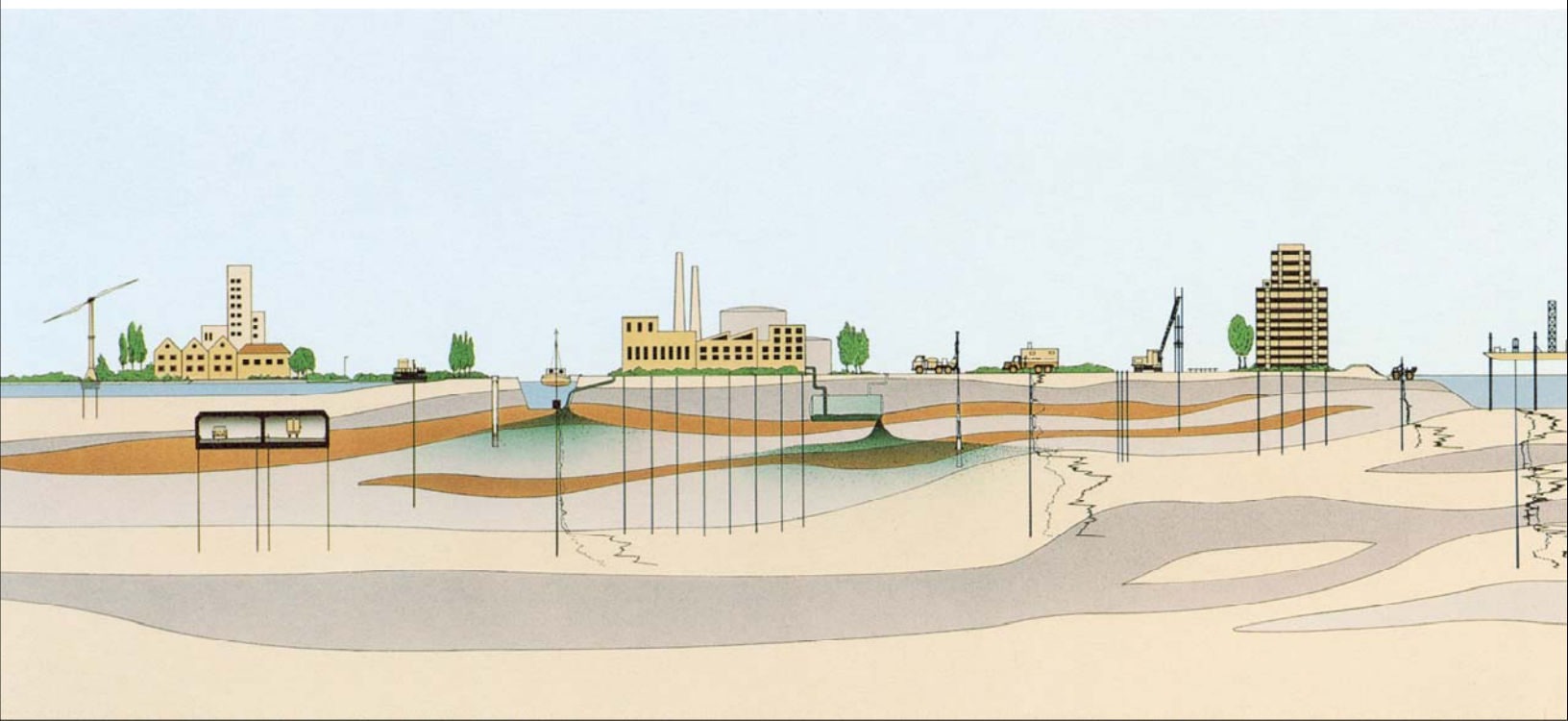
FUGRO CONSULTANTS, INC.

GEOTECHNICAL DESIGN REPORT
CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

COASTAL PLANNING & ENGINEERING, INC.
BOCA RATON, FLORIDA



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Report No. 04.55104010-REV
June 30, 2011

COASTAL PLANNING & ENGINEERING, INC.
2481 NW Boca Raton Blvd.
Boca Raton, Florida 33431

Attention: Mr. Gordon Thomson, P.E.
Vice President

Geotechnical Study
Chenier Ronquille Restoration
Plaquemines Parish, Louisiana

Fugro Consultants, Inc. (Fugro) is pleased to submit this report of our geotechnical study for the above-referenced project. We received Notice to Proceed from Mr. Gordon G. Thomson, P.E., Vice President for Coastal Planning and Engineering, Inc. (CPE), on July 19, 2010. Preliminary laboratory results were provided to CPE via e-mail on October 1 through 7, 2010. This study was performed in general accordance with our Proposal No. 04.55104010, dated February 11, 2010. Some modifications to the boring depths were requested by CPE prior to our mobilization.

We appreciate the opportunity to be of service to Coastal Planning and Engineering, Inc. on this important project. Please feel free to call us if you have any questions concerning this report or when we may be of further assistance.

Sincerely,
FUGRO CONSULTANTS, INC.

Brenda Novoa, P.E.
Senior Professional

STATE OF LOUISIANA
BRENDA NOVOA
License No. 33665
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING
6/30/2011

Reviewed by:

Eric R. Marx, P.E.
Branch Manager

Jennifer E. Aguettant, P.E.
Engineering Supervisor

Copies Submitted: (4) Addressee

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1.0 INTRODUCTION

1.1 Introduction

The Chenier Ronquille Barrier Headland is located along the Plaquemines/Barataria Barrier Shoreline, about 8 miles east of Grand Isle, Louisiana. The Chenier Ronquille Barrier Headland has suffered significant erosion and deterioration due to coastal processes and recent hurricane activity. We understand that the Louisiana Office of Coastal Protection and Restoration (OCPR) and the National Marine Fisheries Service (NMFS) have jointly sponsored a project to restore the Chenier Ronquille Barrier Headland. This project will focus on increasing the headland longevity by restoring the dune and marsh platforms at the project site. We understand that sand sources have already been identified to provide material to repair breaches and tidal inlets, restore the barrier headland and reinforce the existing shoreline.

Coastal Planning and Engineering, Inc. is providing design engineering services for the project. We were requested to provide geotechnical recommendations to assist CPE in the design of the headland restoration.

1.2 Scope

The purposes of our geotechnical study were: 1) to explore and evaluate the subsurface soil conditions at the site, and 2) to provide geotechnical recommendations to assist the design team in the restoration of the Chenier Ronquille Barrier Headland. The scope of this study included the following:

- drilling 4 soil borings to a depth of about 60 ft each below the mudline and 5 soil borings to a depth of about 40 ft each below the mudline;
- performing field and laboratory tests on select soil samples to assess pertinent engineering soil properties;
- performing analyses to estimate the settlement of the natural underlying soils due to the placement of marsh creation fill material and containment dike material;
- performing slope stability analyses for the containment dike; and
- preparing a report summarizing our findings and geotechnical recommendations.

Environmental assessments, compliance with state and federal regulatory requirements, and/or environmental analyses including those associated with mold, fungi, and other biologic agents

were beyond the scope of this study. A geologic fault study was also beyond the scope of this study.

1.3 Applicability of Report

The explorations and analyses for this study, as well as the conclusions and recommendations contained in this report, were selected or developed based on our understanding of the project as described previously and in later sections of this report. If there are differences in project location or design features as we understand them, or if the locations or design features change, we should be authorized to review the changes and, if necessary, modify our conclusions and recommendations. The observations, conclusions, and recommendations presented in this report may not apply to locations not explored by our borings or areas outside the project boundaries.

We have prepared this report exclusively for Coastal Planning and Engineering, Inc. to guide the geotechnical aspects of the restoration of the Chenier Ronquille Barrier Headland. We have conducted this study using the standard level of care and diligence normally practiced by recognized engineering firms now performing similar services under similar circumstances. We intend for this report, including all illustrations, to be used in its entirety. This report should be made available for information only and not as a warranty of subsurface conditions.

1.4 Variations in Subsurface Conditions

Our interpretations of soil and depth-to-water conditions, as described in this report, are based on data obtained from our sample borings, laboratory tests, and our experience. Although we have allowed for minor variations in the subsurface conditions, our recommendations may not be appropriate for subsurface conditions other than those reported herein. It is possible that some undisclosed variations in soil or water conditions might occur outside the boring locations. We recommend careful observations during construction to verify our interpretations. Should variations from our interpretations be found, we recommend that we be notified and authorized to evaluate what, if any, revisions should be made to our recommendations.

2.0 FIELD EXPLORATION

Our field activities are discussed in this section. We have included discussions of drilling methods and boring locations, and soil sampling methods.

2.1 Drilling Methods and Boring Locations

As previously discussed, our overall field exploration program included a total of 4 soil borings to a depth of approximately 60 ft each below the mudline and 5 soil borings to a depth of approximately 40 ft each below the mudline. The borings are designated Borings B-1 through B-9. The locations and depths for the soil borings were requested by CPE and staked in the field by John Chance Land Surveyors prior to the arrival of our drilling crew onsite. John Chance Land Surveyors provided longitude and latitude coordinates for each of the staked boring locations. Fugro located the boring locations in the field using a hand-held GPS system. The locations of the borings are included on the Plan of Borings on Plate 1. The coordinates of each boring location are included on the boring logs on Plates 2 through 10.

The 9 soil borings for this study were drilled between September 10 and September 13, 2010, with a marsh buggy-mounted drilling rig using wet-rotary drilling techniques. The boring logs for this study are presented on Plates 2 through 10. A key identifying the terms and symbols used on the boring logs is presented on Plates 11a and 11b.

2.2 Soil Sampling Methods

Soil samples were generally taken at about 3-ft intervals from the mudline to a depth of about 40-ft, and at about 10-ft intervals thereafter to the completion depth of the borings as indicated on the boring logs. Undisturbed samples of cohesive soils were generally obtained by hydraulically pushing a 3-inch-diameter, thin-walled tube a distance of about 24 inches. Our field procedure for cohesive soil sampling was conducted in general accordance with the *Standard Practice for Thin-Walled Tube Sampling of Soils* (ASTM D1587). The samples were sealed in the field and transported to our laboratory where they were extruded and visually classified by one of our senior geotechnical personnel.

Our field procedure for sampling granular soils was conducted in general accordance with the *Standard Method for Penetration Test and Split-Barrel Sampling of Soils* (ASTM D 1586). Granular soil samples were obtained using the Standard Penetration Test (SPT) as described on Plate 11b. Our geotechnical personnel recorded the hammer blows for each sampling interval. An automatic hammer was used to drive the sampler. The uncorrected SPT N-value, described on Plate 11b, is recorded on the boring logs. The soil samples obtained from the split-barrel sampler were visually classified and packaged for transportation to our laboratory.

3.0 LABORATORY TESTING

The laboratory-testing program for this study was directed toward evaluating the classification properties, undrained shear strength, and compressibility characteristics of the subsurface soils. Our laboratory tests were performed in general accordance with the appropriate ASTM standards as tabulated in this section.

3.1 Classification Tests

The classification tests included tests for natural water content, liquid and plastic limits (collectively termed Atterberg limits), material finer than the No. 200 sieve, and grain size analysis. These tests aid in classifying the soils and are used to correlate the results of other tests performed on samples taken from different borings and/or different depths. The results of the classification tests are recorded on the boring logs on Plates 2 through 10. The grain size curves for the soil boring samples are presented on Plates 12a through 12h.

3.2 Undrained Shear Strength Tests

We measured the undrained shear strength of select undisturbed samples of cohesive soils by performing undisturbed and remolded miniature vane shear and unconsolidated-undrained triaxial compression tests. Natural water contents and dry unit weights were determined as routine portions of the compression tests. The results of the laboratory shear strength tests, along with the field estimates of shear strengths, are presented on the boring logs on Plates 2 through 10.

3.3 One-Dimensional Consolidation Testing

We measured the compressibility characteristics of the foundation soils by performing eight incremental one-dimensional consolidation tests. Undisturbed soil samples from Boring B-2 at depths of 40 ft and 50 ft, Boring B-3 at a depth of 13 ft, Boring B-4 at a depth of 10 ft, Boring B-5 at a depth of 37 ft, Boring B-7 a depth of 37 ft, Boring B-8 at a depth of 7 ft, and Boring B-9 at a depth of 10 ft were selected for consolidation testing. Natural moisture contents and dry unit weights were determined as routine portions of the consolidation tests. Consolidation test results are presented in the following table. In addition, consolidation test results, as plots of effective vertical stress versus axial strain, are presented on Plates 13a through 13h. A summary of the results for the consolidation tests is included on the table on the following page.

Summary of Consolidation Test Results

Boring No.	Depth (ft)	e_0	Cc	Cr	σ'_v (tsf)	σ'_p (tsf)	OCR
2	40	1.07	0.09	0.01	0.84	2.63	3.13
2	50	1.39	0.54	0.10	1.03	0.93	0.90
3	13	2.00	0.45	0.07	0.23	0.22	0.94
4	10	2.03	0.61	0.14	0.18	0.18	1.00
5	37	1.64	0.64	0.14	0.79	0.80	1.01
7	37	0.89	0.14	0.02	0.79	1.03	1.30
8	7	1.86	0.60	0.06	0.13	0.19	1.46
9	10	2.38	0.81	0.15	0.18	0.18	1.00

e_0 = initial void ratio

C_c = compression index

C_r = recompression index

σ'_v = effective overburden pressure

σ'_p = effective preconsolidation pressure

OCR = overconsolidation ratio

3.4 Summary of Laboratory Testing

The types and number of laboratory tests performed for this study and the applicable testing standards are included on the table on the following page. The results of our laboratory testing are also tabulated in the Summary of Test Results presented in Appendix A.

Laboratory Test	Quantity	Testing Standard
Water Content	22	ASTM D 2216
Atterberg Limits	24	ASTM D 4318
Dry Unit Weight	8	ASTM D 2166
Specific Gravity	8	ASTM D 854
Material Finer than a No. 200 Sieve	23	ASTM D 1140
Sieve Analysis	24	ASTM D 422
Miniature Vane Shear (Undisturbed and Remolded)	15	ASTM D 4648
Unconsolidated-Undrained Triaxial Compression (Undisturbed and Remolded)	19	ASTM D 2850
One-Dimensional Consolidation Tests	8	ASTM D 2435

4.0 GENERAL SITE CONDITIONS

The interpreted site and subsurface conditions, based upon our field exploration, laboratory testing, and experience, are discussed in this section.

4.1 Site Description

The proposed area of headland restoration is located approximately 8 miles east of Grand Isle, Louisiana. Bay Long is located to the north and west of the project site, Pass La Mer is located to the east, and the Gulf of Mexico is located to the south of the project site. Based on information provided by John Chance Land Surveys, the mudline varied in elevation from approximately El. +2-ft to El. –2-ft within the limits of the Chenier Ronquille Barrier Headland restoration at the time of our field investigation. Based on the Tides and Currents data provided by the National Oceanic and Atmospheric Administration (NOAA), the water level at the time of our field investigation varied from El. –0.3-ft to El. 1.2-ft relative to mean sea level. Pipelines running northeast to southwest are present in the vicinity of the project area.

4.2 General Subsurface Conditions

The subsurface soil conditions at the site were explored by drilling 4 soil borings to a depth of about 60-ft each below the mudline and 5 soil borings to a depth of about 40-ft each below the mudline. Based on a review of the field and laboratory tests performed, the subsurface soils generally consist of alternating layers of granular and cohesive materials from the mudline to the completion depth of the borings. Highly compressible and soft clay and organic clay were encountered in Borings B-5, B-6, and B-8 near the surface. We encountered silty sands at the surface at the remainder of the borings. A generalized subsurface profile based on our borings is presented on Plate 14.

The estimated and measured soil properties from the laboratory tests performed on samples from the boring locations, as well as additional information relating to the subsurface conditions encountered, are presented on the boring logs on Plates 2 through 10 at the end of this report. A key identifying the terms and symbols used on the boring logs is presented on Plates 11a and 11b.

5.0 PROJECT DESCRIPTION

We understand that plans to restore the Chenier Ronquille Barrier Headland include the construction of a perimeter containment dike to confine dredged marsh fill material, which will be hydraulically pumped from an offshore location. The source of the proposed dredged marsh fill material was unknown at the time of this report. We understand that the containment dike will be constructed using material located within the confined area immediately adjacent to the containment dike. Based on the information from our soil borings, this material will generally consist of granular material. There were isolated areas where soft, highly compressible, cohesive materials were encountered. We do not recommend using these materials for containment dike construction.

As mentioned previously, the elevation of the mudline at the time of our field investigation varied from approximately El. +2-ft to El. –2-ft within the limits of the Chenier Ronquille Barrier Headland restoration. The anticipated containment dike crown elevation will be El. +5-ft. As indicated by CPE, the dike will have a 10-ft wide crown and 4 Horizontal: 1 Vertical side slopes. The constructed elevation of the marsh fill will be between El. +1-ft and El. +3-ft.

Settlement analyses of the in-situ soils due to the application of the containment dike and the marsh fill material over the 20-year project life were performed. Samples of the proposed dredge material were not available. Therefore, a settlement analysis of the marsh fill material was not performed for our study. Finally, slope stability analyses were performed to evaluate the side slopes of the containment dike.

The methodology, geometry, and results of the settlement and slope stability analyses are presented in Sections 6 and 7, respectively.

6.0 SETTLEMENT ANALYSES

A discussion of our settlement analyses, selection of soil parameters, and the results of our analyses are presented in the following sections.

6.1 Methodology

To evaluate the anticipated settlement of the underlying soils due to the construction of the containment dike material and the marsh fill material, we used the Corps of Engineers CSETT computer program. The CSETT program first computes the induced stresses under general-shaped loads using Boussinesq's or Westergaard's theories of stress distribution. The program then uses soil compressibility parameters to evaluate the change in thickness of individual layers and computes the overall movement of the foundation at select locations. It should be noted that the effects of regional subsidence or relative sea rise were not considered in our calculations.

6.2 Soil Parameters

Soil compressibility parameters were developed for the in-situ soils using consolidation tests performed on select samples from our soil borings as discussed in Section 3.3. We selected values of the compressibility index, C_c, and the initial void ratio, e_o, based on the consolidation tests performed and plotted the parameters versus elevation to develop a "consolidation parameter profile" to use in our settlement analyses.

After reviewing the consolidation data, we determined that the soil layers extending from the "natural" mudline elevation (approximately El –2-ft) to approximately El –36-ft are normally consolidated and will settle along a virgin compression line. We determined that the soils below El. –36-ft were slightly over-consolidated. The consolidation parameters selected for our analyses are presented in the table on the following page.

Consolidation Design Parameters for Settlement Analyses

Layer	Top Elevation (ft)	Void Ratio, e_o	Compression Index, C_c	Recompression Index, C_r	Coefficient of Consolidation, C_v (ft^2/yr)	Poisson's Ratio, ν
1	-2	1.86	0.63	0.06	7.3	0.32
2	-15	--	--	--	--	--
3	-21	2.03	0.63	0.14	3.65	0.32
4	-27	--	--	--	--	--
5	-36	1.39	0.60	0.10	730	0.32
6	-60	--	--	--	--	--

We performed our settlement analyses using a composite cohesive profile to calculate a conservative estimate of the predicted settlement. We also evaluated the settlement using a composite granular profile to bracket the range of expected settlement. We did encounter highly organic, compressible clays near the surface of Boring B-6 that may exhibit more settlement than presented herein.

In an effort to evaluate the time rate of settlement, we determined the coefficient of consolidation (c_v) values from the consolidation test results. Using the c_v values, we calculated the time rate of settlement due to the application of the containment dike and the marsh fill. The soil compressibility parameters used in our analyses are included in the following table. The settlement of the containment dike and the soils underlying the marsh fill material are described in more detail in the following sections.

6.3 Settlement of the In-Situ Material Beneath the Containment Dike

We understand that the containment dike will be constructed with a crown elevation at El. +5-ft. For our settlement analyses we assumed a pre-construction mudline elevation at El. –2-ft. Due to the granular nature of the proposed dike material, we assumed in our settlement analyses that most of the settlement due to the self-weight of the dike material will occur during the construction process. We assumed that any settlement of the dike material occurring after the construction process will be negligible relative to the settlement of the in-situ soils beneath the containment dike. We did encounter highly organic material near the surface at Borings B-5, B-6 and B-8. This material is not suitable for construction of the containment dike and was not considered in our

analyses. A time rate of settlement curve for the in-situ material beneath the containment dike crown using the composite cohesive profile is presented on Plate 15.

6.4 Settlement of the In-Situ Material Beneath the Marsh Fill

We understand that the constructed elevation of the marsh fill creation will be between El. +1-ft and El. +3-ft. For our settlement analyses, we assumed a mudline elevation at El. –2-ft and constructed marsh fill elevations of El. +1-ft, El. +2-ft, and El. +3-ft. Settlement analyses were performed for the in-situ material beneath the marsh fill placed at elevations El. +1-ft, El. +2-ft, and El. +3-ft.

Time rate of settlement curves for the in-situ material beneath the marsh fill using the composite cohesive profile are presented on Plate 16. In general, the long-term settlement is on the order of 0.5- to 1.2-ft depending on the height of the marsh fill.

7.0 CONTAINMENT DIKE SLOPE STABILITY

Our slope stability analyses are discussed in this section. We have included discussions of design methodology, required factors of safety, and a discussion of our analyses.

7.1 Methodology

To evaluate stable side slopes for the containment dike, we analyzed the slope stability using Spencer's method with the SLOPE/W software developed by GEO-SLOPE International, Ltd. The search for the critical factor of safety using Spencer's analysis was performed using circular failure surfaces. Failure surfaces were varied in the analyses to locate the failure surface with the lowest factor of safety. We evaluated the stability of the containment dike side slopes under undrained soil conditions as they provided lower factors of safety than drained soil conditions. Our laboratory strength test results and our design strength and unit weight profiles are presented on Plate 22.

7.2 Geometry

For our slope stability analyses, we used a containment dike crown elevation at El. +5-ft and a crown width of 10-ft, as requested by CPE. We used a side slope inclination of 4:Horizontal on 1:Vertical (4H:1V) for the containment dike. We first evaluated the factor of safety for potential failure surfaces initiating in the marsh and undermining the containment dike for marsh fill elevations of El. +1-ft, El. +2-ft, and El. +3-ft. Finally, we evaluated the factor of safety for failure surfaces using a dike cross-section with an excavated zone adjacent to the toe of the containment dike. CPE requested we use a water elevation of El. 0-ft on the exterior slope of the containment dike and a water depth of 4-ft below the top of the marsh fill area on the interior face of the containment dike. The dike and marsh fill geometry and water elevations used in our analyses (as indicated by CPE) are presented on Plates 17 through 21 for each marsh fill elevation evaluated. The design shear strength and unit weight profiles used in our slope stability analyses are presented on Plate 22.

7.3 Results

The results of our stability analyses of the containment dike are presented in the table on the following page. The calculated factors of safety are greater than 1.3, and as such, we believe they are adequate based on the proposed construction. The lowest factor of safety calculated during our search was indicative of an infinite slope failure surface of the containment dike side slope. The factor of safety for a larger global failure was greater than 1.5. The failure surfaces corresponding to the critical factors of safety for each analysis are presented on Plates 17 through 21.

Results of Stability Analyses – Spencer's Method	
Marsh Fill Elevation	**Critical Calculated Factor of Safety**
Elev. +1-ft	1.36
Elev. +2-ft	1.35
Elev. +3-ft without excavation	1.35
Elev. +3-ft with outside containment dike excavation	1.41
Containment dike excavation in marsh fill area	1.60

8.0 ADDITIONAL CONSIDERATIONS

The following design details are also recommended to benefit the project.

We recommend erosion control be placed on the containment dike to reduce the impacts of erosion. Erosion control measures can include a rock breakwater structure on the seaward face of the containment dike. In addition, a geosynthetic can be placed on the face of the containment dike to reduce the impacts of erosion. The location of the breakwater structure should extend far enough seaward to prevent toe erosion at the base of the containment dike. Finally, we recommend that vegetation be planted in the marsh creation area. The placement of vegetation will help solidify the near surface marsh creation fill material and also provide some erosion control.

ILLUSTRATIONS

N

NOT TO SCALE

Note: Generalized cross-section A - A' is presented on Plate 14.

COORDINATES			
BORING	LATITUDE	LONGITUDE	MUDLINE\GROUND SURFACE ELEVATION (feet)
B-1	29° 19' 00.6"	89° 48' 56.3"	1.0
B-2	29° 18' 56.2"	89° 48' 39.5"	-1.4
B-3	29° 18' 59.9"	89° 48' 23.0"	2.4
B-4	29° 18' 55.9"	89° 47' 58.4"	1.3
B-5	29° 19' 04.1"	89° 47' 59.4"	-1.9
B-6	29° 19' 06.0"	89° 47' 46.8"	0.3
B-7	29° 19' 02.0"	89° 47' 31.5"	-1.1
B-8	29° 18' 53.0"	89° 47' 20.3"	-1.4
B-9	29° 19' 10.4"	89° 47' 14.6"	-1.6

REFERENCE:
Images by Google Earth Pro.

SITE MAP

VICINITY MAP

FUGRO

CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

PLAN OF BORINGS AND SITE/VICINITY MAP

SIZE	PROJECT NO.		REV.
B	04.55104010		0

SCALE:	DRAWN BY:	CHKD BY:	DATE:	Plate No.:
AS SHOWN	DMS	BN	11/15/10	1

November 15, 2010 04.55104010 Plate 01 Boring Plan.dwg

LOCATION: See Plate 1

COORDINATES: N 29° 19' 00.6"
W 89° 48' 56.3"

SURFACE EL.: 1'

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	N=2	**POORLY GRADED SAND WITH SILT (SP-SM)**, very loose, dark gray, fine to medium-grained, with shells, roots, and organics			8	31			
5	N=WOH								
	N=2				20	34			
			9.0						
10	N=21	**POORLY GRADED SAND (SP)**, medium-dense, gray, with shells, and roots							
	N=22				5	26			
15	N=4	- loose below 15.5'							
			18.0			28	38	14	24
20		**SANDY LEAN CLAY (CL)**, soft, gray				56			
			24.0						
25	N=10	**SILTY SAND (SM)**, medium-dense, gray, fine-grained, with shell fragments			14	24			
	N=10								
30	N=2	- very loose to loose below 30.5'	31.0		53	40			
		SANDY SILT (ML), very loose to loose, gray							
	N=6								
35			36.0			37	33	21	12
		LEAN CLAY (CL), firm, gray		81		39			
40			41.0						

CLASSIFICATION

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT
0.2 0.4 0.6 0.8 1.0

NOTES:
1. Terms and symbols defined on a and b.

DATE: September 10, 2010
TOTAL DEPTH: 41'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 41'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-1

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 2

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

LOCATION: See Plate 1

COORDINATES: N 29° 18' 56.2"
W 89° 48' 39.5"

SURFACE EL.: -1.4'

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	N=WOH	**LEAN CLAY (CL)**, dark gray to black, with grass							
			3.0						
	N=Push	**SILTY SAND (SM)**, very loose to loose, gray, fine to medium-grained, with organics, and roots			41	60			
5	N=6								
10	N=8				12	33			
	N=WOH								
15		**POORLY GRADED SAND WITH SILT (SP-SM)**, gray, fine-grained, with clay pockets	15.0		10	26			
			18.0						
	N=12	**POORLY GRADED SAND (SP)**, medium-dense, dark gray, fine to medium-grained							
20	N=12				6	28			
25	N=18								
	N=15	**SILTY SAND (SM)**, loose to medium-dense, gray, with shell fragments	28.0		35	28			
30	N=6								
	N=2	**LEAN CLAY WITH SAND (CL)**, firm, dark gray	34.0		73	44			
35				77		44			
40							38	20	18

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.

DATE: September 10, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-2

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 3a

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

LOCATION: See Plate 1

COORDINATES: N 29° 18' 56.2"
W 89° 48' 39.5"

SURFACE EL.: -1.4'

DEPTH, FT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
45	**LEAN CLAY WITH SAND (CL)**, firm, dark gray							
		49.0						
50	**FAT CLAY (CH)**, dark gray, with sandy silt				45	62	22	40
55								
		59.0			63	31	23	8
60	**LEAN CLAY (CL)**, firm, gray, with silt, and sand layers		79		44			
		61.0						
65								
70								
75								
80								

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.

DATE: September 10, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-2

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 3b

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

LOCATION: See Plate 1

COORDINATES: N 29° 18' 59.9" W 89° 48' 23.0"

SURFACE EL.: 2.4'

SHEAR STRENGTH legend: □ Penetrometer; ◇ Torvane; △ Field Vane; Unconfined ▼; Triaxial ●; Miniature Vane ▲ — KIPS PER SQ FT (0.2, 0.4, 0.6, 0.8, 1.0)

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH
0–6	N=4	**POORLY GRADED SAND WITH SILT (SP-SM)**, loose, dark gray, fine to medium-grained, with clay pockets, and shell fragments			11	27				
	N=6		6.0							
6–12	N=WOH	**LEAN CLAY WITH SAND (CL)**, soft to firm, dark gray			77	71				
		- with silt and organics at 9'	12.0							◇, ▲
12–15		**ELASTIC SILT (MH)**, very soft to soft, dark gray	15.0			93	77	43	34	▲, ◇
15–18		**SILTY SAND (SM)**, dark gray	18.0							
18–21		**LEAN CLAY (CL)**, stiff, gray, with silt, and sand seams	21.0	91		32				1.7 ●
21–27		**LEAN CLAY WITH SAND (CL)**, dark gray	27.0		84	70				
27–33	N=17	**SILTY SAND (SM)**, medium-dense, gray, fine-grained	33.0		33	27				
33–35	N=3	**CLAYEY SAND (SC)**, loose, dark gray	35.0							
35–41		**SANDY LEAN CLAY (CL)**, soft, dark gray		77		36 49	35	20	15	●
			41.0		60	35				

NOTES:

1. Terms and symbols defined on a and b.

DATE: September 11, 2010

TOTAL DEPTH: 41'

CAVED DEPTH: Not Applicable

DRY AUGER: Not Applicable

WET ROTARY: 0' to 41'

BACKFILL: Cement-Bentonite Grout

LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-3

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 4

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

LOCATION: See Plate 1

COORDINATES: N 29° 18' 55.9"
W 89° 47' 58.4"

SURFACE EL.: 1.3'

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	N=WOH	**POORLY GRADED SAND WITH SILT (SP-SM)**, very loose, gray, fine to medium-grained							
5	N=4	- with shell fragments and organics at 3.5'			10	29			
	N=WOH	**FAT CLAY (CH)**, very soft to soft, dark gray	7.0						
10						73	97	27	70
		- gray, with sand pockets, shells, and organics at 12'		91		32			
15									
		- dark gray below 18'				75	78	27	51
20		**SILTY SAND (SM)**, medium-dense, gray	19.0			33			
	N=Push								
25	N=14				44	27			
		POORLY GRADED SAND (SP), medium-dense, dark gray, fine-grained, with shells	27.0						
30	N=10								
	N=29				23	25			
35	N=15								
	N=16	**LEAN CLAY WITH SAND (CL)**, dark gray	37.0		77	49			
		FAT CLAY (CH), firm, gray, with silt, and sand pockets	39.0						
40				66		54			

CLASSIFICATION

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT
0.2 0.4 0.6 0.8 1.0

NOTES:
1. Terms and symbols defined on a and b.

DATE: September 11, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-4

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 5a

LOCATION: See Plate 1

COORDINATES: N 29° 18' 55.9"
W 89° 47' 58.4"

SURFACE EL.: 1.3'

DEPTH, FT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
45	**FAT CLAY (CH)**, firm, gray, with silt, and sand pockets							
		49.0						
50	**SANDY LEAN CLAY (CL)**, soft, gray, with silt pockets, and organics		77		45			
		55.0						
55	**SILTY SAND (SM)**, gray							
60		61.0		38	26			
65								
70								
75								
80								

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.

DATE: September 11, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-4

Plaquemines Parish, Louisiana

Project No.
04.55104010

PLATE 5b

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

LOCATION: See Plate 1

COORDINATES: N 29° 19' 04.1"
W 89° 47' 59.4"

SURFACE EL.: -1.9'

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	N=WOR	**FAT CLAY (CH)**, very soft, black, with organics				181	132	34	98
5	N=2	**SILTY SAND (SM)**, very loose, dark gray, with organics, and clay pockets	4.0		32	90			
	N=WOR								
10		**LEAN CLAY WITH SAND (CL)**, soft, dark gray	9.0		76	51	28	19	9
	N=Push	**SANDY SILT (ML)**, medium-dense, dark gray	12.0						
15	N=11				54	33			
20	N=10	- with clay layer from 19.0' to 19.5'							
	N=Push	**CLAYEY SAND (SC)**, medium-dense, gray, fine-grained	21.0		11	33			
25	N=12								
	N=26	- with shells at 27.5'			17	31			
30	N=29								
	N=20				27	26			
35		**FAT CLAY (CH)**, dark gray	36.0			59	85	25	60
		LEAN CLAY (CL), soft, gray	39.0			38	46	16	30
40			41.0	66		61			

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

◇ at 0.4 (LEAN CLAY WITH SAND)
● at 0.4 (LEAN CLAY)

NOTES:

1. Terms and symbols defined on a and b.
2. WOR = Weight of Rod

DATE: September 11, 2010
TOTAL DEPTH: 41'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 41'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-5

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 6

LOCATION: See Plate 1

COORDINATES: N 29° 19' 06.0"
W 89° 47' 46.8"

SURFACE EL.: 0.3'

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	N=WOR	**ORGANIC CLAY (OH)**, very soft, black, with silt, and sand pockets							
	N=WOR	- gray, with peat and grass at 3.5'			79	197	164	45	119
5	N=Push	- with sand and roots at 6'			84	138			
			9.0						
10	N=2	**SILTY SAND (SM)**, very loose, dark gray			20	31			
			12.0						
	N=WOH	**SILT WITH SAND (ML)**, very loose, dark gray							
15		- gray at 15'			81	32			
20	N=10	- medium-dense below 21.5'							
			23.0						
25	N=13	**POORLY GRADED SAND WITH SILT (SP-SM)**, medium-dense, gray, with organics, and shell fragments			12	29			
	N=33	- dense from 27.5' to 29'							
30	N=21	- with 4-inch clay layer at 31 '							
			33.0			43	46	18	28
35		**LEAN CLAY (CL)**, gray, with sand lenses, and shell fragments							
			36.0		46	37			
		SILTY SAND (SM), dark gray							
40	N=6		39.5						
		SANDY LEAN CLAY (CL), dark gray	41.0						

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.
2. WOR = Weight of Rod

DATE: September 12, 2010
TOTAL DEPTH: 41'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 41'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-6

Plaquemines Parish, Louisiana

Project No.
04.55104010

PLATE 7

LOCATION: See Plate 1

COORDINATES: N 29° 19' 02.0"
W 89° 47' 31.5"

SURFACE EL.: -1.1'

DEPTH, FT	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	N=WOH	**POORLY GRADED SAND WITH SILT (SP-SM)**, very loose, dark gray, with shell fragments							
	N=2	**FAT CLAY (CH)**, gray, with organics, sand pockets, shells, and roots	3.0			94	76	21	55
5	N=3	**POORLY GRADED SAND WITH SILT (SP-SM)**, very loose to loose, gray, with shell fragments	6.0		9	28			
10	N=3								
	N=6				16	27			
15	N=5								
		CLAYEY SAND (SC), loose to medium-dense, gray	18.0			28	NP	NP	NP
20	N=16								
25	N=7	- with shells below 24.5'			24	30			
	N=8								
30	N=4	**SILTY SAND (SM)**, loose, gray, with organics, and shell fragments	30.0		40	29			
		SANDY LEAN CLAY (CL), dark gray	33.0						
35		**SILTY CLAY (CL-ML)**, very soft, gray	36.0			34	28	21	7
40				76		45			

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.

DATE: September 12, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

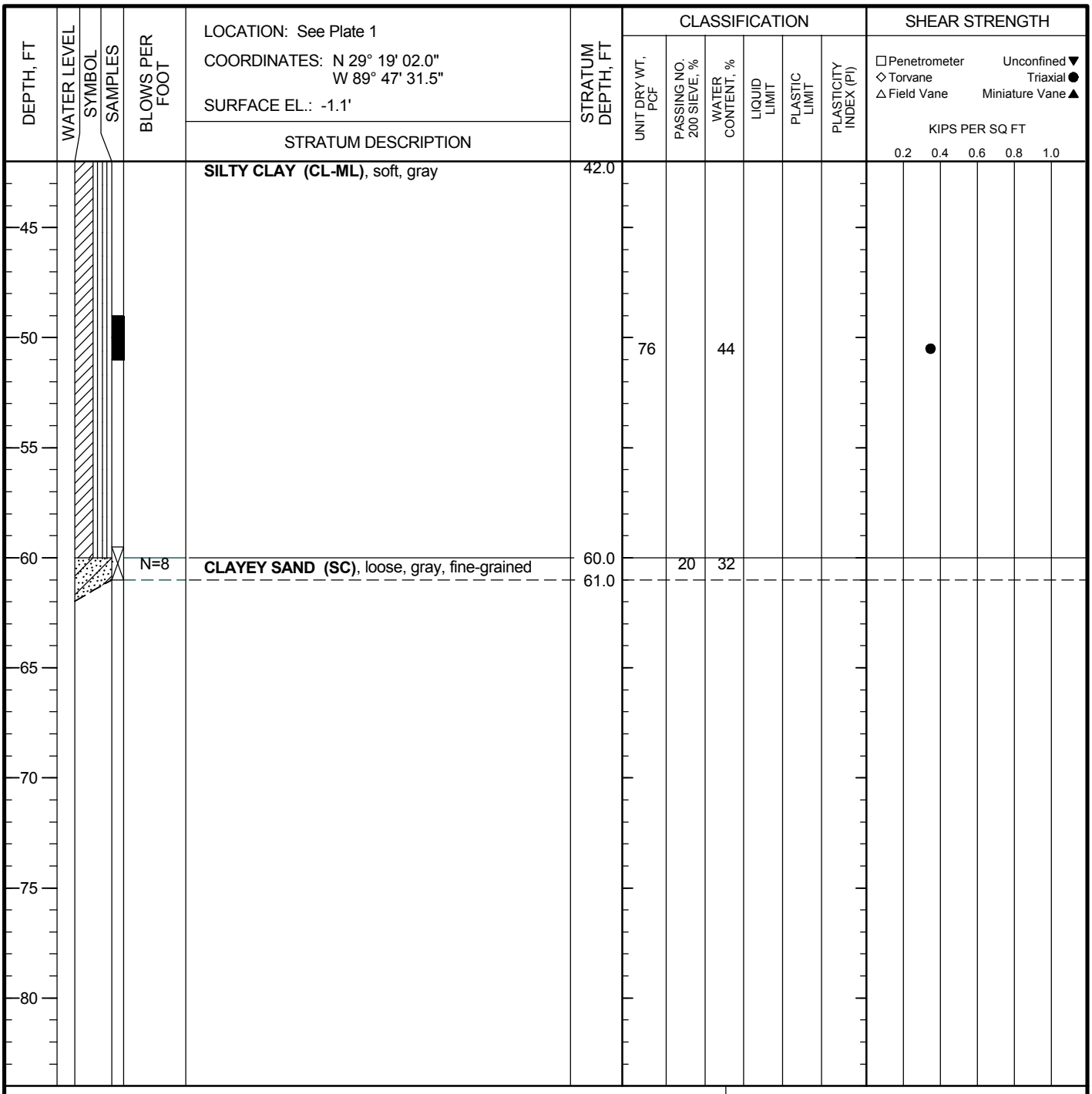
Chenier Ronquille Restoration

LOG OF BORING NO. B-7

Plaquemines Parish, Louisiana

Project No.
04.55104010

PLATE 8a



NOTES:

1. Terms and symbols defined on a and b.

DATE: September 12, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-7

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 8b

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

LOCATION: See Plate 1

COORDINATES: N 29° 18' 53.0"
W 89° 47' 20.3"

SURFACE EL.: -1.4'

DEPTH, FT	SAMPLES	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0		N=WOR	**FAT CLAY (CH)**, very soft to soft, dark gray				93	83	24	59
		N=WOR								
5							72	68	23	45
10							54			
			- firm below 12'							
15		N=Push	**SILT WITH SAND (ML)**, very loose, gray	15.0		76	38			
			SILTY CLAY (CL), dark gray	18.0						
20		N=WOH								
			SANDY FAT CLAY (CH), gray	21.0			38	51	18	33
			SILTY CLAY (CL), very soft, dark gray	24.0						
25					79		43			
		N=12	**SANDY SILT (ML)**, loose to medium-dense, dark gray	27.0						
30		N=7	- gray, with shell fragments at 30.5'			58	33			
		N=6								
35			**SILTY CLAY (CL)**, very soft, gray	36.0						
					78		40			
40		N=7	- dark gray at 39'			91	63			
				41.0						

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.
2. WOR = Weight of Rod

DATE: September 12, 2010
TOTAL DEPTH: 41'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 41'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-8

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 9

LOCATION: See Plate 1

COORDINATES: N 29° 19' 10.4"
W 89° 47' 14.6"

SURFACE EL.: -1.6'

DEPTH, FT	STRATUM DESCRIPTION	STRATUM DEPTH, FT	BLOWS PER FOOT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SILTY SAND (SM), very loose, dark gray		N=WOR		38	44			
5			N=WOR		36	39	NP	NP	NP
	FAT CLAY (CH), very soft, dark gray	7.0				65			
10						90	88	26	62
						93			
15	**CLAYEY SAND (SC)**, very loose, dark gray	15.0	N=3						
	- with a sandy clay layer from 18.5' to 19 '		N=9						
20	- loose to medium-dense below 18.5'								
	- gray, with organics at 21.5'		N=14		40	28			
25			N=13						
			N=12		37	36			
30			N=13						
	- with organics and shell fragments at 33.5'		N=14		23	35			
35									
	LEAN CLAY (CL), soft to firm, gray, with silt pockets, shells, and organics	37.0				54			
40						41	45	20	25
				73		48			

SHEAR STRENGTH

□ Penetrometer ▼ Unconfined
◇ Torvane ● Triaxial
△ Field Vane ▲ Miniature Vane

KIPS PER SQ FT

0.2 0.4 0.6 0.8 1.0

NOTES:

1. Terms and symbols defined on a and b.
2. WOR = Weight of Rod

DATE: September 13, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

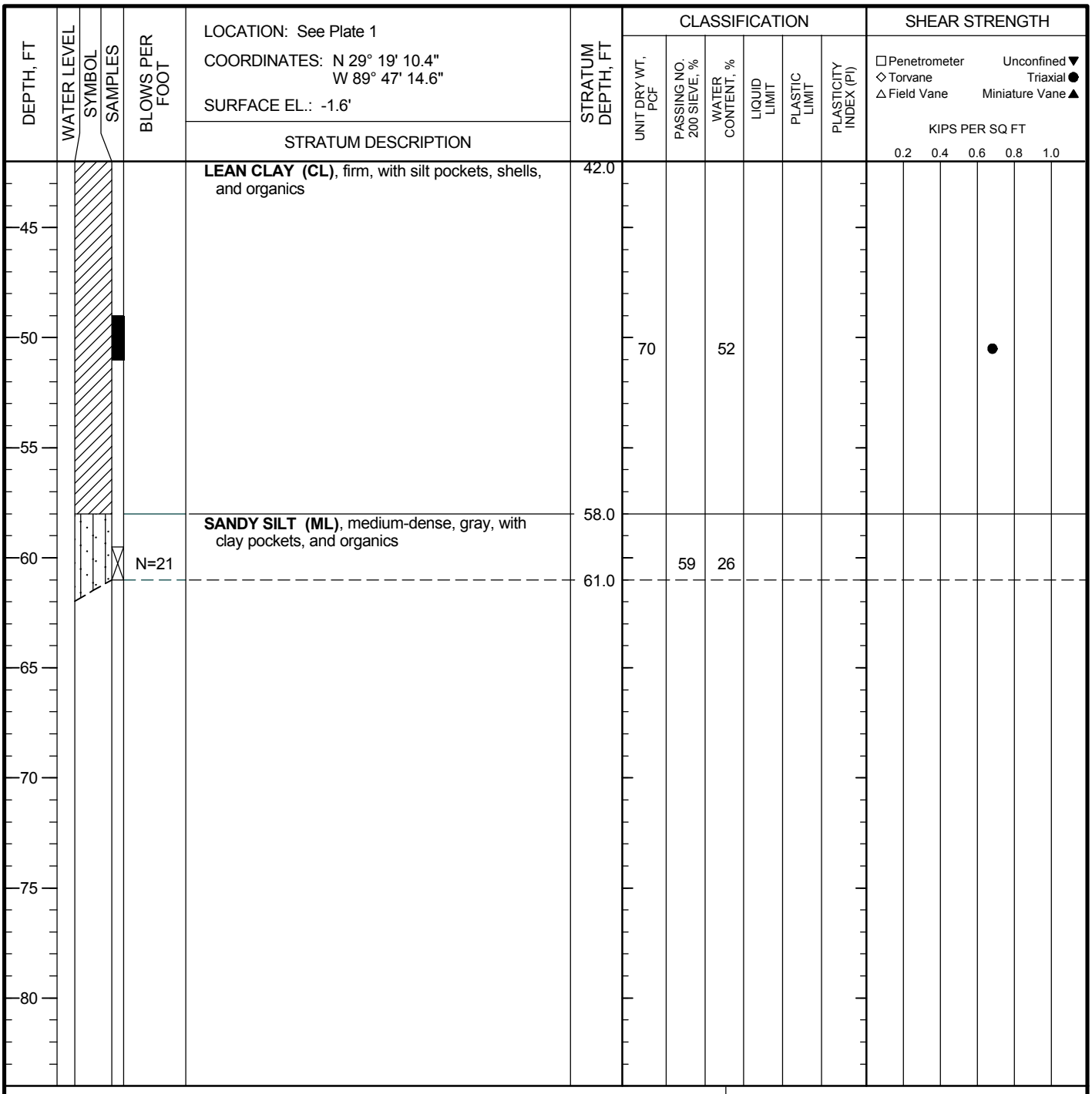
Chenier Ronquille Restoration

LOG OF BORING NO. B-9

Plaquemines Parish, Louisiana

Project No. 04.55104010

PLATE 10a



NOTES:

1. Terms and symbols defined on a and b.
2. WOR = Weight of Rod

DATE: September 13, 2010
TOTAL DEPTH: 61'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 61'
BACKFILL: Cement-Bentonite Grout
LOGGER: T. Ferro

Fugro Consultants, Inc.

Chenier Ronquille Restoration

LOG OF BORING NO. B-9

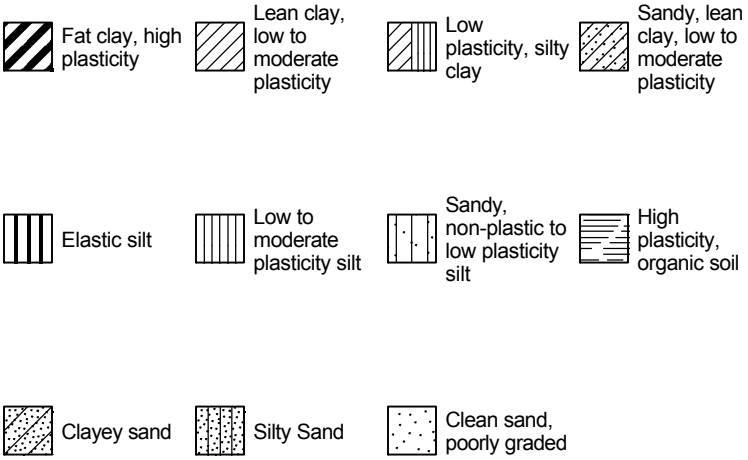
Plaquemines Parish, Louisiana

Project No. 04.55104010

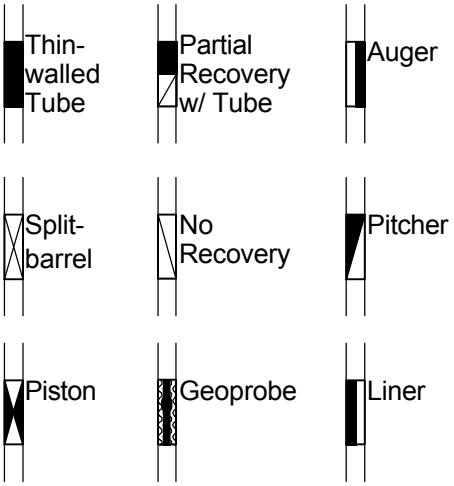
PLATE 10b

04.55104016 FCBR_LOG_(FINAL) 04.55104010.GPJ 5510-4016.GPJ 11/15/10

SOIL TYPES

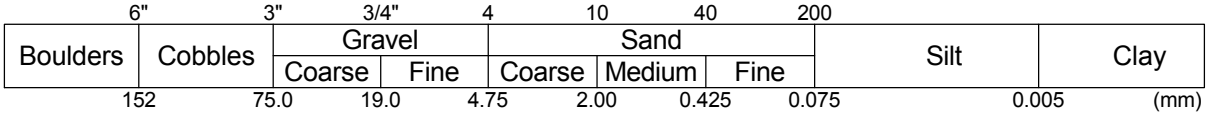


SAMPLER TYPES

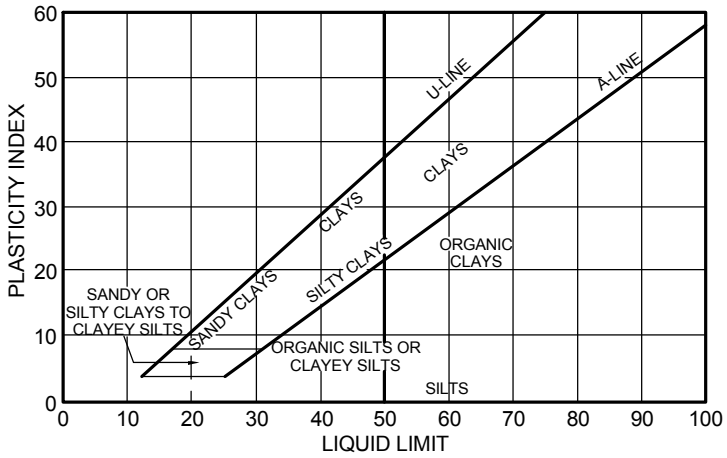


SOIL GRAIN SIZE

U.S. Standard Sieve



PLASTICITY CHART



SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

STANDARD PENETRATION TEST (SPT)

A 2-in.-OD, 1-3/8-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

DENSITY OF GRANULAR SOILS

Descriptive Term	*Relative Density, %	**Blows Per Foot (SPT)
Very Loose	< 15	0 to 4
Loose	15 to 35	5 to 10
Medium Dense	35 to 65	11 to 30
Dense	65 to 85	31 to 50
Very Dense	> 85	> 50

*Estimated from sampler driving record.

**Requires correction for depth, groundwater level, and grain size.

STRENGTH OF COHESIVE SOILS

Term	Undrained Shear Strength, ksf	Blows Per Foot (SPT) (approximate)
Very Soft	< 0.25	0 to 2
Soft	0.25 to 0.50	2 to 4
Firm	0.50 to 1.00	4 to 8
Stiff	1.00 to 2.00	8 to 16
Very Stiff	2.00 to 4.00	16 to 32
Hard	> 4.00	> 32

SHEAR STRENGTH TEST METHOD

U - Unconfined Q = Unconsolidated - Undrained Triaxial

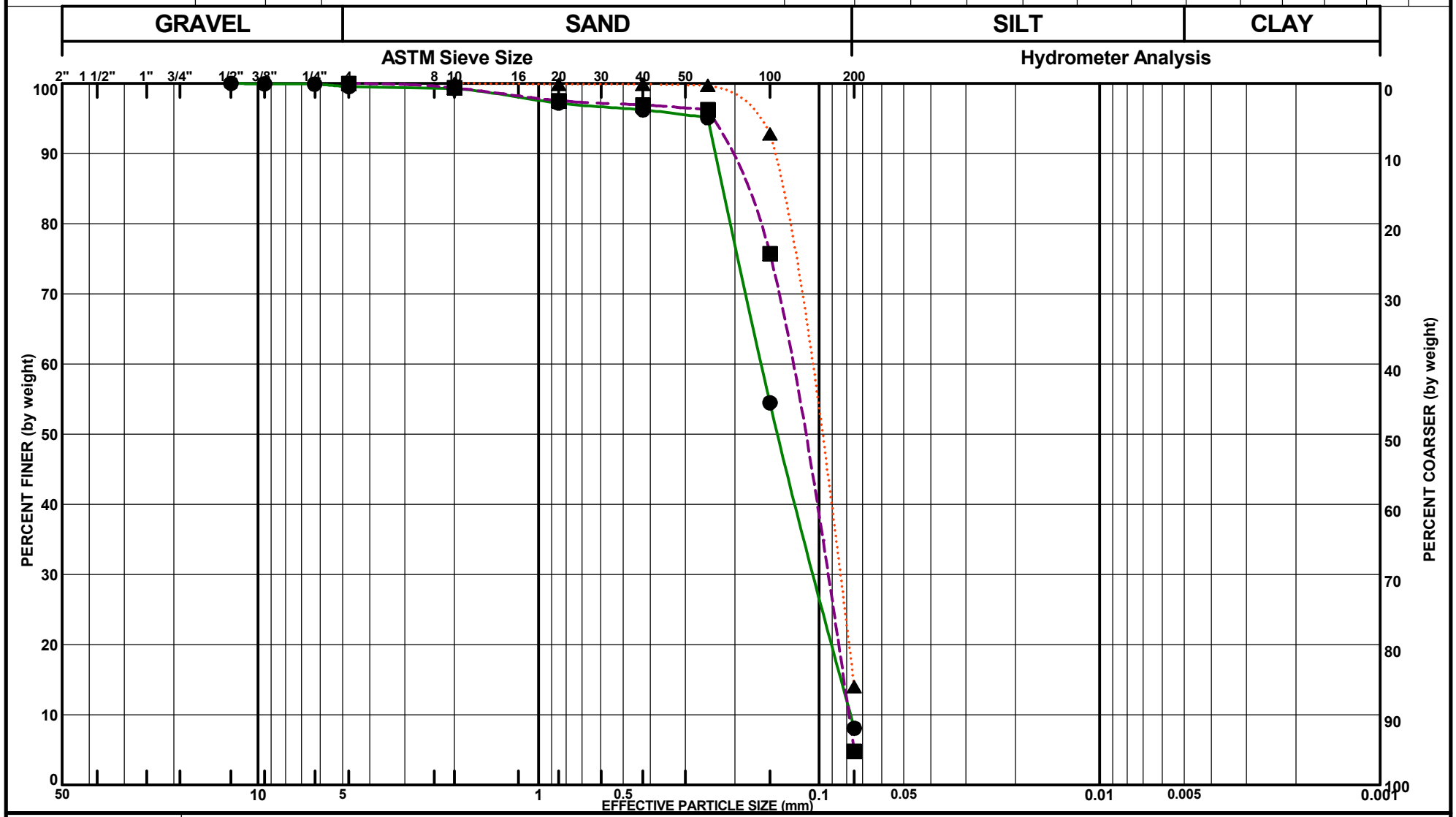
P = Pocket Penetrometer T = Torvane V = Miniature Vane F = Field Vane

HAND PENETROMETER CORRECTION

Our experience has shown that the hand penetrometer generally overestimates the in-situ undrained shear strength of over consolidated Pleistocene Gulf Coast clays. These strengths are partially controlled by the presence of macroscopic soil defects such as slickensides, which generally do not influence smaller scale tests like the hand penetrometer. Based on our experience, we have adjusted these field estimates of the undrained shear strength of natural, overconsolidated Pleistocene Gulf Coast soils by multiplying the measured penetrometer reading by a factor of 0.6. These adjusted strength estimates are recorded in the "Shear Strength" column on the boring logs. Except as described in the text, we have not adjusted estimates of the undrained shear strength for projects located outside of the Pleistocene Gulf Coast formations.

Information on each boring log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the time and places indicated, and can vary with time, geologic condition, or construction activity.

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-1	1	0.5-2	POORLY GRADED SAND WITH SILT (SP-SM), dark gray, fine to medium-grained, with shells, roots, and organics	0.5	91.4			12.5	0.161	0.104	0.077	0.87	2.08			
■ B-1	5	12.5-14	POORLY GRADED SAND (SP), gray, with shells and roots	0.0	95.2			4.75	0.129	0.096	0.079	0.91	1.63			
▲ B-1	9	24.5-26	SILTY SAND (SM), gray, fine-grained, with shell fragments	0.0	86.0			2	0.112	0.086						



FUGRO
Fugro Consultants, Inc

Chenier Ronquille Restoration

Plaquemines Parish, Louisiana

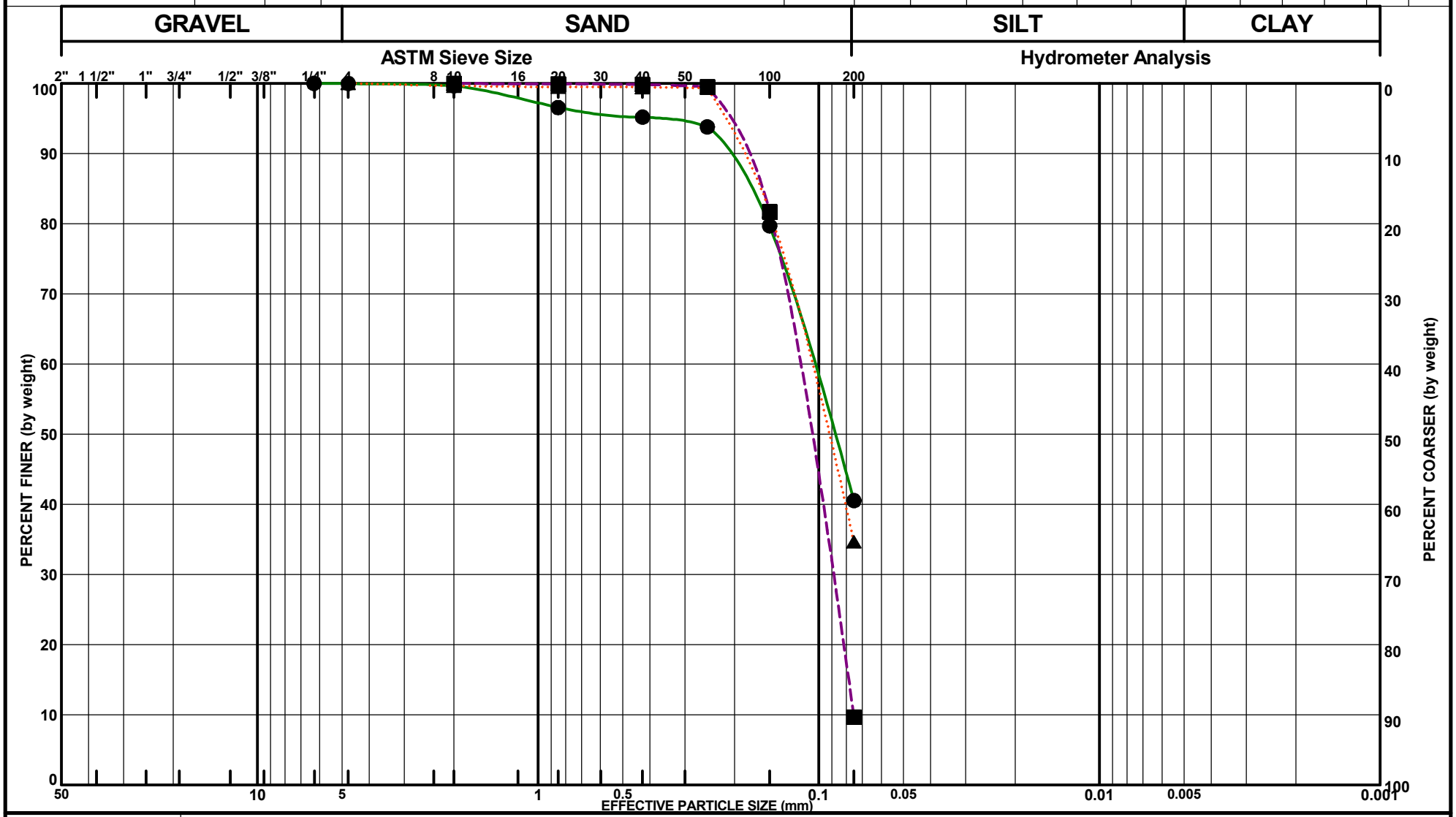
PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12a

FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-2	2	3.5-5	SILTY SAND (SM), gray, fine to medium-grained, with organics and roots	0.0	59.5			6.3	0.106							
■ B-2	6	15-16	POORLY GRADED SAND WITH SILT (SP-SM), gray, with clay pockets	0.0	90.3			2	0.122	0.091	0.075	0.91	1.62			
▲ B-2	10	27.5-29	SILTY SAND (SM), gray, with shell fragments	0.0	65.3			4.75	0.109							



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

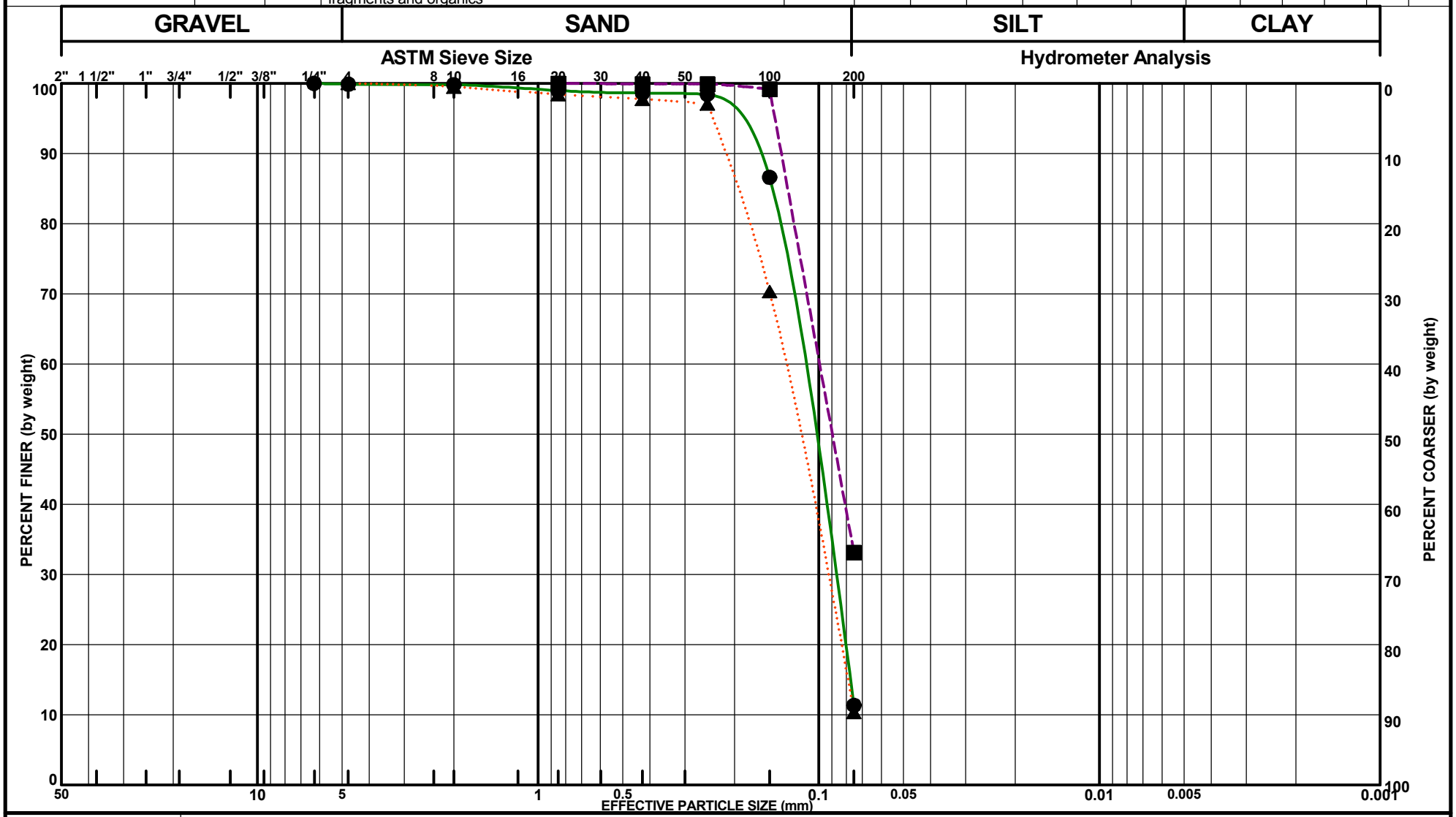
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12b

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-3	1	0.5-2	POORLY GRADED SAND WITH SILT(SP-SM), dark gray, fine to medium-grained, with clay pockets and shell fragments	0.1	88.6			6.3	0.117	0.089						
■ B-3	11	30.5-32	SILTY SAND (SM), gray, fine-grained	0.0	66.8			0.85	0.099							
▲ B-4	2	3.5-5	POORLY GRADED SAND WITH SILT(SP-SM), gray, with shell fragments and organics	0.0	89.7			4.75	0.133	0.094						



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

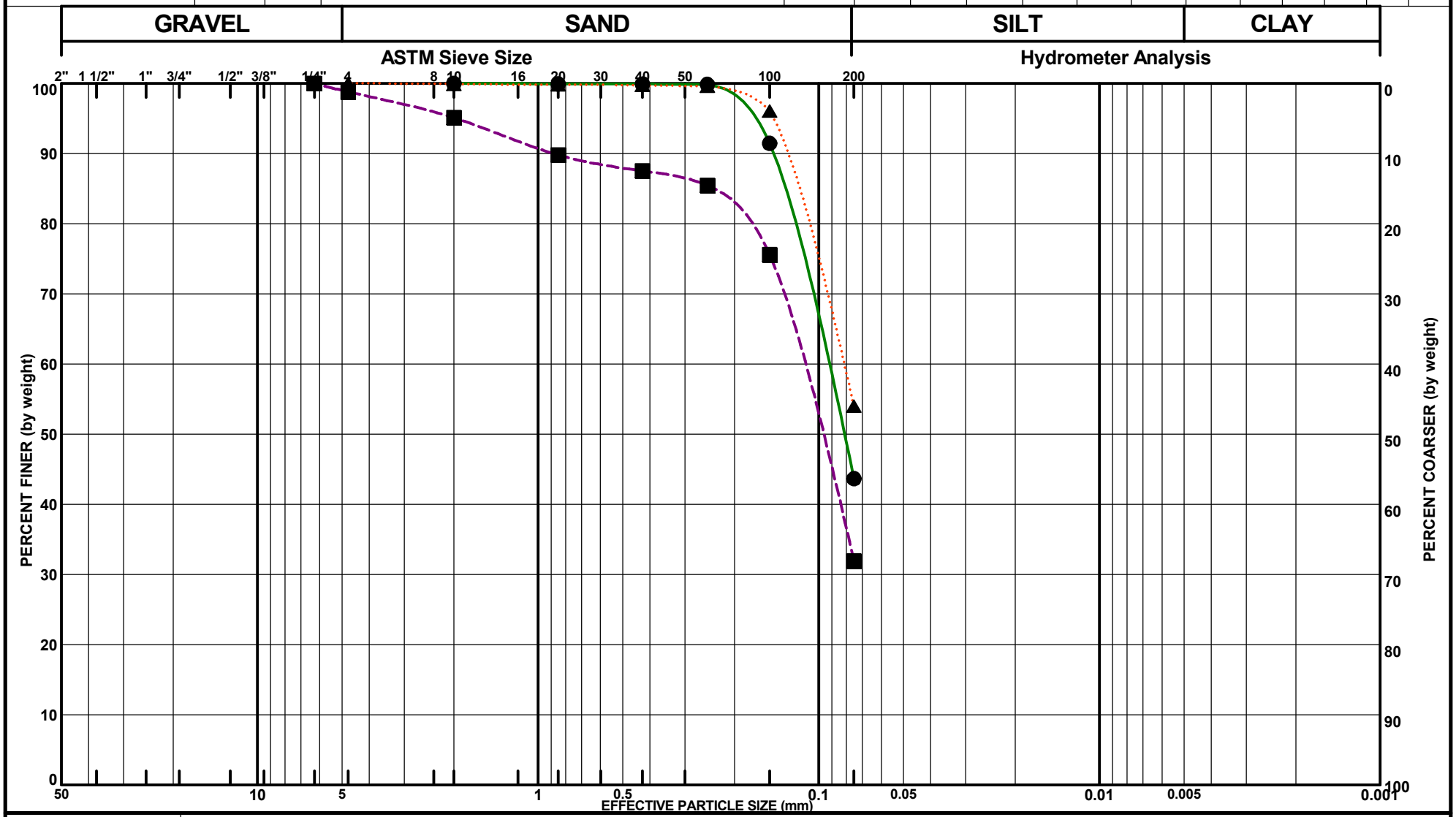
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12c

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-4	9	24.5-26	SILTY SAND (SM), gray	0.0	56.3			2	0.095							
■ B-5	2	3.5-5	SILTY SAND (SM), dark gray, with organics and clay pockets	1.2	66.8			6.3	0.117							
▲ B-5	6	15.5-17	SANDY SILT (ML), gray	0.0	46.0			4.75	0.083							



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

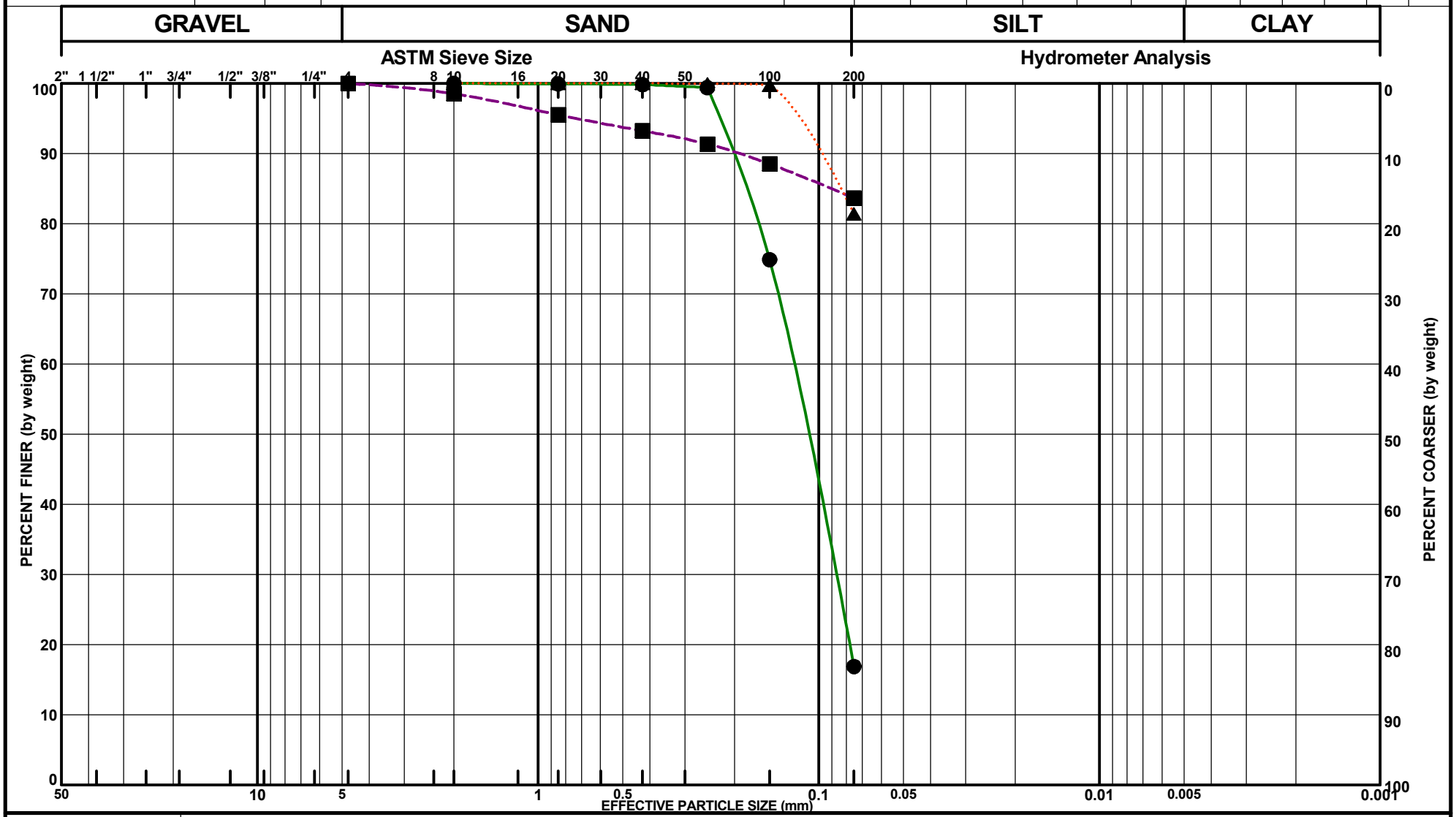
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12d

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-5	10	27.5-29	CLAYEY SAND (SC), gray, fine-grained, with shells	0.0	83.1			2	0.126	0.088						
■ B-6	3	6-7	ORGANIC CLAY (OH), gray, with sand and silt pockets, grass, and roots	0.0	16.3			4.75								
▲ B-6	6A	15-16	SILT WITH SAND (ML), gray	0.0	18.6			2								



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

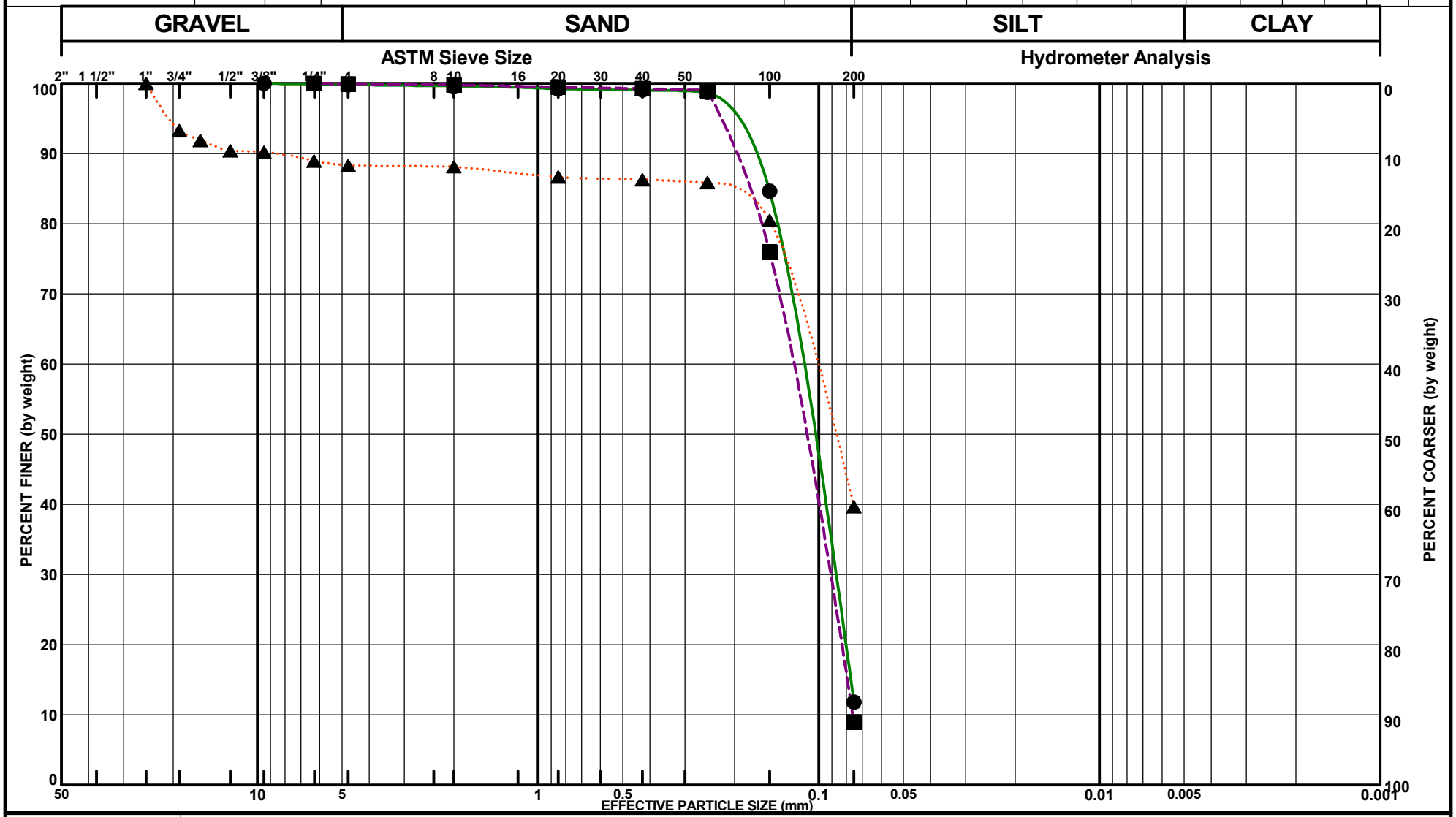
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12e

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-6	9	24.5-26	POORLY GRADED SAND WITH SILT (SP-SM), gray, with organics and shell fragments	0.2	88.0			9.5	0.119	0.089						
■ B-7	3	6.5-8	POORLY GRADED SAND WITH SILT (SP-SM), gray, with shell fragments	0.1	90.9			6.3	0.127	0.093	0.076	0.90	1.68			
▲ B-7	11	30.5-32	SANDY SILT (ML), gray, with organics and shell fragments	11.7	48.6			25	0.106							



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

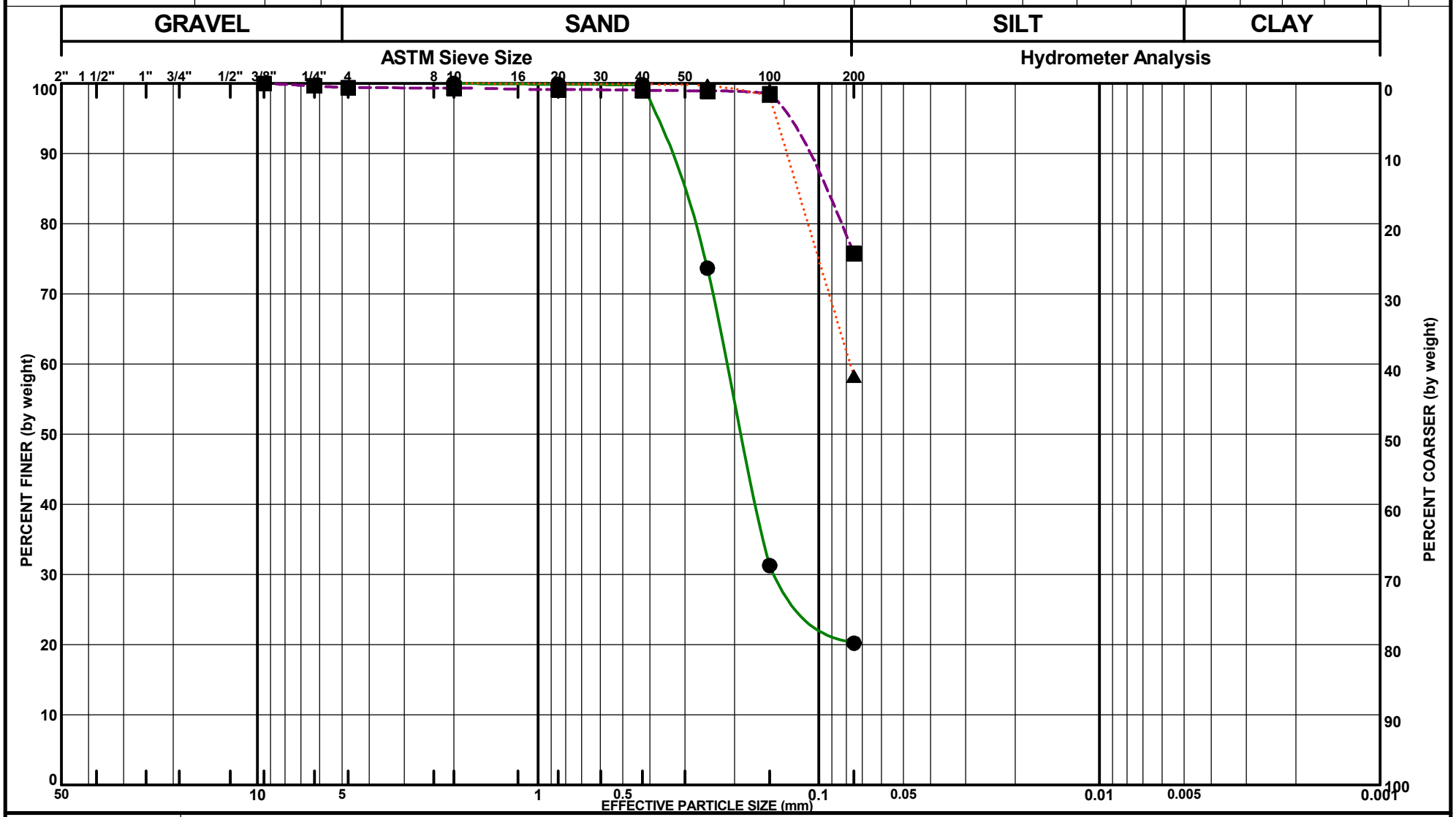
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12f

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-7	16	59.5-61	CLAYEY SAND (SC), gray, fine-grained	0.0	79.8			2	0.212	0.138						
■ B-8	6	15-16	SILT WITH SAND (ML), gray	0.6	23.6			9.5								
▲ B-8	11	30.5-32	SANDY SILT (ML), gray, with shell fragments	0.0	41.7			2	0.077							



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

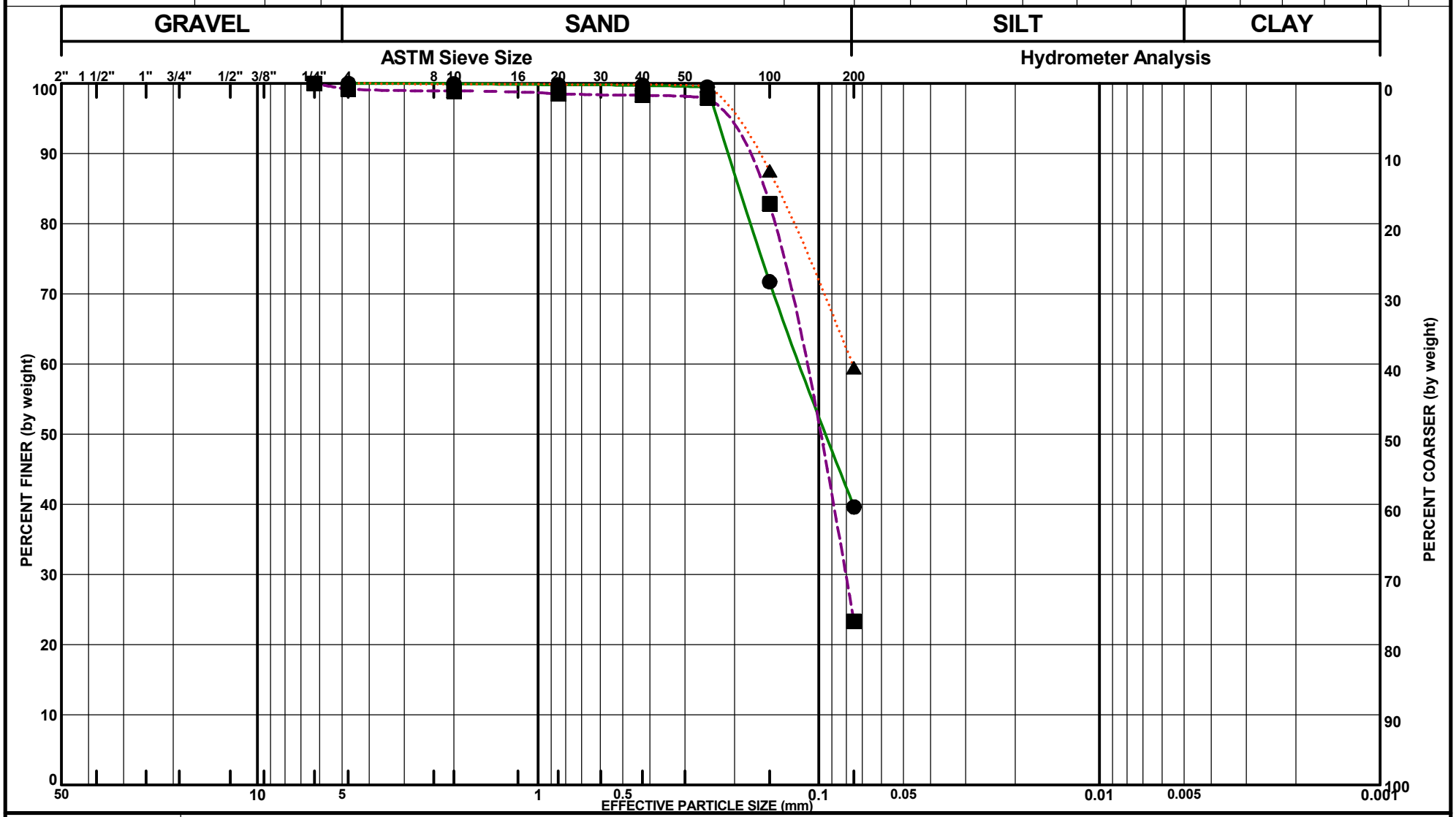
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
HP	9/24/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12g

Boring Number	Sample Number	Depth (ft.)	Material Description	%Gravel	%Sand	%Silt	%Clay	D100	D60	D30	D10	Cc	Cu	LL	PL	PI
● B-9	8	21.5-23	CLAYEY SAND (SC), gray, with organics	0.0	60.4			4.75	0.116							
■ B-9	12	33.5-35	CLAYEY SAND (SC), gray, with organics and shell fragments	0.8	75.8			6.3	0.115	0.081						
▲ B-9	16	59.5-61	SANDY SILT (ML), gray, with clay pockets and organics	0.0	40.6			4.75	0.076							



FCBR GSA LANDSCAPE 04.55104010.GPJ FUGRO DATA TEMPLATE 042610.GDT 11/03/10

Fugro Consultants, Inc

Chenier Ronquille Restoration

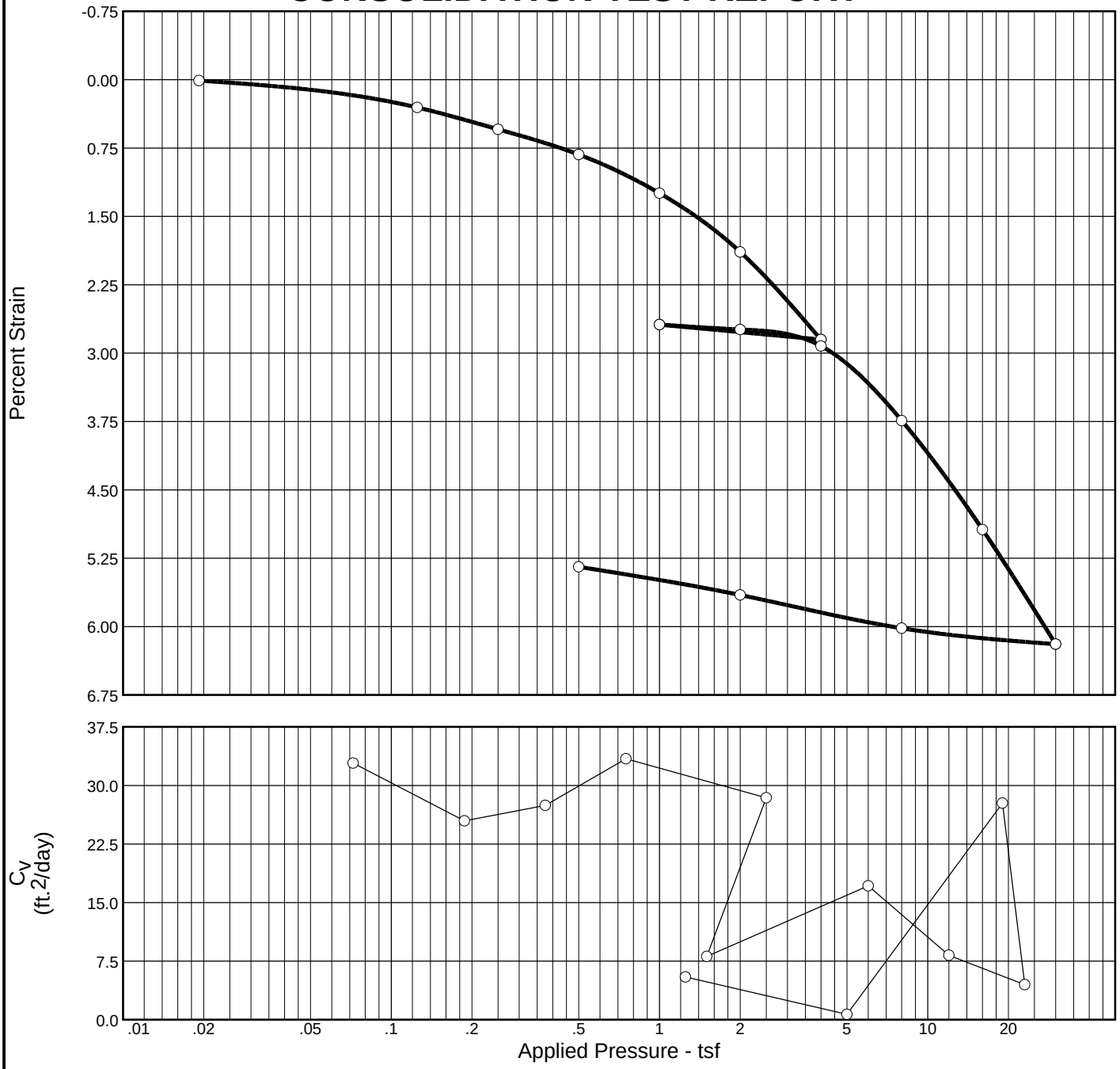
Plaquemines Parish, Louisiana

PARTICLE-SIZE ANALYSIS

ASTM D422/D6913/C136

Tested By:	Date Tested:	Reviewed By:	Date Reviewed:	Project No.	
EEL	9/23/2010	Jennifer Aguettant	10/1/2010	04.55104010	PLATE 12h

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
111.4 %	45.4 %	79.3	38	18	2.63	0.84	2.64	0.09	0.01	1.072

MATERIAL DESCRIPTION	USCS	AASHTO
LEAN CLAY WITH SAND, firm, dark gray	CL	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-2 **Sample No.:** 14B **Elev./Depth:** 40

Fugro Consultants, Inc.

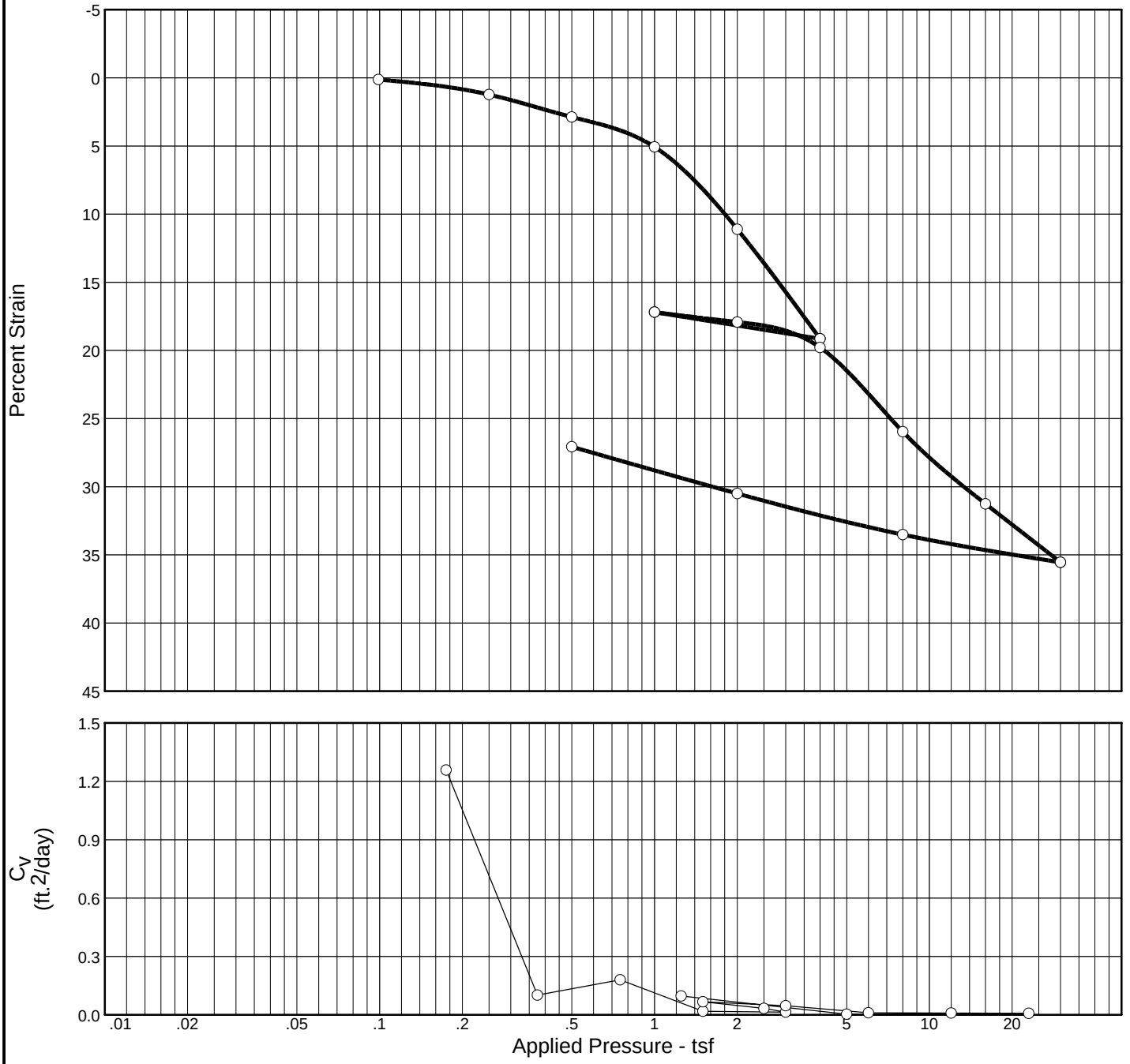
Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by:JSA
Checked by: BN

Plate 13a

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
87.8 %	45.2 %	70.5	62	40	2.70	1.03	0.93	0.54	0.10	1.390

MATERIAL DESCRIPTION	USCS	AASHTO
FAT CLAY, dark gray, with sandy silt	CH	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-2 **Sample No.:** 15B **Elev./Depth:** 50

Fugro Consultants, Inc.

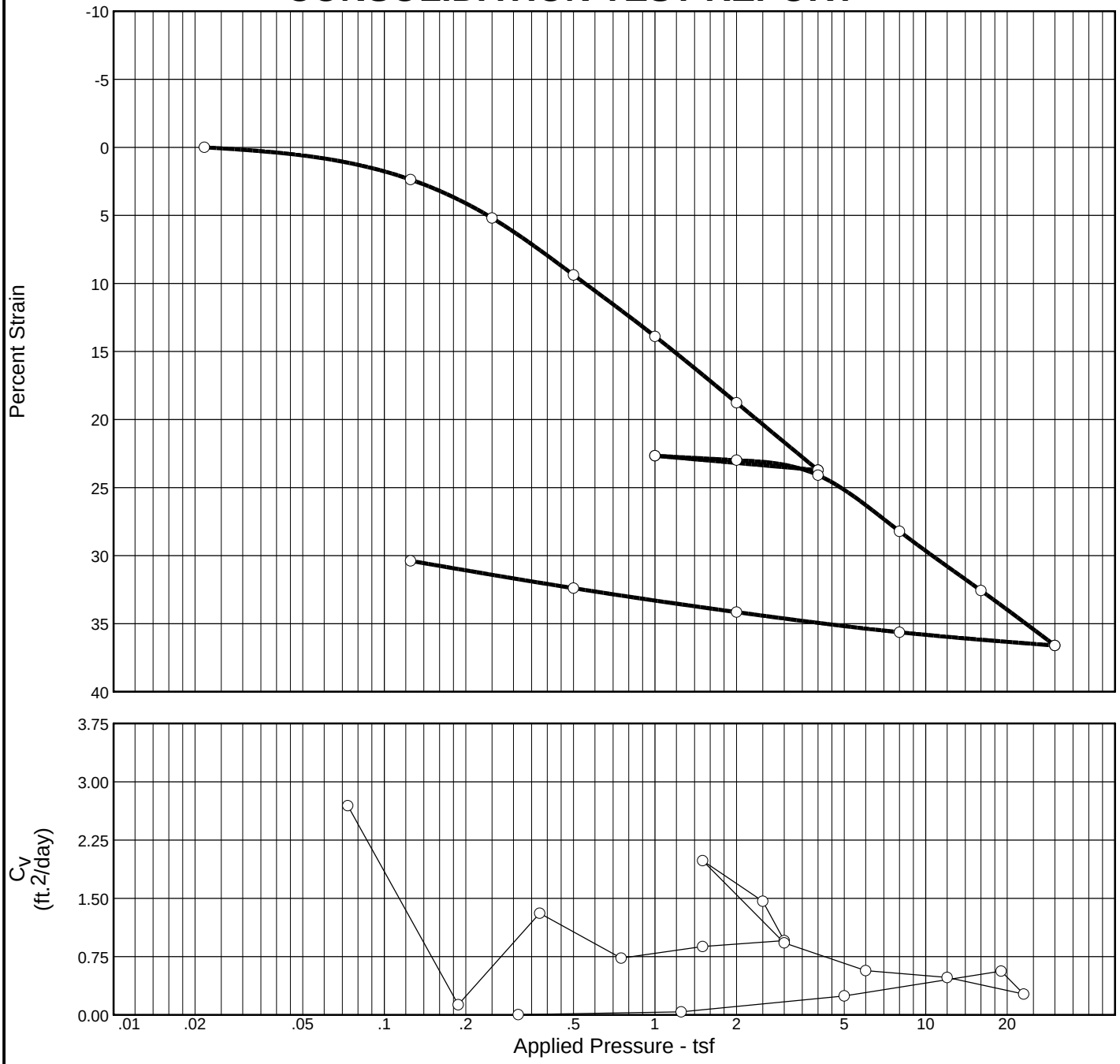
Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by: JSA
Checked by: BN

Plate 13b

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
116.7 %	93.3 %	52.1	77	34	2.50	0.23	0.22	0.45	0.07	1.998

MATERIAL DESCRIPTION	USCS	AASHTO
ELASTIC SILT, very soft to soft, dark gray	MH	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-3 **Sample No.:** 5B **Elev./Depth:** 13

Fugro Consultants, Inc.

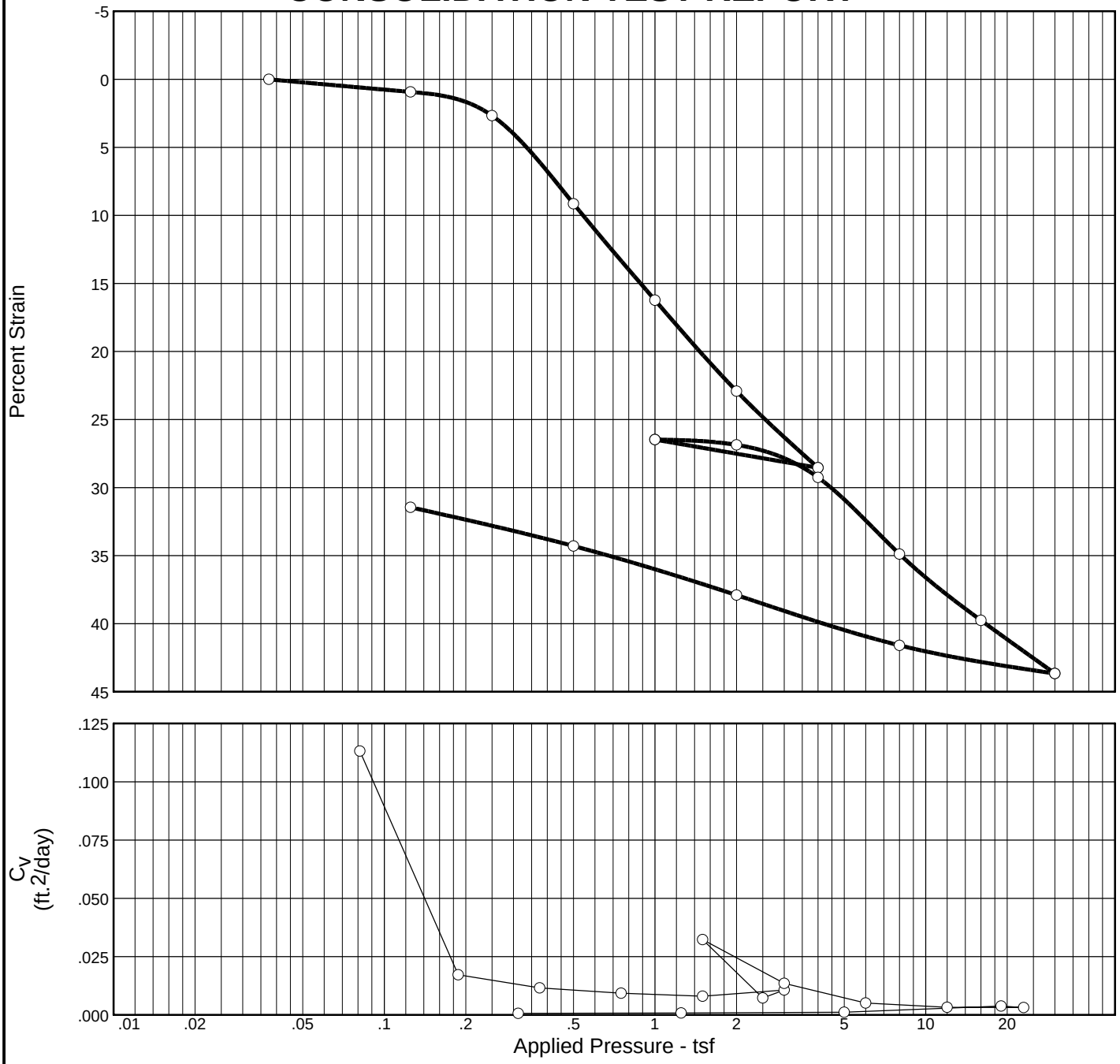
Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by: JSA
Checked by: BN

Plate 13c

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
97.1 %	72.6 %	56.0	97	70	2.72	0.18	0.18	0.62	0.14	2.033

MATERIAL DESCRIPTION	USCS	AASHTO
FAT CLAY, very soft to soft, dark gray	CH	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-4 **Sample No.:** 4B **Elev./Depth:** 10

Fugro Consultants, Inc.

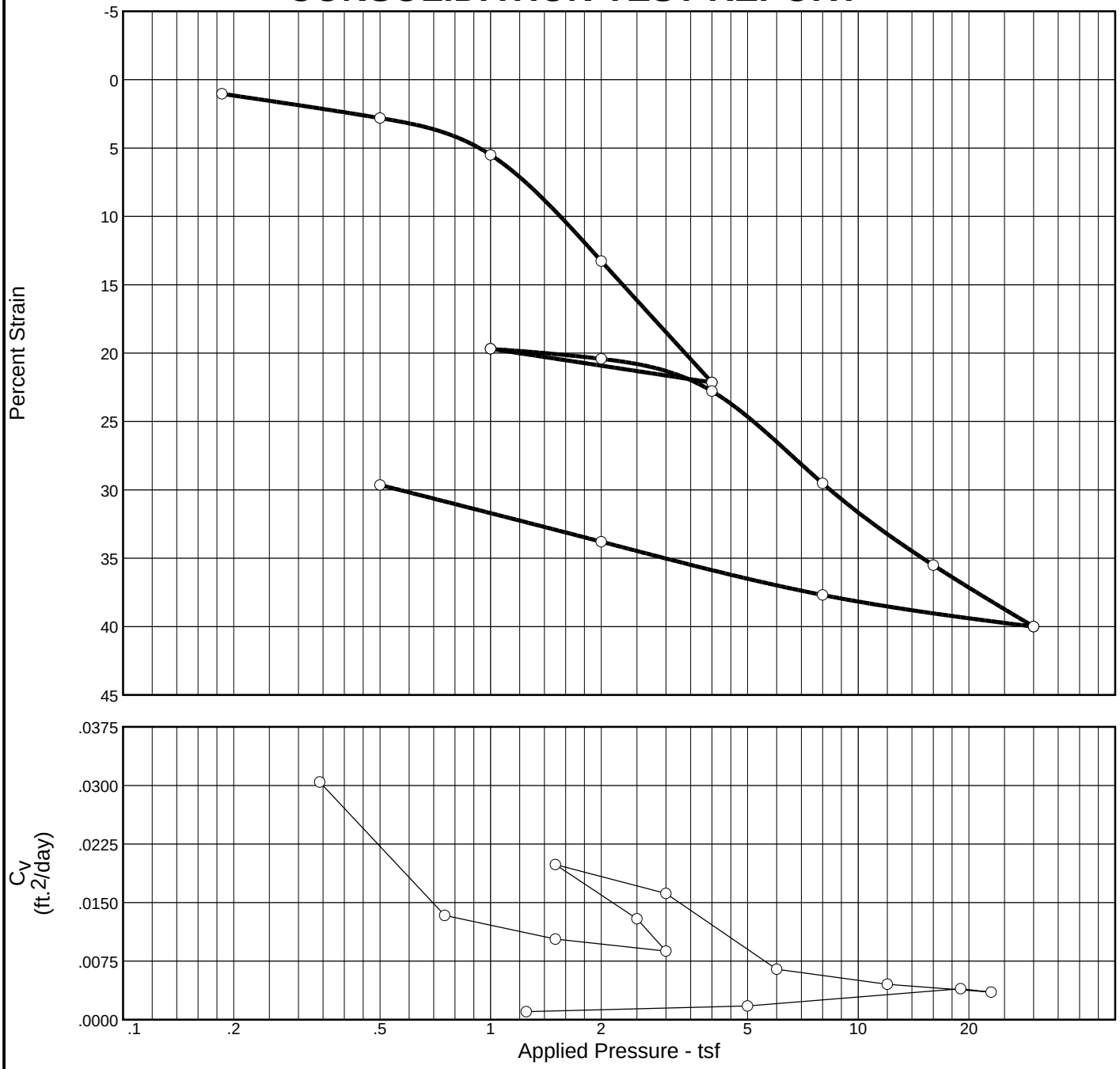
Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by: JSA
Checked by: BN

Plate 13d

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
96.6 %	58.8 %	63.7	85	60	2.69	0.79	0.80	0.64	0.14	1.638

MATERIAL DESCRIPTION	USCS	AASHTO
FAT CLAY, dark gray	CH	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-5 **Sample No.:** 13B **Elev./Depth:** 37

Fugro Consultants, Inc.

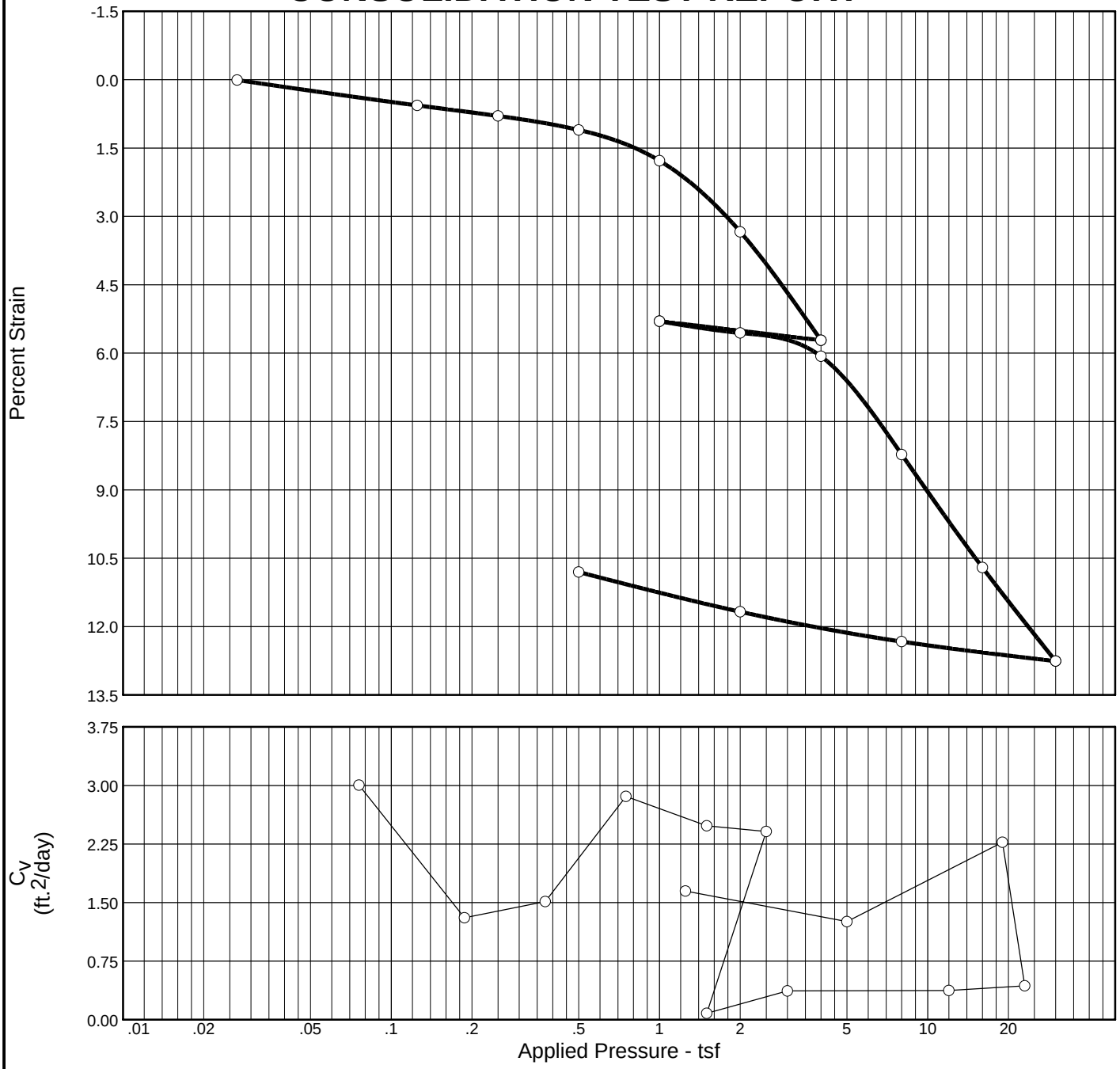
Baton Rouge, LA

Remarks:

Checked by: IK
Calculated by: JSA
Checked by: BN

Plate 13e

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
100.5 %	33.6 %	87.7	28	7	2.65	0.79	1.03	0.14	0.02	0.886

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY CLAY, very soft, gray	CL-ML	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-7 **Sample No.:** 13B **Elev./Depth:** 37

Fugro Consultants, Inc.

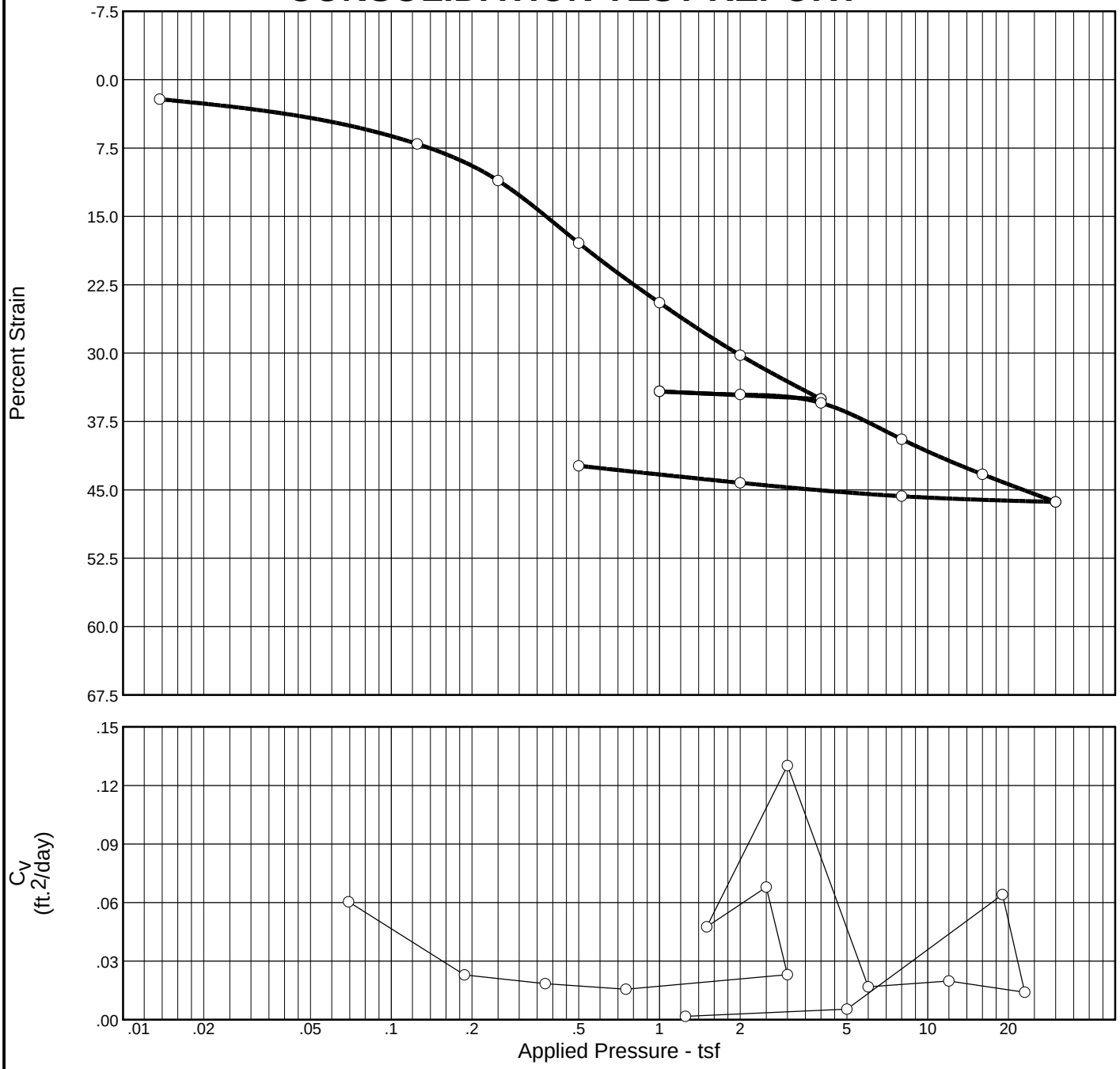
Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by: JSA
Checked by: BN

Plate 13f

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
103.3 %	72.3 %	57.9	68	45	2.65	0.13	0.19	0.57	0.06	1.855

MATERIAL DESCRIPTION	USCS	AASHTO
FAT CLAY, very soft to soft, dark gray	CH	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-8 **Sample No.:** 3B **Elev./Depth:** 7

Fugro Consultants, Inc.

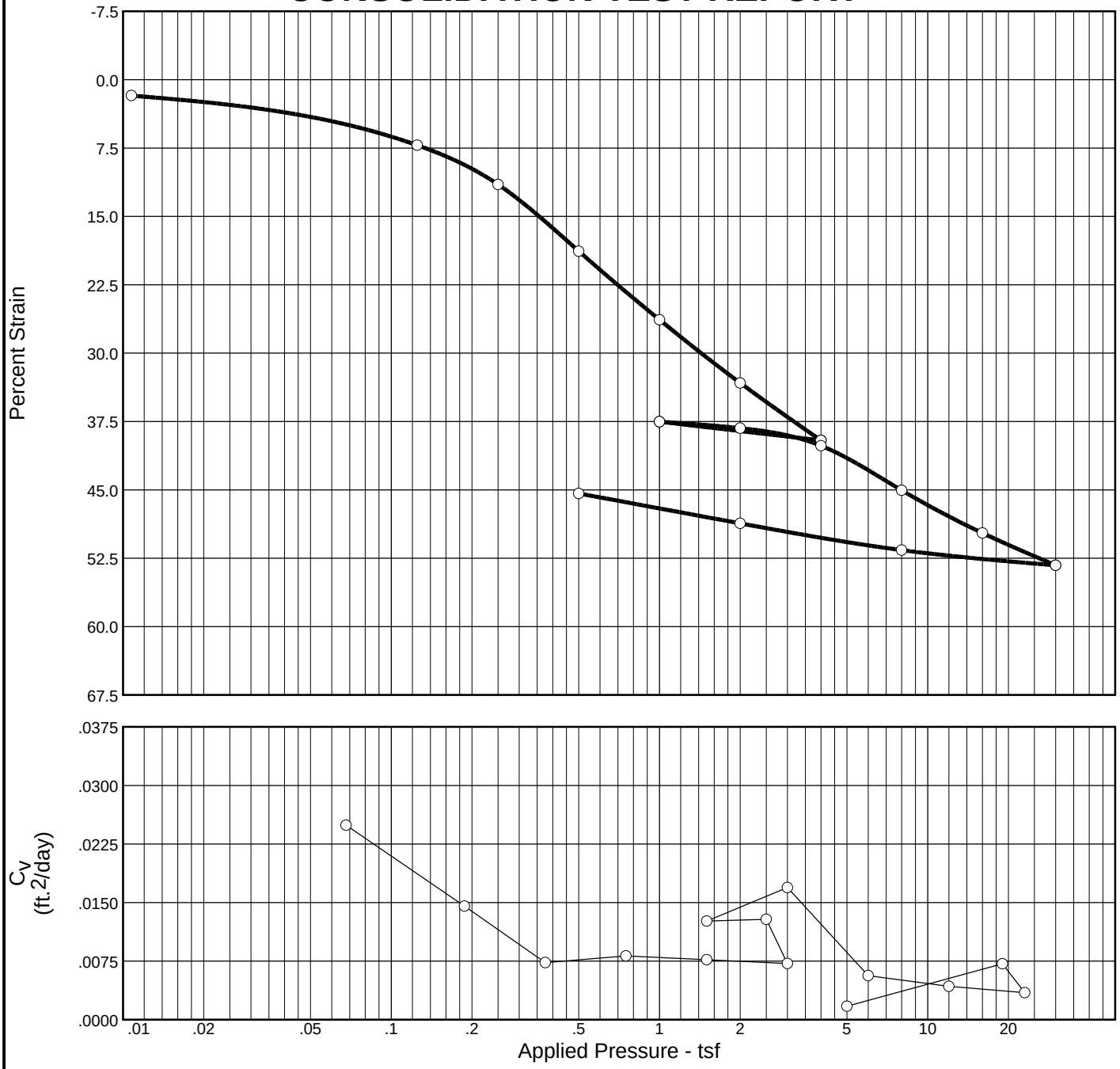
Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by: JSA
Checked by : BN

Plate 13g

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
100.0 %	89.5 %	49.1	88	62	2.66	0.18	0.18	0.80	0.15	2.381

MATERIAL DESCRIPTION	USCS	AASHTO
FAT CLAY, very soft, dark gray	CH	

Project No. 04.55104010 **Client:** CPE

Project: Chenier Ronquille Restoration

Source: B-9 **Sample No.:** 4B **Elev./Depth:** 10

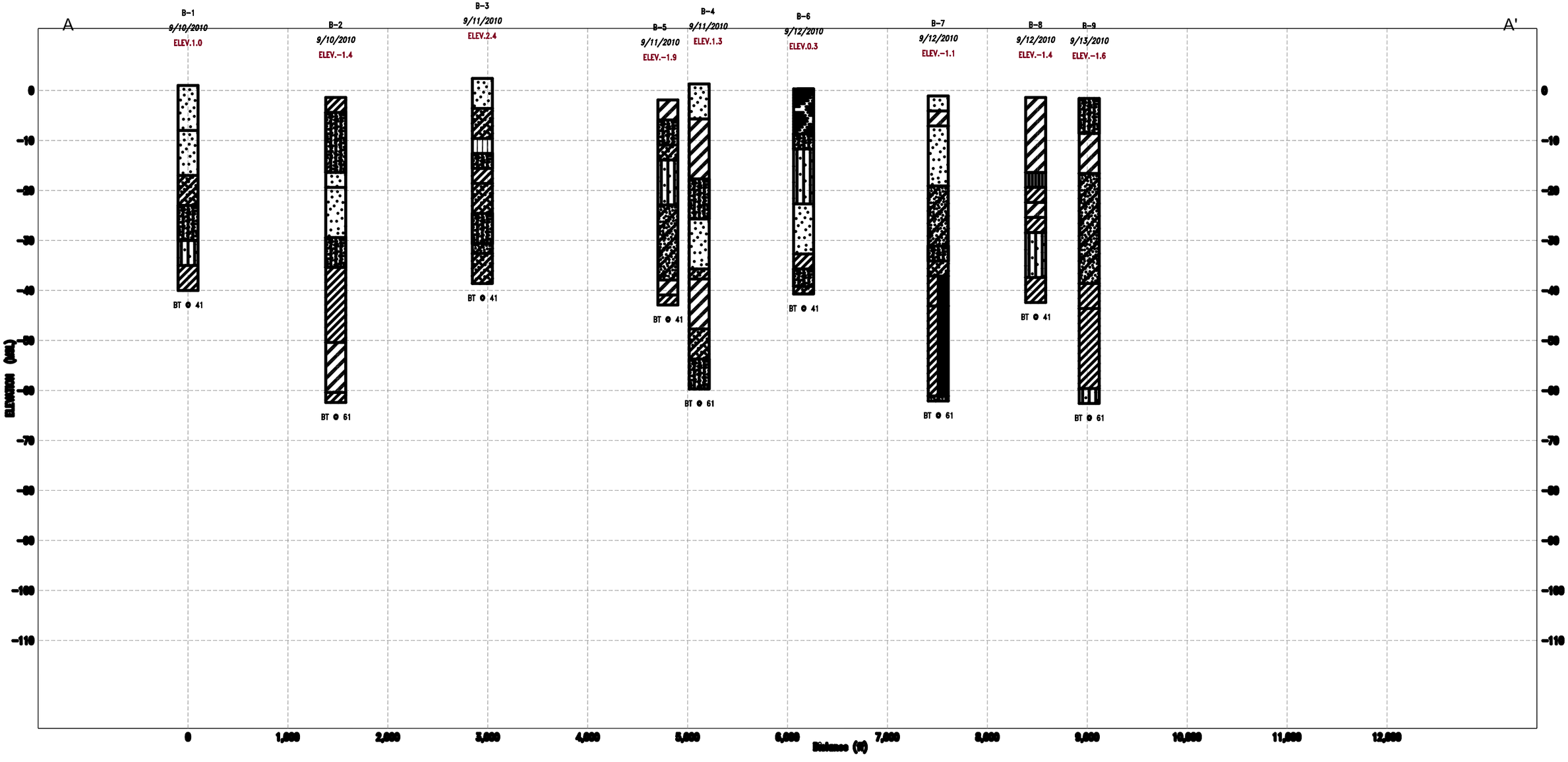
Fugro Consultants, Inc.

Baton Rouge, LA

Remarks:

Tested by: IK
Calculated by: JSA
Checked by: BN

Plate 13h



LITHOLOGY GRAPHICS

- Fat clay, high plasticity
- Lean clay, low to moderate plasticity
- Low plasticity, silty clay
- Sandy, lean clay, low to moderate plasticity
- Elastic silt
- Low to moderate plasticity silt
- Sandy, non-plastic to low plasticity silt
- High plasticity, organic soil
- Clayey sand
- Silty Sand
- Clean sand, poorly graded

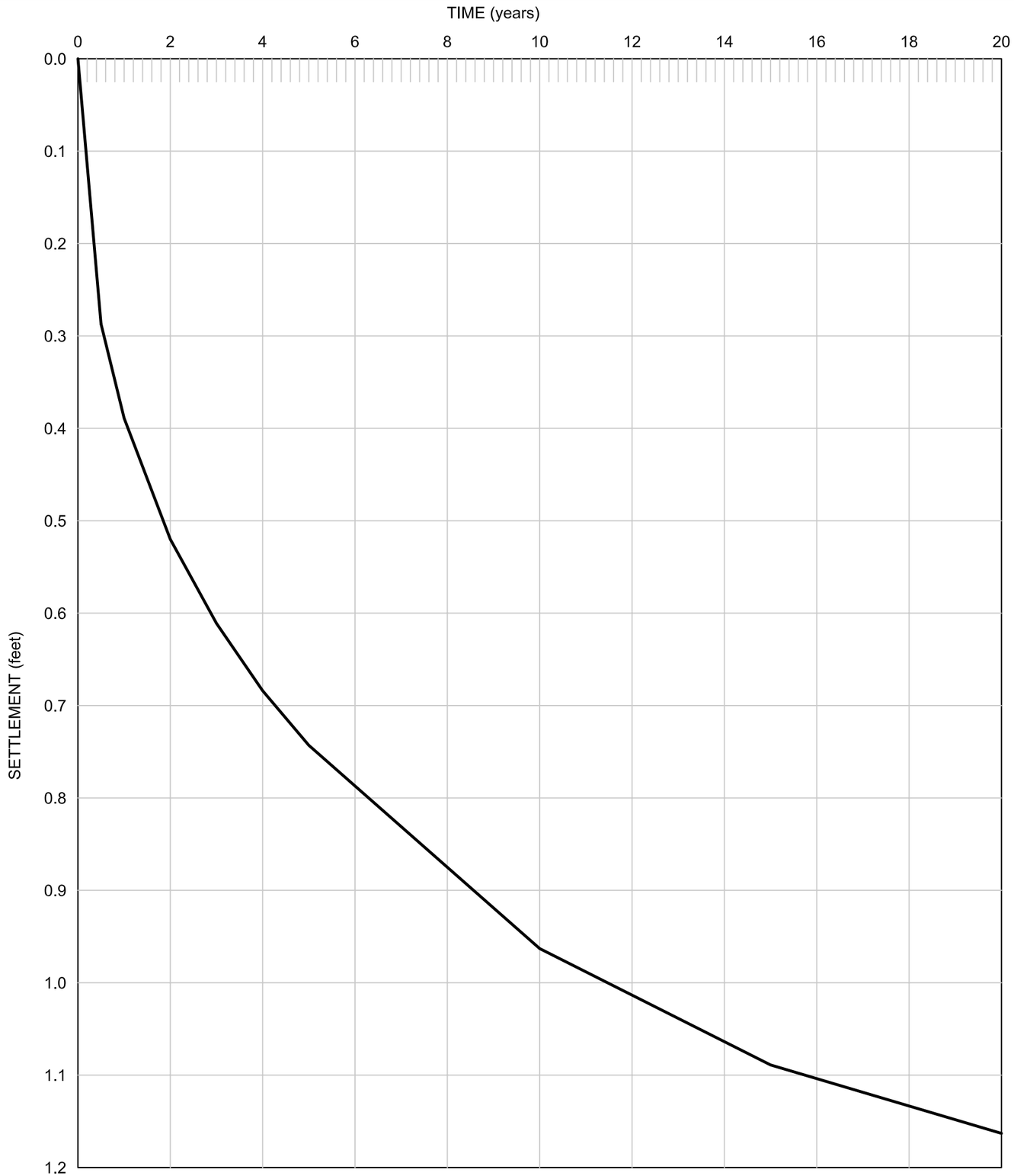
FUGRO

CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

GENERALIZED SUBSURFACE PROFILE

SIZE	PROJECT NO.		REV.
B	04.55104010		0
SCALE: AS SHOWN	DRAWN BY: DMS	CHKD BY: BN	DATE: 06/29/11	Plate No.: 14

June 29, 2011 04.55104010 Plate 14 General Cross Section Rev.dwg



ANALYSIS RESULTS	
TIME (years)	SETTLEMENT (feet)
0.0	0.000
0.5	0.306
1.0	0.413
2.0	0.549
3.0	0.644
4.0	0.718
5.0	0.782
10.0	1.003
15.0	1.134
20.0	1.209
Long-Term	1.316

FUGRO

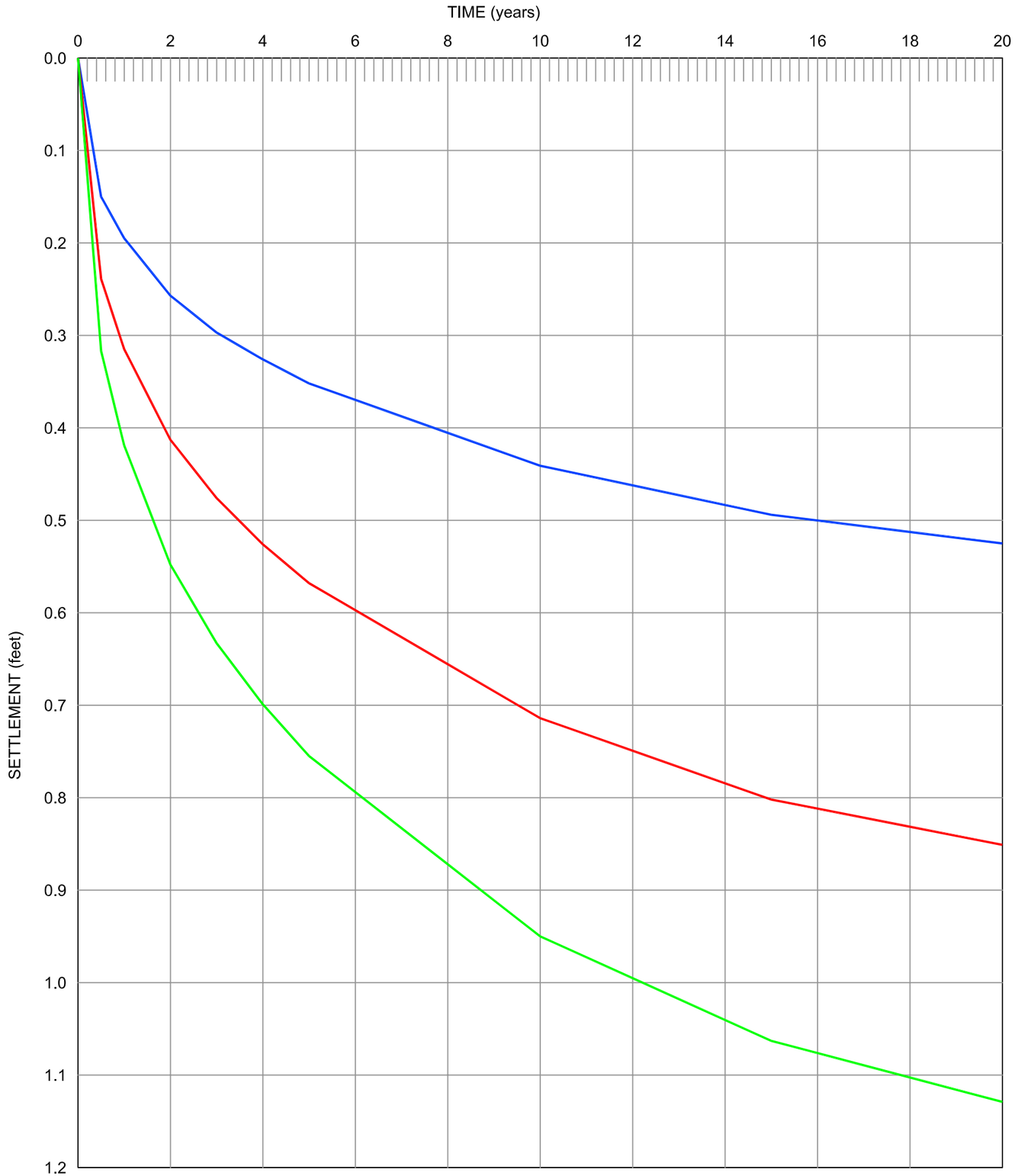
CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

TIME-RATE SETTLEMENT
BENEATH CONTAINMENT DIKE

SIZE	PROJECT NO.		REV.
B	04.55104010		0

SCALE:	DRAWN BY:	CHKD BY:	DATE:	Plate No.:
AS SHOWN	DMS	BN	11/05/10	15

November 5, 2010 04.55104010 Plate 15 Time vs Settlement Beneath Dike.dwg



ANALYSIS RESULTS			
TIME (years)	SETTLEMENT (feet)		
	EL. +1'	EL. +2'	EL. +3'
0.0	0.000	0.000	0.000
0.5	0.150	0.239	0.317
1.0	0.195	0.315	0.419
2.0	0.257	0.413	0.548
3.0	0.297	0.476	0.633
4.0	0.326	0.526	0.699
5.0	0.352	0.568	0.755
10.0	0.441	0.714	0.950
15.0	0.494	0.802	1.063
20.0	0.525	0.851	1.129
Long-Term	0.568	0.923	1.224

NOTE:
Groundwater elevation is +0' for all elevations shown.

L E G E N D:

ELEVATION +1'

ELEVATION +2'

ELEVATION +3'

August 20, 2011 04.55104010 Time vs Settlement Beneath Marsh.dwg

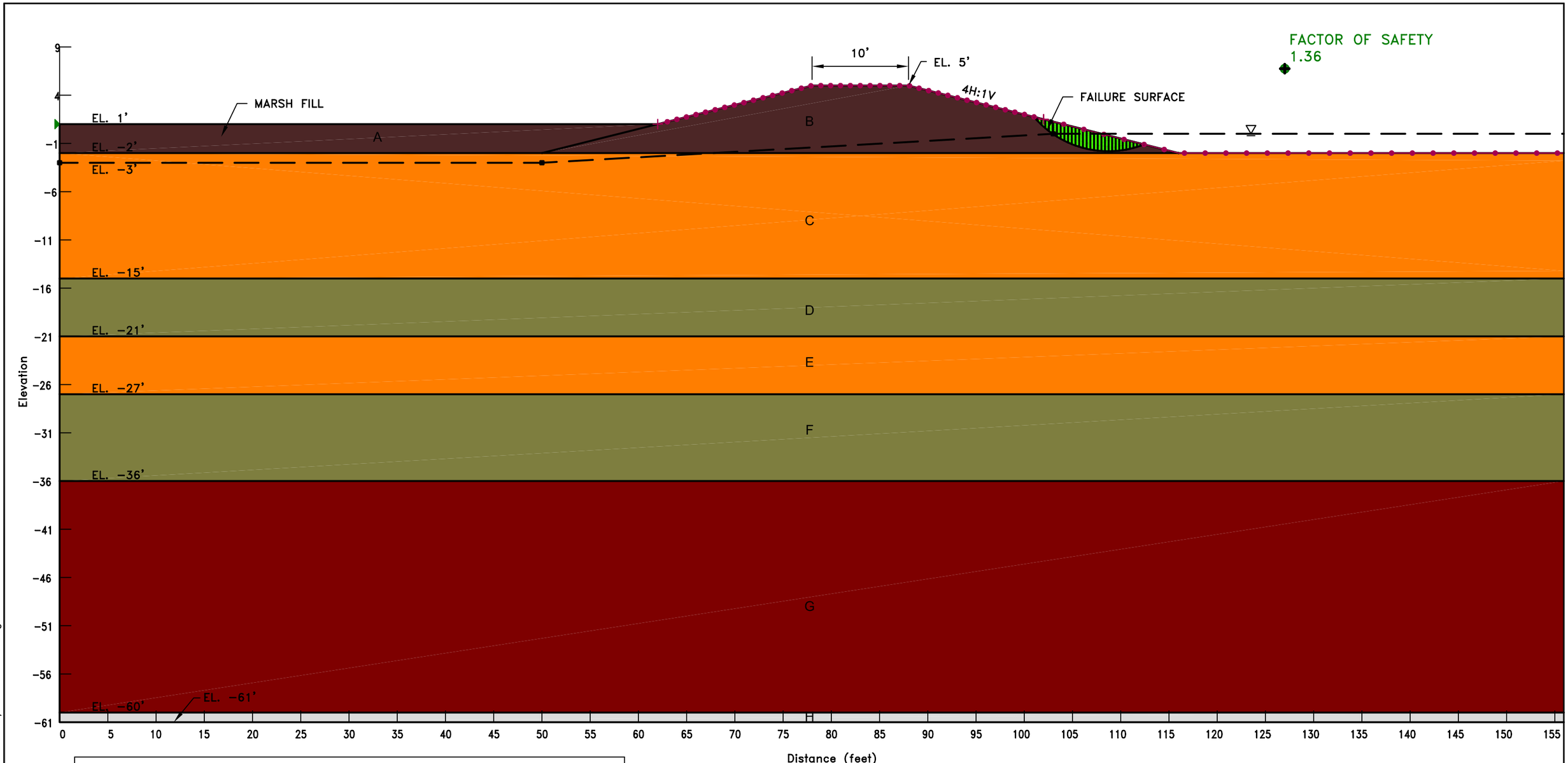
FUGRO

CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

TIME-RATE SETTLEMENT
BENEATH MARSH FILL

SIZE	PROJECT NO.		REV.
B	04.55104010		0

SCALE:	DRAWN BY:	CHKD BY:	DATE:	Plate No.:
AS SHOWN	DMS	BN	08/20/11	



SOIL PARAMETERS				
LAYER	SOIL TYPE	COHESION (psf)	TOTAL UNIT WEIGHT (pcf)	FRICTION ANGLE (degrees)
A	MARSH	0	85	0
B	FILL	0	85	25
C	CLAY	150	100	0
D	SILT WITH SAND	200	117	20
E	CLAY	150	97	0
F	SANDY SILT	200	117	20
G	SILTY CLAY	250	102	0
H	CLAYEY SAND	0	120	30

FUGRO

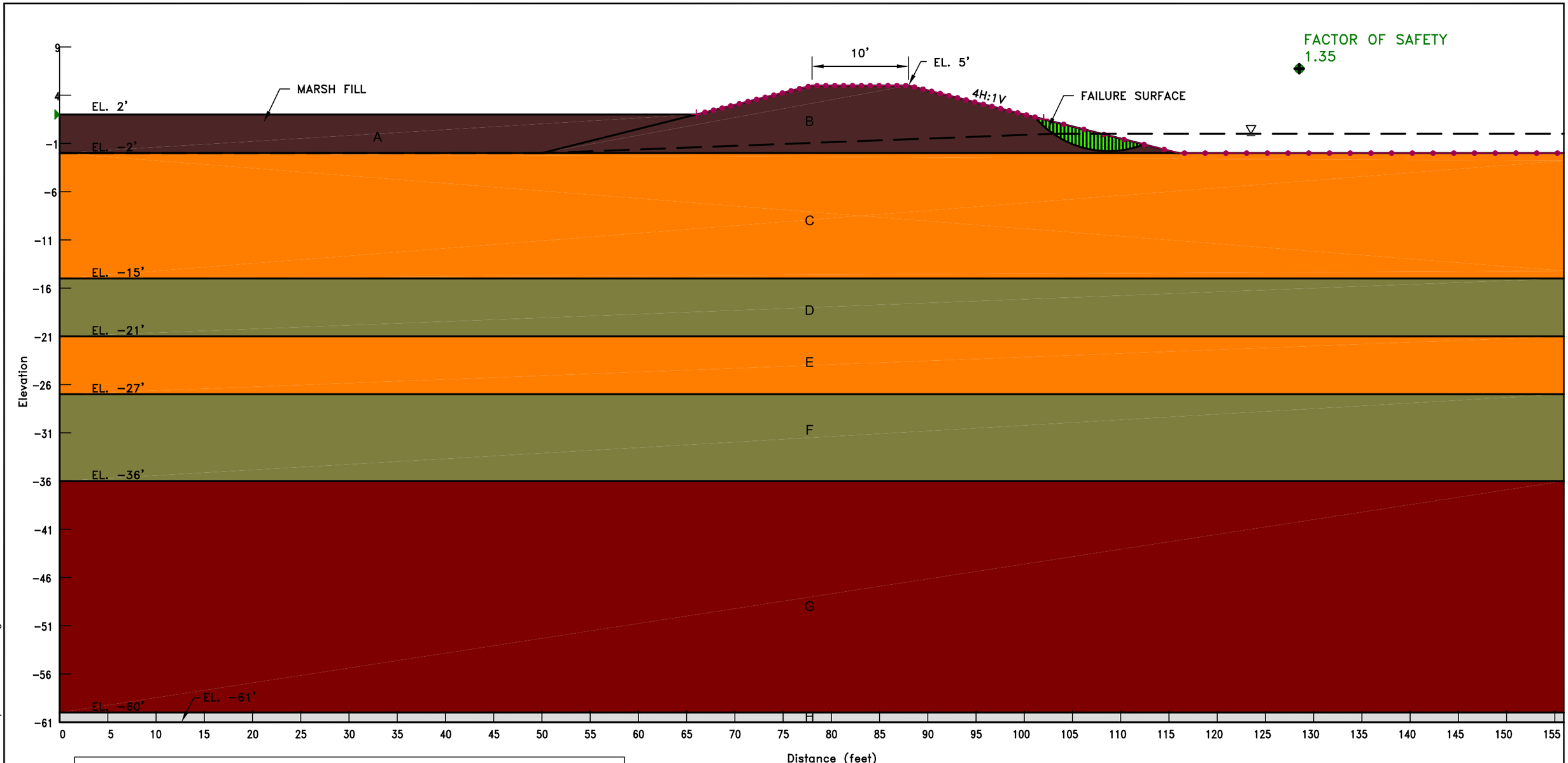
CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

SLOPE STABILITY
MARSH AT ELEVATION +1'

SIZE	PROJECT NO.		REV.
B	04.55104010		0

SCALE:	DRAWN BY:	CHKD BY:	DATE:	Plate No.:
AS SHOWN	DMS	BN	06/29/11	17

June 29, 2011 04.55104010 Plate 17 Slope Stability at Elev +1.dwg



SOIL PARAMETERS				
LAYER	SOIL TYPE	COHESION (psf)	TOTAL UNIT WEIGHT (pcf)	FRICTION ANGLE (degrees)
A	MARSH	0	85	0
B	FILL	0	85	25
C	CLAY	150	100	0
D	SILT WITH SAND	200	117	20
E	CLAY	150	97	0
F	SANDY SILT	200	117	20
G	SILTY CLAY	250	102	0
H	CLAYEY SAND	0	120	30

FUGRO

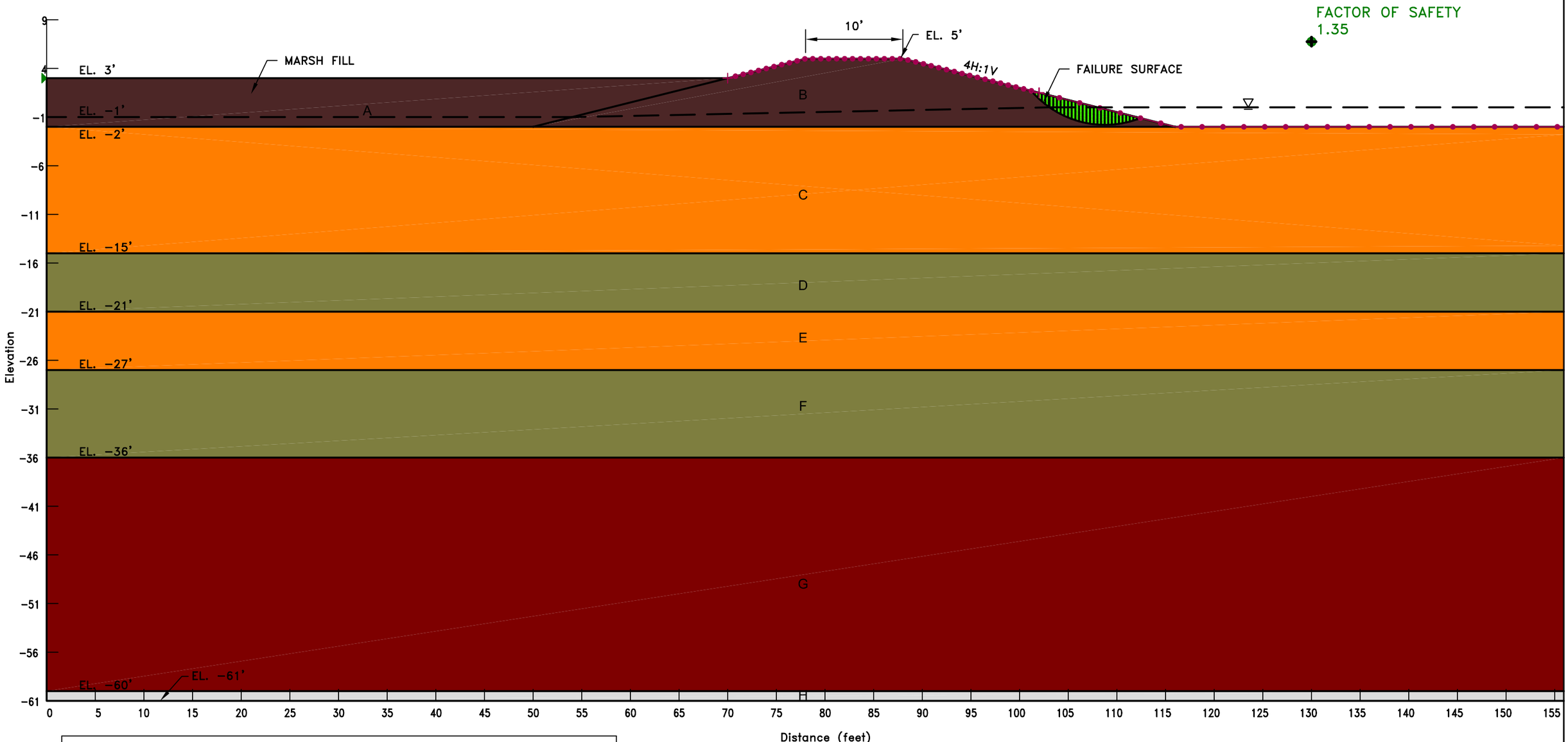
CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

SLOPE STABILITY
MARSH AT ELEVATION +2'

SIZE	PROJECT NO.		REV.
B	04.55104010		0

SCALE:	DRAWN BY:	CHKD BY:	DATE:	Plate No.:
AS SHOWN	DMS	BN	06/29/11	18

June 29, 2011 04.55104010 Plate 18 Slope Stability at Elev +2.dwg



SOIL PARAMETERS				
LAYER	SOIL TYPE	COHESION (psf)	TOTAL UNIT WEIGHT (pcf)	FRICTION ANGLE (degrees)
A	MARSH	0	85	0
B	FILL	0	85	25
C	CLAY	150	100	0
D	SILT WITH SAND	200	117	20
E	CLAY	150	97	0
F	SANDY SILT	200	117	20
G	SILTY CLAY	250	102	0
H	CLAYEY SAND	0	120	30

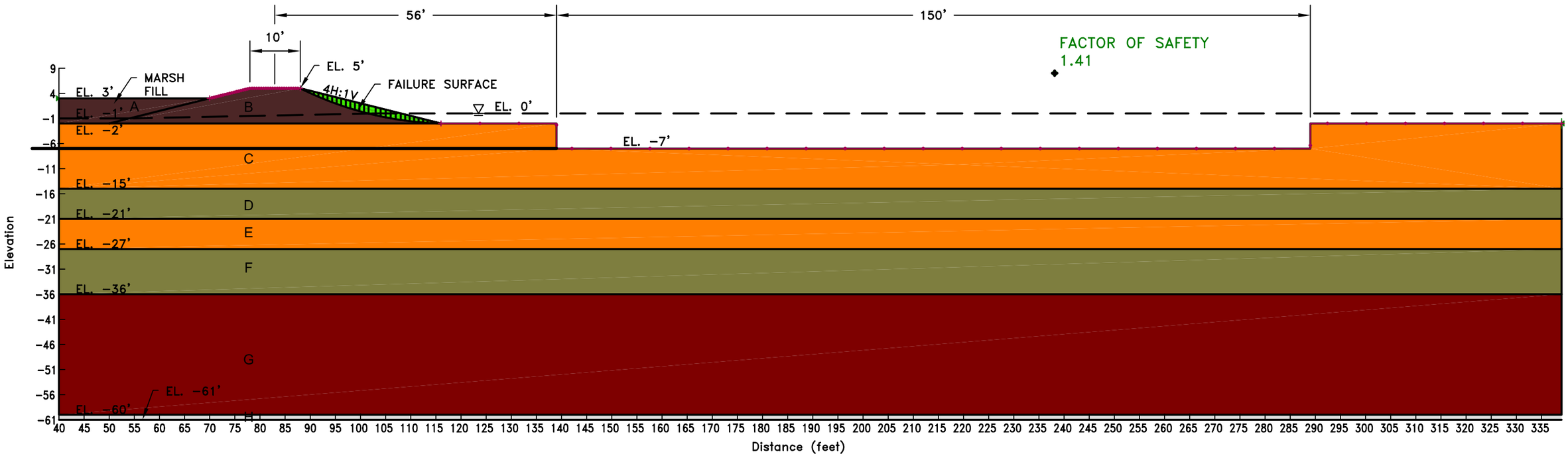
FUGRO

CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

SLOPE STABILITY
MARSH AT ELEVATION +3'

SIZE	PROJECT NO.		REV.
B	04.55104010		0
SCALE: AS SHOWN	DRAWN BY: DMS	CHKD BY: BN	DATE: 06/29/11	Plate No.: 19

June 29, 2011 04.55104010 Plate 19 Slope Stability at Elev +3.dwg



SOIL PARAMETERS				
LAYER	SOIL TYPE	COHESION (psf)	TOTAL UNIT WEIGHT (pcf)	FRICTION ANGLE (degrees)
A	MARSH	0	85	0
B	FILL	0	85	25
C	CLAY	150	100	0
D	SILT WITH SAND	200	117	20
E	CLAY	150	97	0
F	SANDY SILT	200	117	20
G	SILTY CLAY	250	102	0
H	CLAYEY SAND	0	120	30

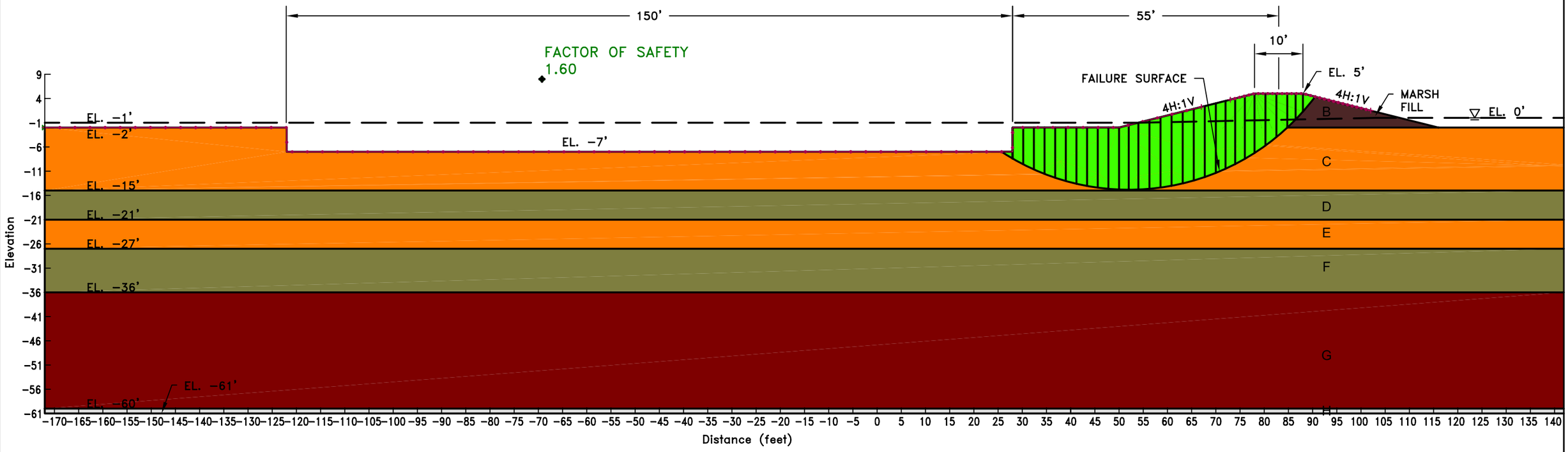
FUGRO

CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

SLOPE STABILITY - MARSH AT ELEVATION +3' AND OUTSIDE CONTAINMENT DIKE EXCAVATION

SIZE	PROJECT NO.		REV.
B	04.55104010		0
SCALE: AS SHOWN	DRAWN BY: DMS	CHKD BY: BN	DATE: 08/11/11	Plate No.: 20

August 11, 2011 04.55104010 Plate 20 Slope Stability at Elev +3 Outside Excavation.dwg



SOIL PARAMETERS				
LAYER	SOIL TYPE	COHESION (psf)	TOTAL UNIT WEIGHT (pcf)	FRICTION ANGLE (degrees)
A	MARSH	0	85	0
B	FILL	0	85	25
C	CLAY	150	100	0
D	SILT WITH SAND	200	117	20
E	CLAY	150	97	0
F	SANDY SILT	200	117	20
G	SILTY CLAY	250	102	0
H	CLAYEY SAND	0	120	30

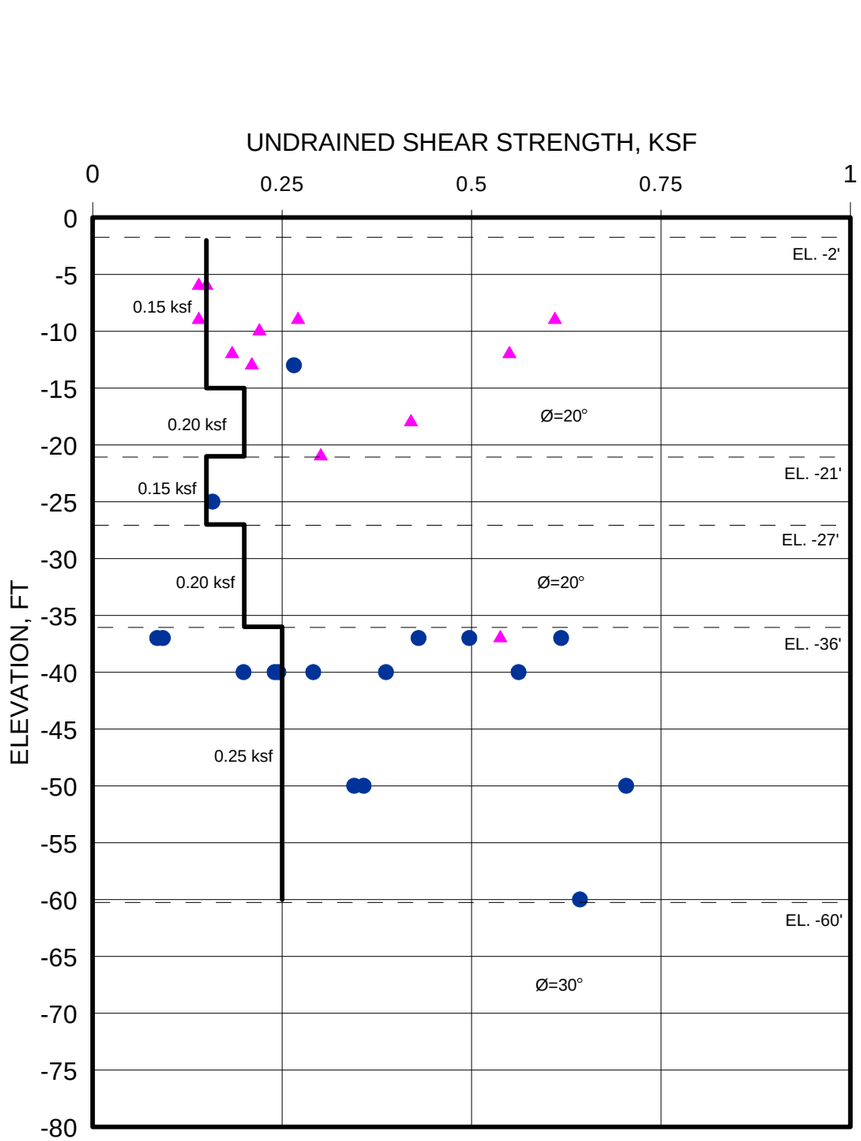
FUGRO

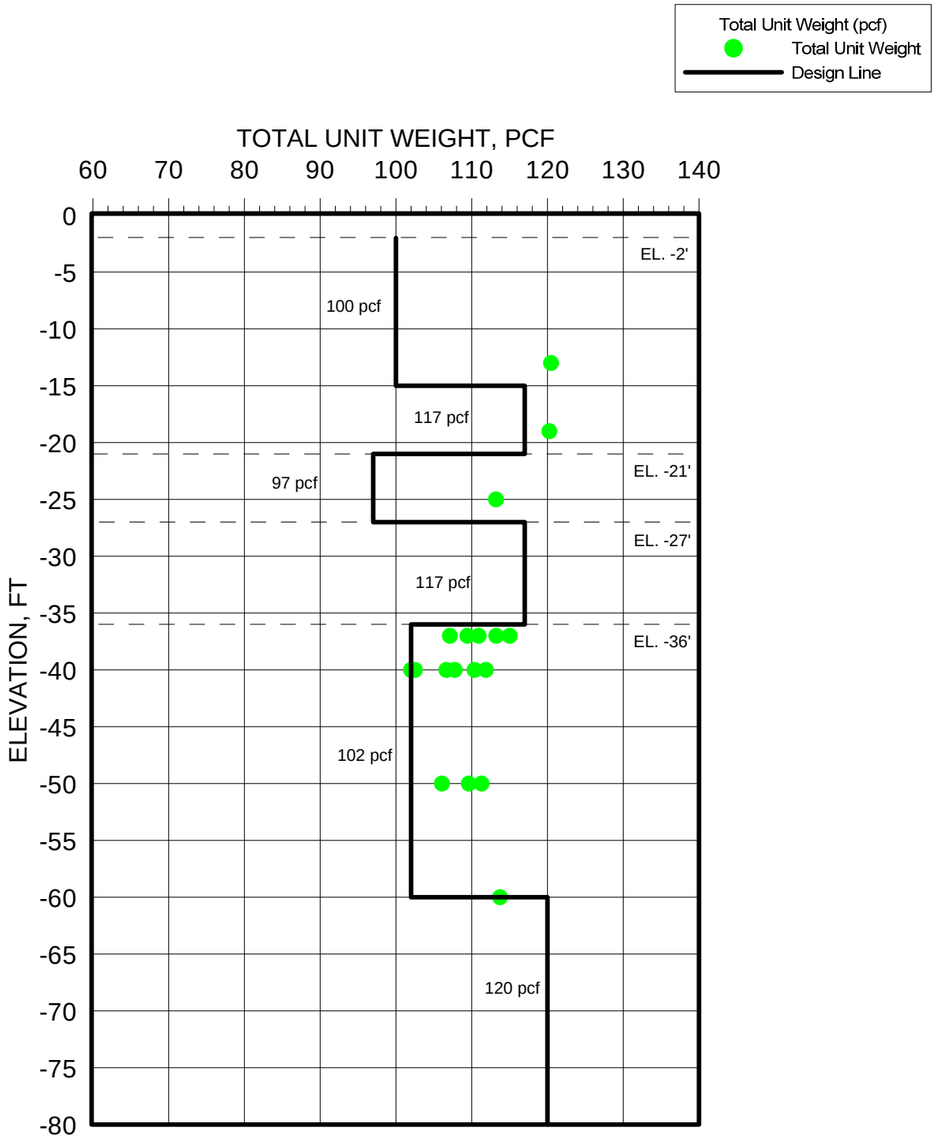
CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

SLOPE STABILITY - CONTAINMENT DIKE
EXCAVATION IN MARSH FILL AREA

SIZE	PROJECT NO.		REV.
B	04.55104010		0
SCALE: AS SHOWN	DRAWN BY: DMS	CHKD BY: BN	DATE: 08/11/11	Plate No.: 21

August 11, 2011 04.55104010 Plate 21 Slope Stability at Excavation.dwg





Fugro Consultants, Inc.

DESIGN STRENGTH AND UNIT WEIGHT

CHENIER RONQUILLE RESTORATION
PLAQUEMINES PARISH, LOUISIANA

Project No.: 04.55104010

Reviewed by: Jennifer Aguettant	Date: 06/30/11	Approved by: Eric Marx	Date: 06/30/11	PLATE 22

APPENDIX A

SUMMARY OF TEST RESULTS

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.5-2				31		8													
3	6.5-8				34		20													
5	12.5-14				26		5													
7	18-19	0.58	38	14	28				0.40	0.42										
7b	19-20				56															
8	21-22								0.30	0.30										
9	24.5-26				24		14													
11	30.5-32				40		53													
13	36-37	1.31	33	21	37															
13b	37-38				39	81						UU	39	29	0.62		4.7	81	15.0	A

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-1

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
2	3.5-5				60		41													
4	9.5-11				33		12													
6	15-16				26		10													
8	21.5-23				28		6													
10	27.5-29				28		35													
12	33.5-35				44		73													
13b	37-38				44	77						UU	44	29	0.50		1.6	77	11.4	A
14b	40-41		38	20																
15b	50-51	0.57	62	22	45															
16a	59-60	5.13	31	23	63															
16b	60-61				44	79						UU	44	47	0.64		1.5	79	4.5	A,C

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-2

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.5-2				27		11													
3	6.5-8				71		77													
4	9-10								0.30	0.61										
5	12-13								0.30	0.18										
5b	13-14	1.47	77	43	93															
6	15-16																			
7	18-19																			
7b	19-20				32	91						UU	32	15	1.66		8.6	91	15.0	A,C
8	21-22				70		84													
11	30.5-32				27		33													
13	36-38	1.05	35	20	36															
13b	37-38				49	77						UU	49	29	0.43		2.1	77	6.3	A
14	39-41				35		60													

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-3

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
2	3.5-5				29		10													
4	9-10								0.20	0.27										
4b	10-11	0.66	97	27	73															
5	12-13								0.30											
5b	13-14				32	91						UU	32	10	0.27		5.1	91	15.0	A
6	15-16								0.30											
7	18-19	0.93	78	27	75				0.20											
7b	19-20				33															
9	24.5-26				27		44													
11	30.5-32				25		23													
13	36.5-38				49		77													
14b	40-41				54	66						UU	54	31	0.56		1.1	66	5.0	C
14B	40.00001-41				67	61						UU	67	31	0.29		3.1	61	13.1	A
15b	50-51				45	77						UU	45	39	0.35		1.4	77	14.8	C
16b	60-61				26		38													

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-4

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.5-2	1.50	132	34	181															
2	3.5-5				90		32													
4	9-10	3.31	28	19	51		76		0.30											
6	15.5-17				33		54													
8	22-23				33		11													
10	27.5-29				31		17													
12	33.5-35				26		27													
13B	37-38	0.57	85	25	59															
14	39-40	0.72	46	16	38															
14B	40-41				61	66						UU	61	31	0.25		1.1	66	11.1	A

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-5

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.5-2																			
2	3.5-5	1.28	164	45	197		79													
3	6-7				138		84													
4	9.5-11				31		20													
6	15-16				32		81													
7B	19-20																			
9	24.5-26				29		12													
12	33-34	0.89	46	18	43															
12B	34-35																			
13	36-37				37		46													

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-6

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
2	3.5-5	1.32	76	21	94															
3	6.5-8				28		9													
5	12.5-14				27		16													
	15.49-																			
7	18-19		NP	NP	28															
7B	19-20																			
9	24.5-26				30		24													
11	30.5-32				29		40													
13B	37-38	2.02	28	21	34															
14B	40-41				45	76						UU	45	29	0.24		2.6	76	14.8	A
14B	40.00001-41				59	70						UU	59	29	0.20		3.1	70	15.0	A
15B	50-51				44	76						UU	44	39	0.36		1.7	76	15.0	A,B
16	59.5-61				32		20													

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-7

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.5-2	1.16	83	24	93															
3	6-7								0.30	0.14										
3B	7-8		68	23																
4	9-10																			
4B	10-11				54				0.30	0.22	0.17									
5	12-13				72				0.40	0.55										
6	15-16				38		76													
8	21-22	0.60	51	18	38															
9B	25-26				43	79						UU	43	19	0.16		3.4	79	14.6	A
11	30.5-32				33		58													
13B	37-38				40	78						UU	40	29	0.09		2.7	78	14.9	A
13B	37.00001-38				54	70						UU	54	29	0.09		4.1	70	15.0	A
14	39.5-41				63		91													

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

Fugro Consultants, Inc

Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-8

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010

Sample No.	Depth (ft)	Identification Tests						Field Shear Strength Estimate		Miniature Vane Tests		Compression Tests								
		Liquidity Index	Liquid Limit (%)	Plastic Limit (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Passing No. 200 Sieve (%)	Penetrometer* (ksf)	Torvane (ksf)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	Type Test	Moisture Content (%)	Confining Pressure (psi)	Shear Strength (ksf)	Remolded Shear Strength (ksf)	E50 Strain (%)	Dry Unit Weight (pcf)	Failure Strain (%)	Type of Failure
1	0.5-2				44		38													
3	6-7		NP	NP	39		36		0.20	0.15										
3B	7-8				65															
4	9-10								0.20	0.14										
4B	10-11	1.04	88	26	90															
5	12-13																			
5B	13-14				93				0.20	0.21	0.15									
8	21.5-23				28		40													
10	27.5-29				36		37													
12	33.5-35				35		23													
13B	37-38				54				0.50	0.54										
14	39-40	0.84	45	20	41															
14B	40-41				48	73						UU	48	31	0.39		1.4	73	11.6	A
15B	50-51				52	70						UU	52	39	0.70		1.0	70	3.2	B
16	59.5-61				26		59													

Notes:

NP = Non-Plastic Material
*Corrected as described on Terms and Symbols Used on Boring Logs.

TYPE OF TEST
U - Unconfined Compression
UU - Unconsolidated - Undrained Triaxial
CU - Consolidated - Undrained Triaxial

TYPE OF FAILURE
A - Bulge
B - Single Shear Plane
C - Multiple Shear Plane
D - Vertical Fracture

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Chenier Ronquille Restoration

SUMMARY OF TEST RESULTS - BORING B-9

LELAP Lab ID #10001

Plaquemines Parish, Louisiana

Project No.
04.55104010