# Geotechnical Data Report for 30% Design

Mid Barataria Diversion Project (BA-153)
Plaquemines Parish, Louisiana

*for*

**HDR Engineering, Inc.**

January 24, 2014



GeoEngineers
Earth Science + Technology

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## Mid Barataria Diversion Project (BA-153)
## Plaquemines Parish, Louisiana

## LDNR Contract No. 2503-13-59, Task No. 3

## File No. 18274-001-00

## January 24, 2014

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MLR:VT:DSE:CLE:tlm

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**FIGURES**



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Compact Disk with Photographs of Sample Tubes/SPT Soil Samples

## INTRODUCTION

This report provides geotechnical data for the Mid Barataria Diversion (MBD) Project (BA-153) 30% design in accordance with the scope of services presented in the Office of Coastal Protection and Restoration Authority (CPRA), task order 0300 under the LADNR Contract No. 2503-13-59 and our proposal dated January 29, 2013 (Phase 1 scope of services only). GeoEngineers, Inc. (GeoEngineers) is subcontracted to HDR, Inc. (HDR) for the MBD project. The MBD is a large-scale, long-term Mississippi River diversion structure project recommended for implementation in Louisiana's Comprehensive Master Plan for a Sustainable Coast. The project is located near Myrtle Grove, in Plaquemines Parish, Louisiana (Vicinity Map, Figure 1).

Previous work performed by GeoEngineers included a study and review of available geologic information. This work was completed in the early part of 2013 and helped establish the basis for our 30% design scope. Previous studies were presented in our "Report of Existing Geotechnical Data" dated May 22, 2013 (re-issued with additional information on January 17, 2014).

This report contains a site geology description, site plans with soil boring locations, and field data and laboratory test results. Appendix A contains regulatory permits and Appendix B contains the project quality control, safety and other plans. Descriptions of our field investigation for the river, land and marsh along with individual soil boring logs are included in Appendices C through E. Laboratory test results for the river, land and marsh borings are included in Appendices F through H, respectively.

A geotechnical description of the subsurface conditions and our data interpretation is provided in the "Geotechnical Baseline Report for 30% Design" submitted as a standalone report for the project.



## PROJECT AND SITE UNDERSTANDING

The MBD project is a large scale, engineered river diversion that will restore the natural over-land flooding cycle of the Mississippi River and Tributaries (MR&T). The MBD project will consist of the following elements as shown on Surficial Geology, Topography and Project Elements, Figure 2:

1. A diversion structure consisting of a channel into the Mississippi River and through the MR&T levee with levee tie-ins and gates to control flow.
2. A conveyance channel approximately 8,000 feet long with guide levees (conveyance complex) that extends west from the diversion structure to the existing back levee at the western edge of the agricultural land between the two levees. The existing back levee is currently being rebuilt to meet federal levee standards.
3. A storm surge protection structure at the back levee to prevent storm surges from entering the conveyance channel.
4. A new pump station located about 5,500 feet north of the diversion complex near the back levee.
5. An outfall area west of the back levee where sediment diverted from the Mississippi River will settle.

6. A new Louisiana Highway 23 (LA 23) bridge to span the conveyance complex.
7. A new railroad bridge for an extension of an existing railroad spur that will cross the conveyance complex.

As shown on Figure 2, the surficial geology of the site is complex and reflects the different subsurface soil conditions across the project site. The scope of work for the 30% design exploration program was developed based on design requirements for each structure (as of the time of scoping) and expected geologic conditions shown on Figure 2. The intent of the 30% design geotechnical explorations was to evaluate subsurface soil conditions and provide design soil parameters. Figure 2 also presents the project stationing and the topography across the project area.

For the 30% design exploration program, the geotechnical investigation focused on the soil conditions at the diversion structure, the conveyance complex, the storm surge protection structure and the Barataria Bay marsh. We did not investigate the LA 23 overpass, the rail overpass, or the pump station in the 30% geotechnical investigation. At the time of the investigation the location of these features had not yet been determined and was likely to change based on the 30% design for the diversion complex.

## SITE DESCRIPTION

The diversion complex is bounded on the east by the Mississippi River and on the west by the Barataria Bay marsh. Within these limits the conveyance complex alignment crosses LA 23 at approximate Station (Sta.) 65+00. LA 23 is a 4-lane divided highway that extends south to Venice, Louisiana and is the primary evacuation route for Plaquemines Parish. East of LA 23 to the MR&T levee the site is forested. West of LA 23 to the back levee, the site is predominantly agricultural fields that are currently used for livestock grazing. A railroad spur runs along the protected toe (west side) of the MR&T levee.

The natural site grade gently slopes from the Mississippi River where the ground elevation is approximately +5 feet, based on the North American Vertical Datum of 1988 (NAVD 88), to the western edge of the agricultural fields, where the ground elevation is approximately -5 feet. All precipitation that falls between the MR&T and back levees is contained within this area and has to be removed by pumping. Drainage flows through man made shallow swales and ditches spaced at regular intervals throughout the fields to a drainage ditch that parallels the back levee along its eastern edge. A pump station located to the south of the project area pumps water from this ditch to Barataria Bay. The proposed diversion complex will block southward flow in this ditch to the existing pump station; therefore, a new pump station will be required north of the diversion complex to remove drainage water.

The surficial soils become progressively softer and more difficult for equipment access towards the back levee. Below the shallow surface layer of grass and a thin crust of drier soil, the underlying saturated soils are soft. The lower ground elevations and subsurface soil conditions (described below) result in the very soft to soft clay and organic soil remaining saturated.

## GEOLOGIC HISTORY

Based on the information provided in the "USACE Geological Investigation Mississippi River Deltaic Plain, Distribution of Deltaic and Marine Deposits, Quadrangle Pointe A La Hache, Louisiana, dated 1987," the project site is located in the Mississippi deltaic plain that formed from accumulation of sediments within a great structural downwraping called the Gulf Coast Geosyncline (Harold Fisk, 1947). The sediments south of New Orleans represent depositions under fluvial and marine environments and overlie the Pleistocene Prairie formation. The Pleistocene Prairie formation is the youngest of the four Pleistocene terraces in Louisiana, each resulting from deltaic deposition during interglacial periods (20,000 to 100,000 years old). During that period, the sea level was about 400 feet below its current level as a result of an accelerated amassment of glacial ice in the polar regions during the last glacial advance (Late Wisconsin). This led to entrenchment of the gulfward-flowing streams and their tributaries. Due to lowering of the sea level, the exposed deltaic deposits were subjected to tens of thousands of years of consolidation, desiccation, oxidation and erosion. These exposed deltaic deposits form the younger Pleistocene deposits. It is likely that the gradually subsiding Pleistocene shelf was covered with sediments long before the beginnings of the Mississippi River and its distributary systems some 2,800 years ago. Over time as the sea level rose to current levels, the Mississippi River and its tributaries meandered across the deltaic plain. As the river and streams meandered the Pleistocene deltaic plain the soils were eroded, re-worked, re-deposited and covered with newer alluvial deposits. These recent deposits (0 - 17,000 years) form the Holocene deposits and are in general, significantly less consolidated than the Pleistocene deposits.



## GEOLOGIC DEPOSITION DESCRIPTIONS

Eight major geologic deposits were identified at the site by geologic maps, historical reports and our site investigation. The eight deposits are:

1. Point bar
2. Natural levee
3. Nearshore gulf
4. Abandoned distributary
5. Undifferentiated interdistributary/Intradelta
6. Prodelta
7. Pleistocene
8. Marsh

The location, depth and extent of these deposits vary across the site. These deposits (except the Pleistocene and the nearshore gulf) may overlie and be interbedded with one another. A description of each deposit follows.

### Point Bar

These deposits are formed on the inside of a river bend. They consist of material that has been eroded upstream and often consist of relatively coarse material. In the project area, these deposits generally consist of silty sand. Point bar deposits can be distinguished from buried sand beaches by their position in relation to the river and by the fact that beach sands are often mixed with shell fragments. Point bar deposits rarely contain shell fragments.

### Natural Levee

Natural levees are formed by the deposition of the coarse grained sediments carried in suspension by floodwaters that over-top riverbanks. These soils tend to consist of interbedded silty sand, sandy silt, silt and clay, generally with coarser material closer to the river and finer-grained sediment further from the river.

### Nearshore Gulf

Nearshore gulf deposits are relatively coarse grained (i.e. silty sand and sand) deposits with shell fragments that were deposited when the area was formerly a beach type environment. These deposits generally are found directly over the Pleistocene deposits.

### Abandoned Distributary

Distributary channels are natural channels that branch from the main trunk river and help distribute the discharge and sediment load of the main channel. As deltas advance and the river system moves, portions of distributary channels get cut off from the main trunk river. These abandoned distributary channels are then naturally filled over time. The composition of the fill is typically variable and depends on many things, but will likely be different from the surrounding soil. In the project area, the abandoned distributary deposits consist of zones of layered soft clay and loose silty sand, silt and clayey silt.

### Undifferentiated Interdistributary/Intradelta

Interdistributary deposits are typically soft clay deposits that settle in the low areas between distributary channels of the present and past deltas.

The intradelta deposits are generally coarser materials (fine sand and silty sand) that were deposited at the mouth of a distributary channel. Portions of these deposits were preserved as the delta built itself seaward and they typically are interfingered with interdistributary clay deposits.

### Prodelta

Prodelta deposits are soils that were deposited beyond (seaward of) the active toe of the delta. These are generally thick beds of clay formed over a long period of time and are normally consolidated.

### Pleistocene

Pleistocene age deposits represent what was the ground surface approximately 20,000 years ago when sea level was approximately 400 feet lower than present day levels and the shoreline was far gulfward (south) of its present location. As sea level rose, these deposits were covered by new

sediment deposited by the Mississippi River, and since the river gradient decreased as sea level rose, the sediments transported by the river became finer. Typically, Pleistocene deposits at this site are located approximately 120 to 130 feet below grade and consist of over-consolidated stiff to very stiff clay with sand and silt lenses.

### Marsh

These deposits are encountered in the west portion of the project area overlying the soft, fine grained interdistributary/intradelta deposits. Marsh deposits typically consist of peat and organic clay at the surface with progressively less organics with depth. These deposits have very high moisture contents and are highly compressible.

## 30% DESIGN PHASE EXPLORATION PROGRAM

### General

Due to the large project area (over 3 miles long), varying geologic deposits across the project area, and to maximize efficiency of the exploration effort, a multi-phase geotechnical exploration program is being used for the MBD project. The purpose of the explorations for the 30% design phase was to provide general site characterization, estimate the geotechnical engineering properties of soils in the various geologic deposits and identify areas for further exploration in the 60% design phase. The 30% design phase exploration program consisted of drilling and sampling 39 geotechnical soil borings (both 5-inch diameter and 3-inch diameter borings), 4 locations of in-situ field vane strength testing, 19 cone penetration test (CPT) profiles, 4 locations of vibrating wire piezometer installations (3 piezometers at each location), 12 piezometer well locations for pump tests, 2 pump test wells, and 2 in-situ pump tests. Field Investigation Locations, Figure 3 shows the geotechnical exploration locations completed for this phase.

### Permits and Right-of-Entry

All permits required for performing the above explorations for the MBD project were obtained by HDR. Representatives from HDR and GeoEngineers were onsite during all exploration activities to see that permit requirements were met. HDR and GeoEngineers coordinated with the project environmental and archeological consultants to confirm the proposed access routes between exploration locations did not impact known culturally sensitive areas. A variance was obtained from the USACE to work within 1,500 feet of the existing MR&T levee when the water level was higher than elevation +11 feet as measured at the Carrolton Gauge in New Orleans, Louisiana. Copies of the permits are provided in Appendix A.

### Quality Control, Safety, and Other Plans

A project QC program was established for the field exploration phase that follows the general guidelines of USACE “Hurricane and Storm Damage Reduction System Design Guidelines,” dated October 2007. Field representatives completed daily field reports, drilling logs, logs of explorations and chains of custody forms (COCs). The COCs were completed and signed by the GeoEngineers field representative as well as the receiving laboratory’s manager or representative. Completed daily field reports, drilling logs, logs of borings, backfill logs, COCs, job hazard assessments and jobsite personnel rosters were reviewed and compiled into weekly reports and submitted to HDR.

As an additional quality control measure, GeoEngineers created a table tracking the status of each boring from drilling through lab testing, drafting of the boring logs, and QA/QC of the final boring log. The laboratory testing for mini-vane tests, dry unit weight, unconfined compression, unconsolidated undrained compression, consolidated undrained compression, sieve and hydrometer analysis, consolidation tests, permeability tests and Atterberg limits followed the appropriate ASTM standards. A list of ASTM standards and additional details of the QC program are provided in Appendix B.

GeoEngineers developed a project specific safe work plan (PSSWP) for the exploration phase to make field personnel aware of potential hazards involved and reiterate the importance of safety in all field activities. During our site investigation activities, there were several hazards identified at the site including cattle, alligators, snakes, mosquitos, and difficult muddy terrain.

The PSSWP (Appendix B) was reviewed and signed by all personnel prior to entering the site and a copy of the document was onsite during the entire exploration phase.

GeoEngineers developed and followed a Best Management Practices (BMP) plan to minimize disturbance to wetlands, control erosion and sediment transport, and maintain quality of surface water during field investigation for this project (Appendix B).



### Field Investigation

Eighty combined soil borings, CPT's, field vanes, pump test wells and piezometers were completed for the 30% design phase field investigation. Appendices C, D and E, describe the details of our explorations in the Mississippi River, on land, and in the Barataria Bay marsh, respectively. The boring designation for explorations is based on the type of exploration and the proposed structure of the diversion complex the boring was near or on. For example, a "NL" or "SL" designation indicates a boring completed on the proposed conveyance channel north or south levee, respectively. A designation of "IS" indicates a boring near the proposed inlet structure (now referred to as the diversion structure). "M" designations are for borings drilled in the Barataria Bay marsh and "B" designations are for the borings drilled on the batture (the flood side of the MR&T levee). "PZ" and "PT" indicate piezometers and pump tests, respectively. "R" designation includes the borings performed in the Mississippi River. Lastly, "FV" indicates a field vane test. The suffix on each boring also indicates what type of exploration it is. The "A" or "B" at the end of the boring number indicates a soil boring while a "C" indicates a CPT.

Prior to starting the work, all explorations except PZ-16 and Mississippi River borings (R-1A through R-6A) were surveyed and staked by John Chance Land Surveys, Inc. (John Chance). GeoEngineers located the river borings on-site using a Trimble GeoExplorer GeoXT 2005 series GPS unit. The location of PZ-16 was determined on-site and approved by HDR representative prior to drilling. The location coordinates for PZ-16 were recorded by GeoEngineers using a Garmin-GPSmap76CSx handheld GPS unit. GeoEngineers contacted the Louisiana "One-Call" and waited for a period of at least 72 hours for the agencies to mark underground utilities in the area prior to performing drilling on-site. GeoEngineers maintained valid locate tickets for the duration of field work. For soil borings in the marsh area, a 30-foot radius magnetometer survey was also completed at each proposed boring location to confirm no metal objects were present in the near surface.

All explorations were completed between May 11, 2013 and November 19, 2013 using equipment shown in Table 1. All exploration locations were approved by the HDR representative onsite prior to drilling. Field representatives from GeoEngineers managed the drilling on a full time basis, examined and classified the soils encountered, and prepared a log of each exploration.

For each drill rig used to collect standard penetration test (SPT) samples, the hammer energy transfer efficiency was measured. A Pile Driving Analyzer® (PDA) system, model PAX was used to acquire and process the dynamic test data obtained through an instrumented drill rod section. A summary of the hammer calibration results are provided in Table 1 below. The details of the calibration are provided in Appendix K.

**TABLE 1: DRILL RIGS, CPT AND SUPPORT EQUIPMENT INFORMATION**

| Company | Drill Rig | Model | Serial No. | Year Manufactured | Hammer Type | Hammer Efficiency |
|---|---|---|---|---|---|---|
| GeoEngineers Inc. | Truck | Failing 1500 | 902978 | 1965 | 140lb safety hammer w/ 2 turns of rope on cathead | 72% |
| GeoEngineers Inc. | Rubber Tire ATV | Ardco K-1000 | 46824620 | 2008 | Automatic (140lb) | 77% |
| SER[1] | Marsh Buggy Track Drill Rig | SER custom made | MBD001 | 2012 | 140lb safety hammer w/ 2 turns of rope on cathead | 58% |
| Fugro[2] | CME Track Rig | CME 850 | 361982 | 2008 | Automatic (140lb) | 86% |
| SES[3] | Diedrich Track Rig | D50 | 268 | 2007 | Automatic (140lb) | 85% |
| SES[3] | 20 Ton CPT Track Rig | Hogentogler | 17-3 | 2001 | N/A | N/A |
| SES[3] | Geoprobe Grout Rig | Geoprobe 6625 | Z5339T6625 | 2006 | N/A | N/A |
| SER[1] | Marsh Master Carrier | Marsh Master | MM2 | 2010 | N/A | N/A |

1 SER – Specialized Environmental Resources, LLC.
2 Fugro – Fugro Consultants, Inc.
3 SES – Southern Earth Sciences, Inc.

A summary of the field explorations performed for the 30% design phase is given in Table 2 below:

**TABLE 2: FIELD INVESTIGATION 30% DESIGN PHASE SUMMARY**

| Location of Exploration | Type of Exploration | Mapped Surficial Geology * | Number of Explorations |
|---|---|---|---|
| **East of MR&T Levee (Sta. 0+00 to Sta. 28+00)** | | | |
| River | 5-inch Soil Borings | Point Bar | 6 |
| Batture | 5-inch Soil Borings | Natural Levee/Point Bar | 3 |
| | CPT | Natural Levee/Point Bar | 2 |
| **MR&T Levee (Sta. 28+00 to Sta. 32+00)** | | | |
| Protected Side Toe | 5-inch Soil Borings | Natural Levee/Point Bar | 3 |
| | CPT | Natural Levee/Point Bar | 3 |
| Centerline | 5-inch Soil Borings | Natural Levee/Point Bar | 7 |
| | CPT | Natural Levee/Point Bar | 4 |
| **Diversion Structure/ Conveyance Complex/Storm Surge Protection Structure (Sta. 32+00 to Sta. 139+00)** | | | |
| East of Hwy 23 | 5-inch Soil Borings | Natural Levee/Point Bar / Abandoned Distributary | 2 |
| | CPT | Natural Levee /Abandoned Distributary | 1 |
| | Field Vane Test | Natural Levee /Abandoned Distributary | 1 |
| | Pump Test Piezometers | Natural Levee /Point Bar | 6 |
| | Pump Test Well | Natural Levee /Point Bar | 1 |
| | VM Piezometers | Point Bar | 1 |
| Hwy 23 | CPT | Natural Levee /Interdistributary | 1 |
| West of Hwy 23 | 5-inch Soil Borings | Natural Levee/Abandoned Distributary/Interdistributary/Marsh | 2 |
| | CPT | Natural Levee/Abandoned Distributary/Interdistributary/Marsh | 8 |
| | Field Vane Test | Natural Levee/Abandoned Distributary/Interdistributary/Marsh | 3 |
| | VM Piezometers | Natural Levee/Abandoned Distributary/Interdistributary/Marsh | 3 |
| | Pump Test Piezometers | Marsh | 6 |
| | Pump Test Well | Marsh | 1 |
| **Back Levee (Sta. 139+00 to Sta. 140+00)** | | | |
| | None | Marsh | 0 |
| **Outfall Area (Sta. 140+00 and on)** | | | |
| West of NOV levee | 3-inch Soil Borings | Marsh | 16 |
| | | **Total Explorations** | 80 |

* Based on the information provided in the "Geological Investigation Mississippi River Deltaic Plain, Distribution of Deltaic and Marine Deposits, Quadrangle Pointe A La Hache, Louisiana, dated 1987."

Existing geotechnical boring information from USACE was provided to the design team. This included subsurface information from the USACE New Orleans to Venice, Louisiana (NOV), Plaquemines Parish Non-Federal Levee (NOV-NF-W-06) project that had exploration information along the back levee. The USACE had also documented 10 other borings in and around the general project boundaries as shown on Figure 3.

## LABORATORY TESTING

Soil samples obtained from the soil borings were transported to a laboratory and examined to confirm or modify field classifications, as well as to evaluate engineering properties of the samples. General guidelines provided by the USACE were followed for transportation, sample extrusion/preservation and testing of soil samples. The three laboratories used for testing samples were USACE certified.

Samples delivered to the laboratory were extruded from sampling tubes (as appropriate), tested for moisture content, visually classified, and preserved for future testing. This was completed within seven days of drilling and sampling. Following extrusion and visual logging of the samples in the laboratory, the laboratory logs were reviewed by an engineer and compared to the field logs to check field descriptions, to provide initial delineation of soil units and make initial lab assignment recommendations. Mini-vane tests were performed on soil samples collected in the marsh prior to extrusion. The handwritten log with the initial moisture contents was called the “Engineers’ log”.

Laboratory assignments were reviewed and approved by HDR prior to performing the tests. Laboratory testing performed on representative samples included mini-vane tests, unit weight, unconfined compression, unconsolidated undrained compression, consolidated undrained compression, sieve and hydrometer analysis, consolidation, organic content, specific gravity, permeability and Atterberg limits tests. All test results except for consolidation tests are presented on the soil boring logs and are included in Appendices F, G and H for river, land, and marsh borings respectively. The consolidation test results for the 30% design phase exploration have been included in Appendix J.

A self-weight consolidation test performed on a composite sample obtained from river boring R-6A is included in Appendix H.

## LIMITATIONS

The information presented in this report is based on the soil borings and soil testing completed for this study, and judgments made by the engineers. This report is specific to this site and should not be used other than for the design of the Mid Barataria Diversion project (BA-153), located in Myrtle Grove, Louisiana. We have provided the requested information for the geotechnical investigation data report. A detailed engineering report for the marsh borings will be provided in a separate report. HDR will be preparing a geotechnical engineering report for the overall project that will include the information presented in this data report.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area

at the time this report was prepared. No warranty or other conditions express or implied should be understood.

Please refer to "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

## TECHNICAL REFERENCES

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FIGURES



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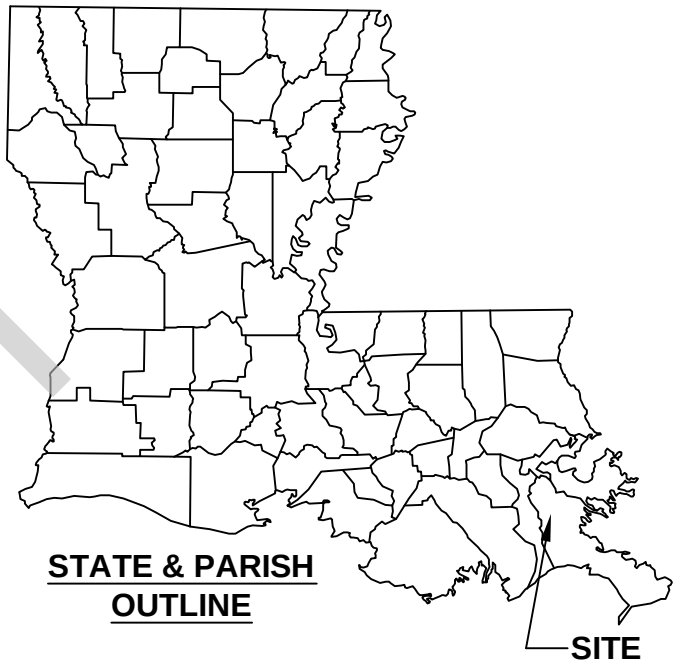
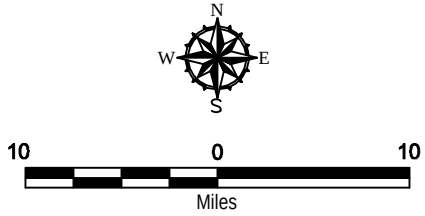
VT : KMC




Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Aerial image was taken from Google Earth Pro., Licensed to GeoEngineers Inc., Imagery dated: 11/14/2012

## VICINITY MAP

Mid Barataria Diversion (BA-153) Project
Plaquemines Parish, Louisiana

GeoEngineers

**Figure 1**

## GEOLOGY LEGEND

- Natural Levee
- Point Bar
- Abandoned Distributary
- Undifferentiated Interdistributary/ Intradelta Deposits
- Land Loss (1932-1983)
- -125 — Elevation of Upper Fine-Grained Pleistocene surface in feet MSL
- Marsh

MISSISSIPPI RIVER
MR&T LEVEE
PUMP STATION
BACK LEVEE
BARATARIA BAY MARSH
-125
EXISTING RAILROAD
DIVERSION STRUCTURE
20+00
30+00
40+00
50+00
60+00
70+00
80+00
90+00
100+00
110+00
120+00
130+00
140+00
CONVEYANCE COMPLEX
LA HWY 23
≈ 5500 ft.
PUMP STATION (SEE DETAIL 1)
STORM SURGE PROTECTION STRUCTURE

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Reference: 1. Geology map was taken from USACE, Alluvial Deposits Map, Quads: Barataria & PointeALaHache, Dated 1987
2. Aerial image was taken from Google Earth Pro., Licensed to GeoEngineers, Inc., Imagery dated: 10-29-2012
3. Base file was provided by HDR Engineering, 60% Bore Plan 103013.dwg, Dated: 10/2013
4. Elevation data was taken from USGS, 1/9 arc Second, Dated 2006. Elevations based on survey information were provided by John Chance for soil exploration for 30% design phase. These elevations vary from approximately +5 ft. to -5 ft. between the MR&T levee and the back levee as shown on boring logs in Appendices C through E.

N W E S
1000 0 1000
Feet

## TOPOGRAPHIC LEGEND

- Minor Contour (2' Intervals)
- Major Contour (10' Intervals)

PUMP STATION

DETAIL 1

# SURFICIAL GEOLOGY, TOPOGRAPHY & PROJECT ELEMENTS

Mid Barataria Diversion (BA-153) Project
Plaquemines Parish, Louisiana

GeoEngineers

Figure 2

DSE : KMC

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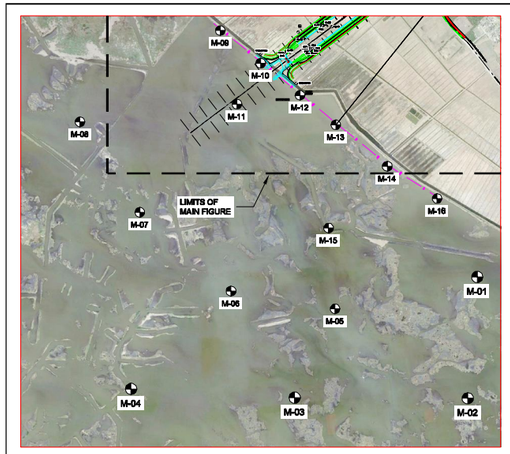


MARSH BORING LOCATIONS

2000 0 2000
Feet




Notes:
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800 0 800
Feet

**LEGEND**

| | |
|---|---|
| M-12/PZ-1 | 3" Borehole Location/ Piezometer Location |
| R-60.4-R | USACE Boring Location |
| NL-1C | CPT Location |
| IS-1A | 5" Borehole Location |

**FIELD INVESTIGATION LOCATIONS**

Mid Barataria Diversion (BA-153) Project
Plaquemines Parish, Louisiana

GeoEngineers

Figure 3

VT : KMC

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APPENDICES



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