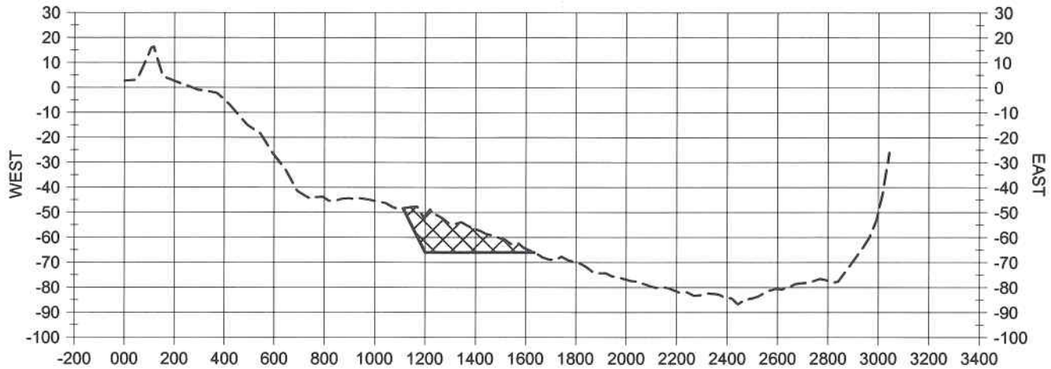
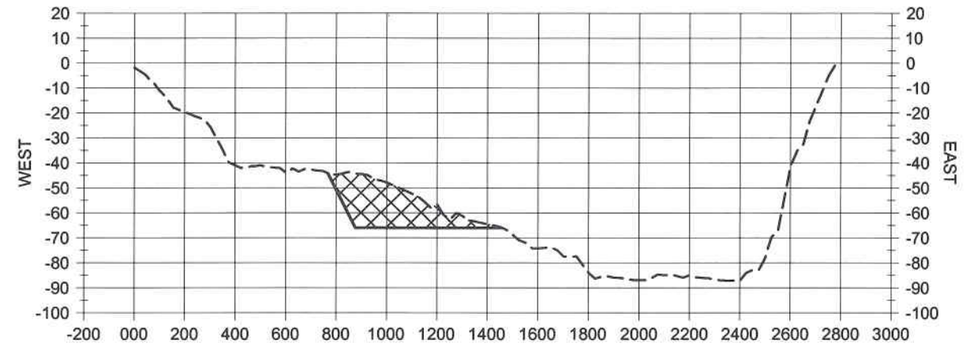
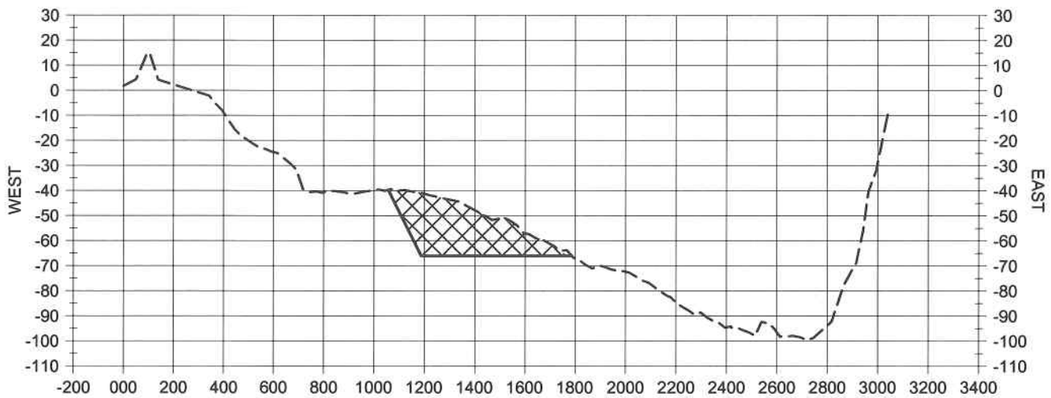


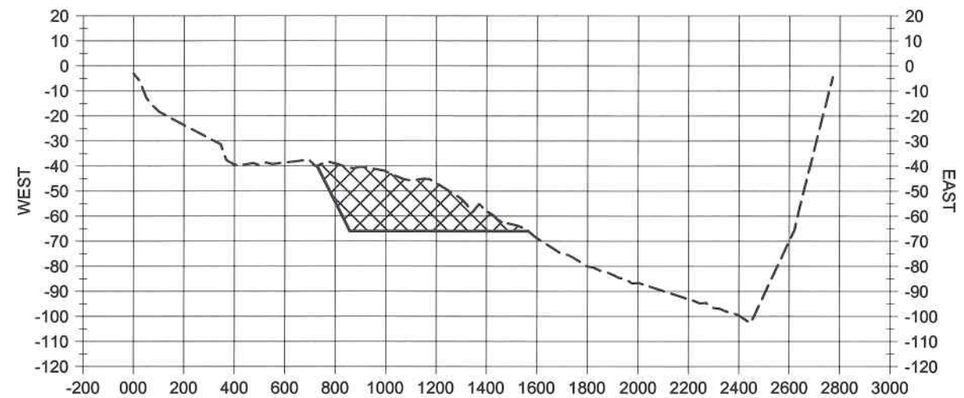
SECTION B



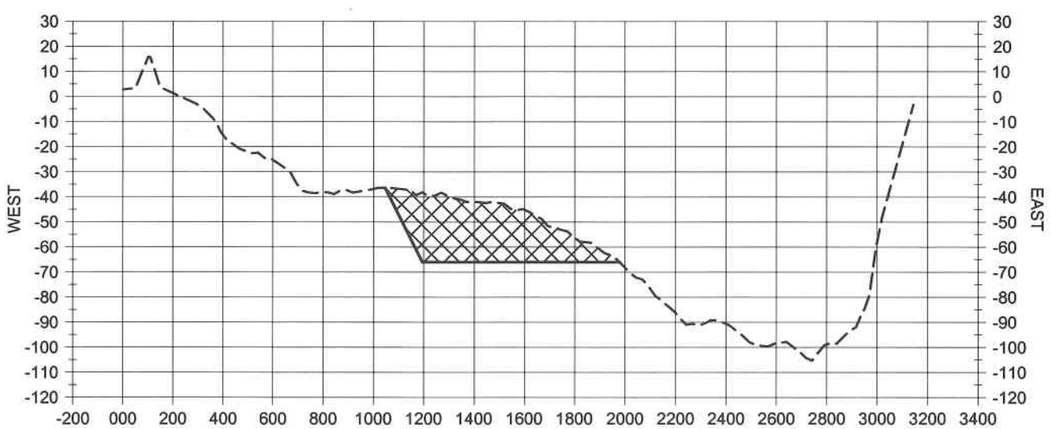
SECTION C



SECTION D



SECTION E



SECTION F

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- – – – EXISTING BOTTOM
- SHORELINE PROTECTION

HORIZONTAL GRAPHIC SCALE

600' 300' 0 600' 1200'

60' 30' 0 60' 120'

VERTICAL GRAPHIC SCALE

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION

STATE PROJECT NUMBER: BA-42

FEDERAL PROJECT NUMBER:

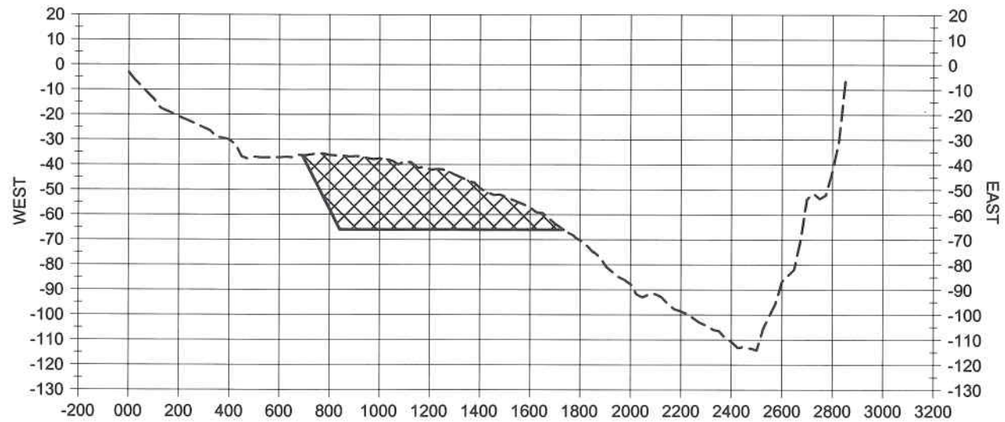
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS

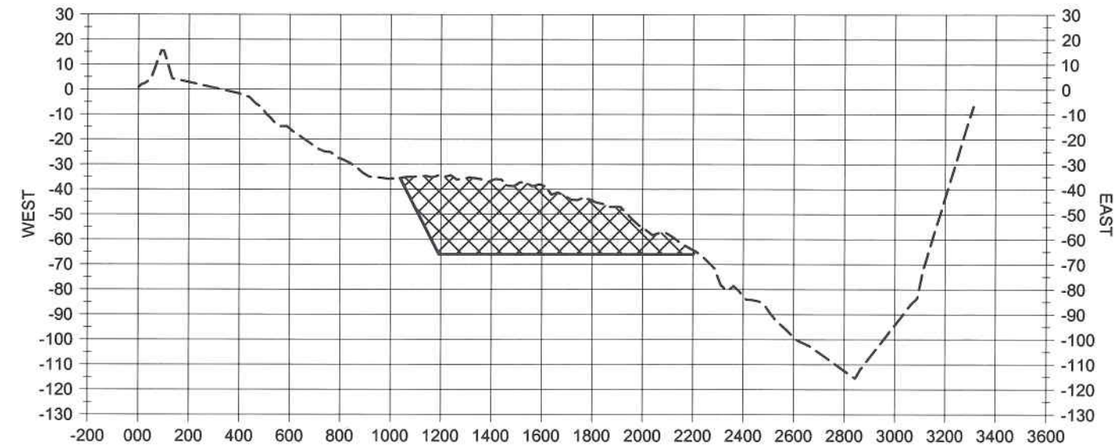
DATE: OCTOBER 2008

SHEET 23 OF 25

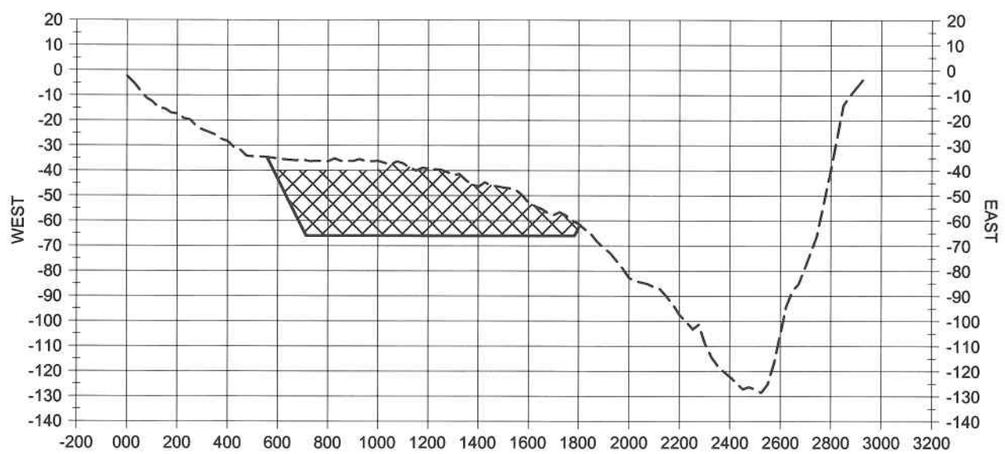
G:\Users\Autocad\BASINS\BA\BA-42 Lake Hermitage\Plans\23-25 Borrow Sections.dwg



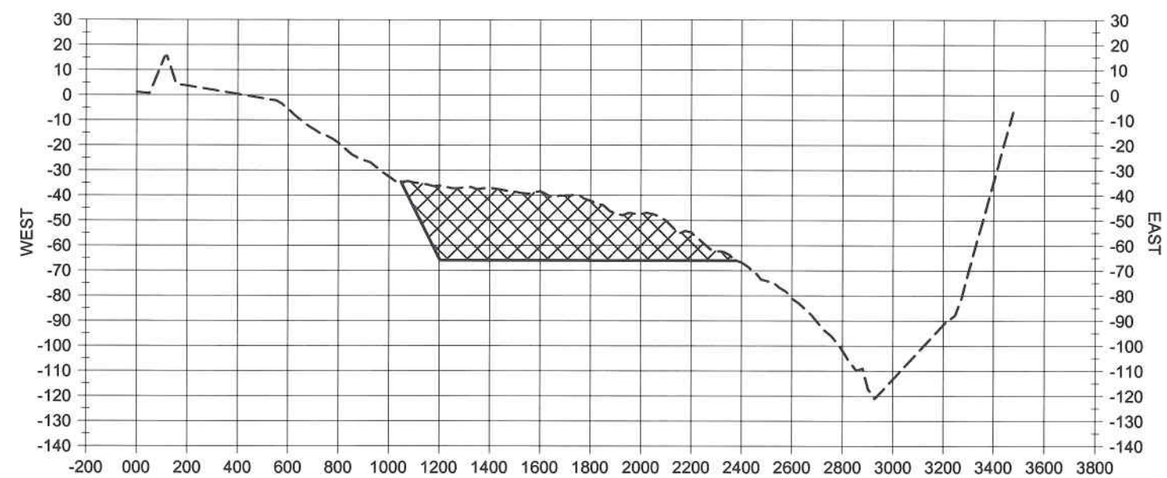
SECTION G



SECTION H



SECTION I



SECTION J

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- – – – EXISTING BOTTOM
- ▨ SHORELINE PROTECTION

HORIZONTAL GRAPHIC SCALE
600' 300' 0 600' 1200'
60' 30' 0 60' 120'
VERTICAL GRAPHIC SCALE

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION
617 NORTH 3RD STREET
BATON ROUGE, LOUISIANA 70802

DRAWN BY: KRISTI CANTU
DESIGNED BY: RUDY SIMONEAUX

LAKE HERMITAGE MARSH CREATION
STATE PROJECT NUMBER: BA-42
FEDERAL PROJECT NUMBER:
APPROVED BY: MAURY CHATELLIER, P.E.

SECTIONS
DATE: OCTOBER 2008
SHEET 24 OF 25

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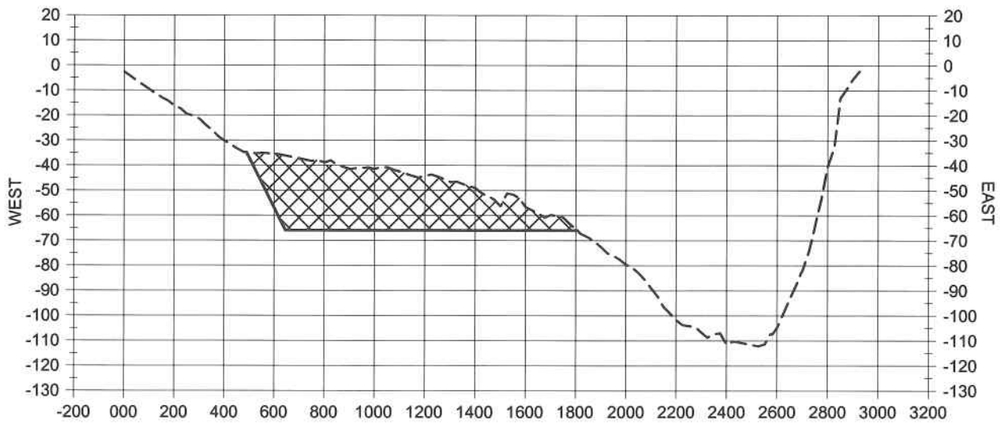
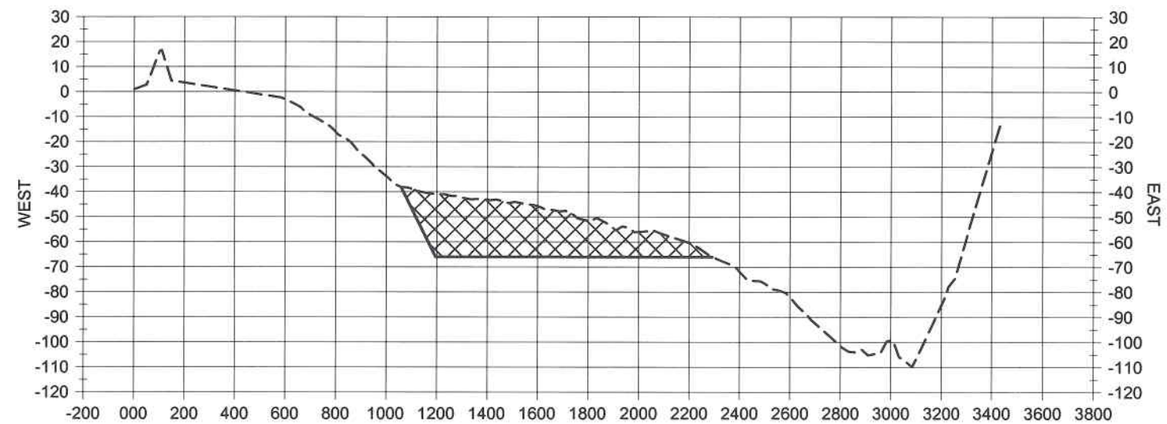
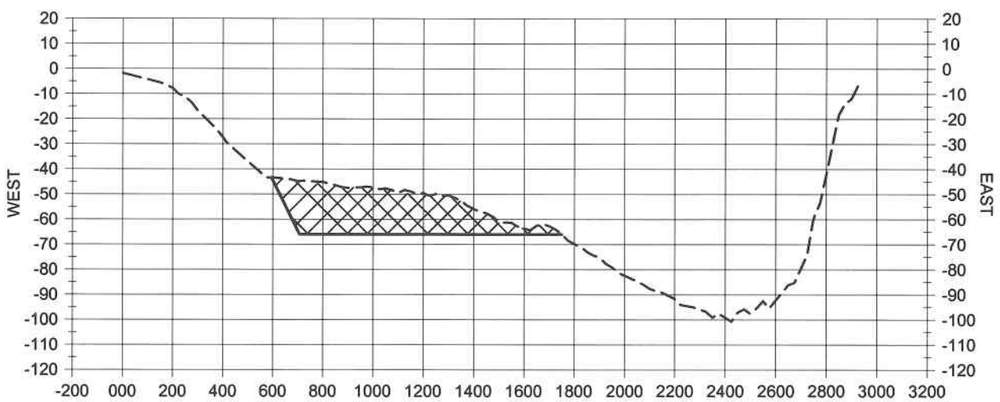


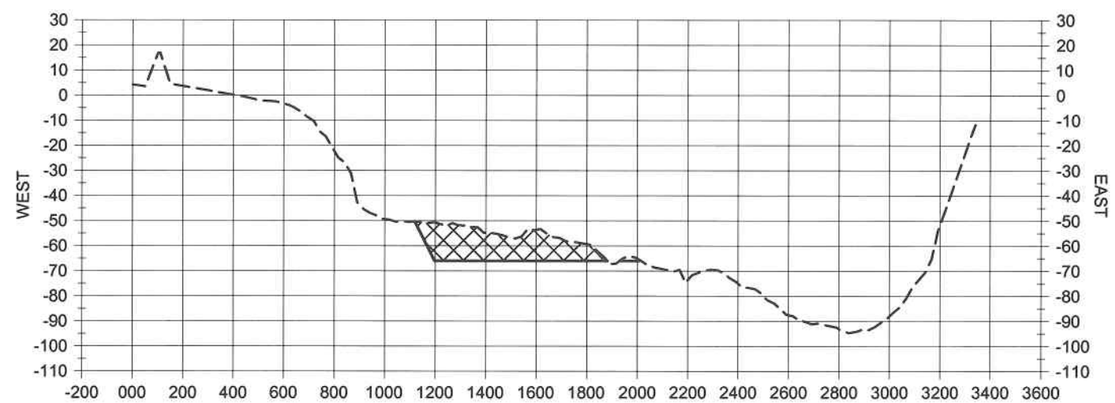
SECTION K



SECTION L



SECTION M



SECTION N

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

- – – – EXISTING BOTTOM
- ▨ SHORELINE PROTECTION

HORIZONTAL GRAPHIC SCALE
600' 300' 0 600' 1200'

VERTICAL GRAPHIC SCALE
60' 30' 0 60' 120'

REV.	DATE	DESCRIPTION	BY

STATE OF LOUISIANA
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617 NORTH 3RD STREET
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SECTIONS

DATE: OCTOBER 2008
SHEET 25 OF 25

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