



**US Army Corps  
of Engineers** ®  
Detroit District

## **APPENDIX B**

### **GEOTECHNICAL APPENDIX**

**Detroit Beach Section 205  
Frenchtown Township, Michigan**

**Detroit Beach  
Frenchtown Township, Michigan  
Geotechnical Appendix**

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## **Detroit Beach – Section 205 Subsurface Conditions Summary**

### **Project Location**

The project site for the Detroit Beach Section 205 Flood Control Project is located along Lake Erie in Frenchtown Township, Monroe County, Michigan. Refer to Figure 1 below for the approximate project location.

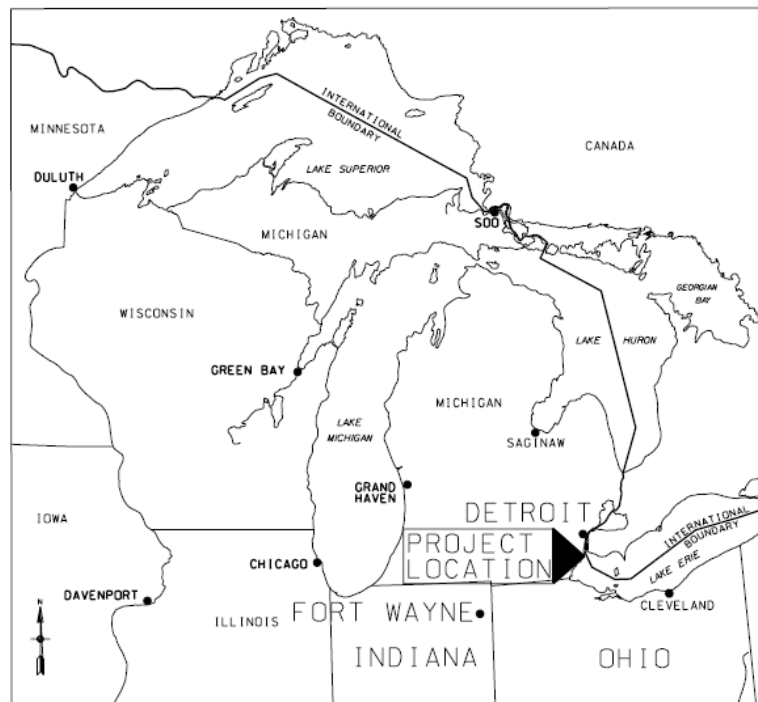


Figure 1. Project Location.

### **Site Geology**

The geology in the vicinity of the project site generally consists of lacustrine clays, silts and sands overlain by various fill materials. Native deposits in the area of the site are comprised of mostly lake bed deposits overlying bedrock. Drift thickness within this area ranges between 11 and 50 feet below existing grade. Bedrock consists of limestone and dolomite of the Late Silurian Bass Islands Group (*Hydrogeologic Atlas of Michigan*, 1981).

### **Site Investigation**

Two borings were collected in 1986 presumably for the design of the now existing Sandy Creek Pump Station located at Grand Blvd and Bronson Blvd in Frenchtown Township, MI (See Attached Boring Logs). No geotechnical testing data was found for these two borings. Based on these two borings, the top of rock surface at the pump station ranges from approximately 18.5 ft to 22 ft below ground surface.

In March of 2007, STS Consultants was contracted to collect geotechnical samples behind the existing SSP wall (See Attached Report). Five borings were collected to a depth of approximately 30 feet, with continuous sampling throughout. Just to note that it was found later that the survey benchmark used was incorrect; therefore the elevations need to be reduced by 2.6 ft. The top of hole elevations on the boring logs have been corrected for reference.

The borings found a mixture of fill, sand, and clay in the top 6-9 feet of material, overlying native clays, and bedrock. Fill material typically consisted of brown clayey silt with variable amounts of sand and gravel. Wood fragments as well as dark brown and black organic deposits with variable amounts of sand and gravel were also encountered. The cohesive fill material ranged from very soft to stiff, and the relative density of the granular fill material was typically loose.

Native granular soil deposits were encountered in each boring. These deposits composed of very loose to medium density sand with variable amounts of gravel and silt. Native organic and inorganic cohesive soils were also encountered at each boring and generally were found beneath the native granular soils. The cohesive soil deposits ranged from medium stiff to very stiff silty clays with variable amounts of sand and gravel. Bedrock was encountered at each of the five borings between approximately 24.5 ft to 28 ft below ground surface (Frenchtown (Detroit Beach) Section 205 Geotechnical Investigation, June 2007). The top of rock elevation used for design purposes is 557.6 ft IGLD85 (International Great Lakes Datum 1985).

A soil profile of the site was developed based on the findings of the geotechnical investigation and other available site data. The soil profile was used to help develop the preliminary SSP wall design for Alternative 3 (See Engineering Appendix) and will be used for future design of the selected alternative.

### **Geotechnical Considerations**

Backfill for catchment area should be free-draining granular or stone fill. A stone blanket is recommended to minimize washout due to wave overtopping. To minimize seepage, it is recommended to cut the existing SSP wall at the ground surface and leave the buried portion to act as a cut-off wall behind the new wall. Controlled low-strength material (a.k.a. flowable fill) should be used between the new wall and left in place wall to also reduce seepage and help seal the new wall joints, especially if a post and panel type wall is to be constructed.

Furthermore, the existing flanking clay levees will need to be inspected and raised or repaired as needed to complete the line of flood protection. Existing encroachments from local property owners will also need to be removed as required to meet current COE guidelines.

### **References**

- 1) Frenchtown (Detroit Beach) Section 205 Geotechnical Investigation, STS Consultants, June 2007.
- 2) *Hydrogeologic Atlas of Michigan*, Western Michigan University, 1981.



Professional Service Industries, Inc.  
Michigan Testing Engineers Division

LOG OF SOIL BORING NO. \_\_\_\_\_

PROJECT Proposed Pump Station

JOB NO. 406-65128

LOCATION Grand Blvd. and Bronson Blvd.

SURFACE ELEV. 579.5 DATE 12-30-86

Frenchtown Township, Michigan

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows Per 6"	Moisture %	Natural WL P.C.F.	Dry Den WL P.C.F.	Unc. Comp. Strength PSF	Str. %
			0'3"						
	1		Sandy TOPSOIL, black, moist, soft						
			Silty clay, variegated, FILL, moist, stiff						
	2			3					
A				5					
SS	3	3'0"		7					
	4		Silty clay, variegated, FILL and layers of sand, moist, stiff						
				3					
B	5			5					
SS				6					
	6	6'0"							
	7		SWAMP BOTTOM and PEAT, moist, firm	4					
C		7'6"		6					
SS	8		Medium SAND, gray, wet, medium dense	6					
	9	8'6"							
			SWAMP BOTTOM, moist, soft	1					
D	10			2					
SS				2					
	11								
	12	12'0"							
	13		Silty CLAY, variegated, moist, soft						
	14			1					
				1					
E	15			1					
SS									
	16								
	17	17'0"							
	18		Silty CLAY, variegated, moist, stiff						
	19			3					
				33					
F	20	20'3"							
SS									
	21		CLAY, gray and stones, moist, hard						
	22	22'0"							
	23		ROCK						
R.C.	24		Run 1, core from 22' to 30'6", R=6'6", RQD=25%						
	25								
TYPE OF SAMPLE			REMARKS:		GROUND WATER OBSERVATIONS				
D DISTURBED					GW ENCOUNTERED AT 7 FT 6 INS				
UL UNDIST. LINER					GW ENCOUNTERED AT 22 FT 0 INS				
ST SHELBY TUBE					GW AFTER COMPLETION 7 FT 0 INS				
SS SPLIT SPOON					GW AFTER HRS FT INS				
RC ROCK CORE					GW VOLUMES HEAVY				
I PENETROMETER									
			Standard Penetration Test — Driving 2" OD Sampler 1" With 140# Hammer Falling 30". Count Made At 6" Intervals						

**Professional Service Industries, Inc.**  
Michigan Testing Engineers Division

CONTINUATION OF SOIL BORING NO. 1

PROJECT Proposed Pump Station

JOB NO. 406-65128

LOCATION Grand Blvd. & Brunsen Blvd.

SURFACE ELEV. 579.5 DATE 12-30-86

Frenchtown Township, Michigan

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows For 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
	26		Run 1, core from 22' to 30'6", R=6'6"						
	27								
	28								
	29								
	30	30'6"							
	31		Run 2, core from 30'6" to 40'6" R=7'3", RQD=37%						
R.C.	32								
	33								
	34								
	35								
	36								
	37								
	38								
	39								
	40	40'6"							
	41		END OF BORING						
	42								
	43								
	44								
	45								
	46								
	47								
	48								
	49								
	50								
<b>TYPE OF SAMPLE</b> D - DISTURBED UL - UNDIST. LINER ST - SHELBY TUBE SS - SPLIT SPOON RC - ROCK CORE ( ) - PENETROMETER			<b>REMARKS:</b>  Standard Penetration Test — Driving 2" O.D. Sampler 1' With 140# Hammer Falling 30". Count Made At 6" Intervals		<b>PLUGGING PROCEDURE</b>  HOLE SEALED WITH <u>cement</u> BETWEEN DEPTHS OF <u>0'0"</u> AND <u>40'6"</u>				

**Professional Service Industries, Inc.**  
Michigan Testing Engineers Division

LOG OF SOIL BORING NO. 4

PROJECT Proposed Pump Station

JOB NO. 401-65128

LOCATION Grand Blvd. & Bronson Blvd.

SURFACE ELEV. 577.0 DATE 1-6-87

Frenchtown Township, Michigan

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows For 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength P.S.F.	Gr. %
	1		Clay FILL, moist, stiff						
	2			2					
A	3	3'0"		5					
SS	3		Sand and clay FILL, wet, stiff	6					
	4								
	5			3					
B	5			7					
SS	6			9					
	6	6'6"							
	7		SWAMP BOTTOM and PEAT, moist, soft	1					
C	8			2					
SS	8			2					
	9								
	10			1					
D	10			1					
SS	11			1					
	12	12'0"							
	13		CLAY, variegated, moist, stiff						
	14	14'0"							
	15		CLAY, gray, oxidized with pebbles, moist, hard	15					
E	15			21					
SS	16			30					
	17								
	18	18'6"							
	19		Fractured ROCK						
	20								
R.C	21		Run 1, core from 18'6" to 24'6", R=6', RQD=0						
	22								
	23								
	24	24'6"							
	25	25'0"	ROCK 3 minutes						
			2 minutes						
<b>TYPE OF SAMPLE</b> D DISTURBED UL UNDIST. LINER ST SHELBY TUBE SS SPLIT SPOON RC ROCK CORE PENETROMETER			<b>REMARKS:</b>  Standard Penetration Test — Driving 2" O.D. Sampler 1' With 140# Hammer Falling 30". Count Made At 6" Intervals		<b>GROUND WATER OBSERVATIONS</b> GW ENCOUNTERED AT 3 FT 0 INS. GW ENCOUNTERED AT FT INS. GW AFTER COMPLETION 3 FT 0 INS. GW AFTER HRS FT INS. GW VOLUMES HEAVY				



**STS CONSULTANTS, LTD.**

**Frenchtown (Detroit Beach)  
Section 205  
Geotechnical Investigation  
Frenchtown Township  
Monroe, Michigan**

U.S. Army Corps of Engineers  
Design Branch – Detroit District  
Delivery Order No. DCO7  
Contract No. W912P6-06-D-0001

STS Project No. 200701266



THE INFRASTRUCTURE IMPERATIVE

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Boring Logs

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  - MOISTURE CONTENT AND DRY DENSITY
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TABLE 2 – SUMMARY OF SURVEY RESULTS

**GEOTECHNICAL INVESTIGATION**  
**Frenchtown (Detroit Beach) Section 205**  
**Monroe, Michigan**

**1.0 INTRODUCTION**

In March 2007 the United States Army Corps of Engineers (USACE) - Detroit District contracted with STS Consultants, Ltd. (STS) to complete a geotechnical investigation of subsurface conditions at the Detroit Beach District in Monroe, Michigan. The work was authorized on March 7, 2007 under contract W912P6-06-D-0001, purchase requisition number W56MES70309508. The approximate location of the project site is shown on Sheet 1: Site Map, which was provided by the USACE, and is included in Appendix A. The existing sea wall consists of steel sheet-pile. Portions of the wall exhibit notable deflections as a result of lateral movement of the wall over time.

The USACE plans to replace the existing sea wall that currently protects Detroit Beach from Lake Erie. The purpose of this investigation was to collect soil samples and complete laboratory testing to determine geotechnical strength and index properties of the native subgrade soils. The information obtained during this investigation will be utilized by the USACE staff to evaluate the stability and feasibility of the proposed changes. This report outlines the field investigation and laboratory test procedures, details the conditions encountered in the borings, and summarizes the laboratory test results.

## **2.0 SCOPE OF WORK**

The STS services were completed in general accordance with Frenchtown (Detroit Beach) Section 205; Geotechnical Investigation; Frenchtown Twp., Michigan; Scope of Work (USACE Delivery Order No. DC07; Contract No. W912P6-06-D-0001. The Scope of Work included the following tasks:

- Coordinated utility clearance with Michigan Miss Dig Hotline, and site access with USACE and Detroit Beach Association representatives.
- Mobilized a Diedrich D-50 drill rig to the site to complete five (5) borings at the locations specified to nominal depths of 30 and 40 feet below existing grade.
- Obtained representative soil samples using split spoon, Shelby Tube, and Osterberg soil sampling techniques at specified intervals at each boring in general accordance with ASTM standards.
- Observed soil and groundwater conditions while drilling and sampling and prepared field logs documenting drilling methods, Standard Penetration Test (SPT) results, soil condition observations, groundwater measurements and other pertinent geotechnical-related observations.
- Mobilized a survey crew to determine coordinates and elevations of as-drilled boring locations.
- Performed laboratory strength and index testing on representative samples, prepared final geotechnical boring logs, and issued this report of our findings.



### **3.0 PROCEDURES**

#### **3.1 Subsurface Exploration**

The borings were completed by an STS drill crew using a Diedrich D-50 rotary drill rig at the approximate locations identified in the Scope of Work. The actual locations were determined at the time of drilling based on access. Minor changes in location were discussed with, and approved by, an USACE representative prior to drilling. A map of the site plan is shown on Sheet 1: Site Plan (provided by the USACE) and the approximate as-drilled boring locations are illustrated on Sheets 2 and 3: Soil Boring Location (also provided by the USACE). Figure 1 illustrates the boring locations on an aerial photograph, as plotted using the Michigan State Plane Coordinate System, NAD 83 coordinates. All above listed sheets and figure are included in Appendix A.

The borings were advanced using split spoon techniques to a depth where groundwater was first encountered, and/or where boring sidewall instability was noted. Below that depth, a 3 7/8-inch diameter rock bit and rotary wash drilling methods were utilized. The drilling fluid consisted of clear water. Temporary steel casing was installed to a depth of ten feet, as was necessary to maintain the stability of the borehole. Each boring was extended to a depth of approximately 30 feet below existing grade.

Representative soil samples were obtained using split-spoon sampling techniques in general accordance with American Society of Testing and Materials (ASTM) Standard D-1586. Undisturbed 3-inch diameter Shelby Tube and Osterberg samples were also obtained in accordance with ASTM D-1587. Soil samples were sealed in the field and returned to the STS laboratory in Vernon Hills, Illinois, for further examination and testing. Water level observations were completed at each borehole while drilling and sampling. The results of these observations are shown on the final boring logs that are included in Appendix B. A copy of the STS Standard Boring Log Procedures is also included in Appendix B.

An STS Field Geologist was present during the drilling activities to prepare field logs documenting drilling methods, SPT results, soil conditions, groundwater measurements, and other pertinent geotechnical-related observations. Copies of the daily field reports, daily logs, and photographs of the field activities are provided in Appendices C and D, respectively. It is important to note that the information included on the field logs is based on the initial interpretations of the soil

conditions and soil types by the STS field geologist. These field logs were then used along with additional visual observations and the results of laboratory testing and laboratory classification for completing the final boring logs.

### 3.2 Laboratory Testing

Laboratory strength and index tests were completed on selected soil samples to characterize the physical properties of the soils encountered in the soil borings. Due to limited sample recovery and/or sample disturbance, several of the specified strength tests could not be completed as specified. After discussion with USACE representative, alternative samples were tested.

The following table outlines the laboratory tests that were completed and their corresponding ASTM designation.

<b>Laboratory Test</b>
Combined Analysis (Sieve #4 to #200 & Hydrometer) – ASTM D 422
Atterberg Limits – ASTM D 4318
Dry Density (incl. moisture content) – EM 1110-2-1906 App. II
Unconfined Compression w/stress-strain curves – ASTM D 2166
Specific Gravity – ASTM D 854
CU Triaxial Test (3 point) – ASTM D 4767

The unconfined compressive strength of selected cohesive samples was also estimated using a calibrated penetrometer. In conjunction with the laboratory testing program, the majority of the samples were classified in the laboratory on the basis of texture and plasticity in accordance with STS Soil Classification System. These descriptions and estimated group symbols are in general conformance with the Unified Soil Classification System which serves as the basis for the STS Soil Classification System, and are included on the soil boring logs.

A brief explanation of the classification of soil samples is included in Appendix B. Laboratory test results are summarized on Table 1 in Appendix E and actual laboratory test results are included in Appendix F.

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
STS Project No. 200701266  
June 4, 2007

### **3.3 Elevation and Location Survey**

The horizontal location of each soil boring was determined using a Trimble GeoXH Global Positioning System (GPS) Receiver. This device provides horizontal location of features with sub one-foot accuracy. The horizontal datum was the Michigan State Plane Coordinate System, South Zone, North American Datum 1983 (NAD 83), U.S. Survey foot.

The elevation of each boring location at ground surface was determined using standard elevation leveling techniques. Elevation data is tied to bench marks of known elevation and is accurate to 0.1 feet. STS utilized an on-site benchmark for a reference elevation. This bench mark was established by the USACE with an elevation of 575.53 feet and is located in the roadway at the intersection of Edgewater and Harborview. The vertical datum was the International Great Lakes Datum 1985 (IGLD 85). The approximate as-drilled boring locations are shown on Sheets 2 and 3 in Appendix A. A summary of the survey results is also provided in Table 2 in Appendix G.



## **4.0 EXPLORATION RESULTS**

### **4.1 Site Conditions**

Frenchtown (Detroit Beach) is located on a stretch of land along the coast of Lake Erie in Frenchtown Township, Monroe County, Michigan. The site is bounded by the Lake Erie sea wall to the east, a Lake Erie channel to the south, and Edgewater Boulevard to the west. The approximate location of the site is shown on Sheet 1: Site Plan included in Appendix A.

The area surrounding the boring locations comprises several small parks that belong to the Detroit Beach Association as well as various residential properties. Lake Erie is located east of the Frenchtown project location.

### **4.2 Site Geology**

The geology in the vicinity of the site generally consists of lake bed and sand deposits; however, some fill was encountered in all borings. All borings were situated between 7 and 14 feet west of the sea wall along the adjacent berm. Native deposits in the area of the site comprise mostly lake beds and sand; drift thickness within this area ranges between 11 and 50 feet below existing grade. Each of the borings encountered refusal between 24.5 and 30 feet. The refusal is interpreted as the bedrock surface. Bedrock geology in the Detroit Beach district, an area that includes the project site, is the Bass Islands formation of the Late Silurian Period (Western Michigan University, Hydrogeologic Atlas of Michigan, 1981).

### **4.3 Soil Conditions**

The general soil profile encountered as part of this geotechnical investigation at the site consisted of a layer of fill underlain by native granular and cohesive soils. A descriptive summary of the soils encountered is presented below. More detailed descriptions of the soil conditions encountered at each boring are provided on the individual boring logs in Appendix B.

### SURFICIAL FILL SOILS

Fill deposits comprising medium brown clayey silt with variable amounts of sand and gravel were encountered in all borings. Wood fragments as well as deposits of dark brown and black organic material with variable amounts of sand and gravel were encountered at borings FT-01-07 and FT-05-07. Black organic sandy fill was also encountered at boring FT-04-07. The consistency of the cohesive fills generally ranged from very soft to stiff. The relative density of the granular soils was typically loose.

The fill deposits extended to depths between six and seven feet below existing grade for borings FT-01-07 through FT-04-07. In FT-05-07, fill deposits extended to a depth of approximately 8.5 feet below existing grade. Only the obvious fill depths were described above and are shown on the boring logs. In all borings, the main distinction between the fill and native soil interface (between the fill and native soil) was the point at which the sample showed a very quartz-rich, fine to medium grained sand. In FT-04-07, the distinguishing point between fill and native soil was the appearance of a highly organic, dark gray peat.

### NATIVE GRANULAR SOILS

Deposits of native granular soils underlying the surficial fills were encountered in each boring. Granular deposits composed of light brown and brown, very loose to medium density, fine to medium sands with variable amounts of fine gravel and silt were encountered at borings except FT-05-07. Granular deposits consisting of light brown to brown rounded and subrounded fine to medium gravel and sand were encountered in all borings except FT-05-07. Dark brown, organic peat was encountered in FT-05-07; for the purpose of this project, this organic peat is considered to be native soil.

### NATIVE COHESIVE SOILS

Deposits of both organic and inorganic cohesive and semi-cohesive soils were encountered below the surficial fills at all boring locations. The organic cohesive and semi-cohesive soils encountered at each boring (FT-01-07 through FT-05-07) comprise very soft to stiff grayish brown, greenish-gray, and medium brown silty clay with variable amounts of sand and gravel. In general, these deposits were encountered immediately below the fill and native granular soils. These cohesive soils encountered in all borings are composed of medium (firm) to very stiff brown and gray silty clay and clayey silt with variable amounts of sand and gravel. One saturated thin sand seam was noted within the individual samples at boring FT-05-07.

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
STS Project No. 200701266  
June 4, 2007

#### **4.4 Groundwater Conditions**

Water level readings were not obtained in the first four soil borings due to the introduction of water in the drilling fluid at approximately ten feet below grade. Prior to the introduction of this fluid, no apparent water levels were observed or recorded. One water level was observed in FT-05-07 at the time of the boring. A saturated sand layer was encountered between eight and 9.5 feet below existing grade; this is noted on the field log. The depth at which this water level was recorded corresponds to an approximate elevation of 573.1 feet IGLD 85. The Lake Erie water level was determined to be elevation 573.91 feet IGLD 85 at the time of the boring elevation survey.

Groundwater level fluctuations may occur with time and seasonal change due to variations in precipitation, evaporation, surface water runoff and local dewatering.

## **5.0 GENERAL QUALIFICATIONS**

The information presented in this report is based on data obtained from soil borings and laboratory testing completed. Variations can occur between borings; the nature and extent of which may not become evident until after construction. If variations are encountered, it may be necessary to reevaluate the information contained in this report with respect to the design and construction.

Water level readings have been made in the borings at the time and under the conditions stated on the boring logs. This data has been reviewed and an interpretation made in the text of this report. However, it must be noted that the period of observation was relatively short, and that seasonal and annual fluctuations in the level of the groundwater will likely occur.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices to aid in the evaluation of this property, and to assist in the design of this project. No other warranty, expressed or implied, is made. The scope of this report is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to soil characteristics. In the event any changes in the design or location of the structures as outlined in this report are planned, we should be informed so the changes can be reviewed, and the conclusions of this report modified as required.

As a check, we recommend that STS be authorized to review project plans and specifications to confirm that the recommendations of this report have been interpreted in accordance with our intent. Without this review, STS Consultants will not be responsible for misinterpretation of our data, our analyses, and/or our recommendations or how these are incorporated into the final design.

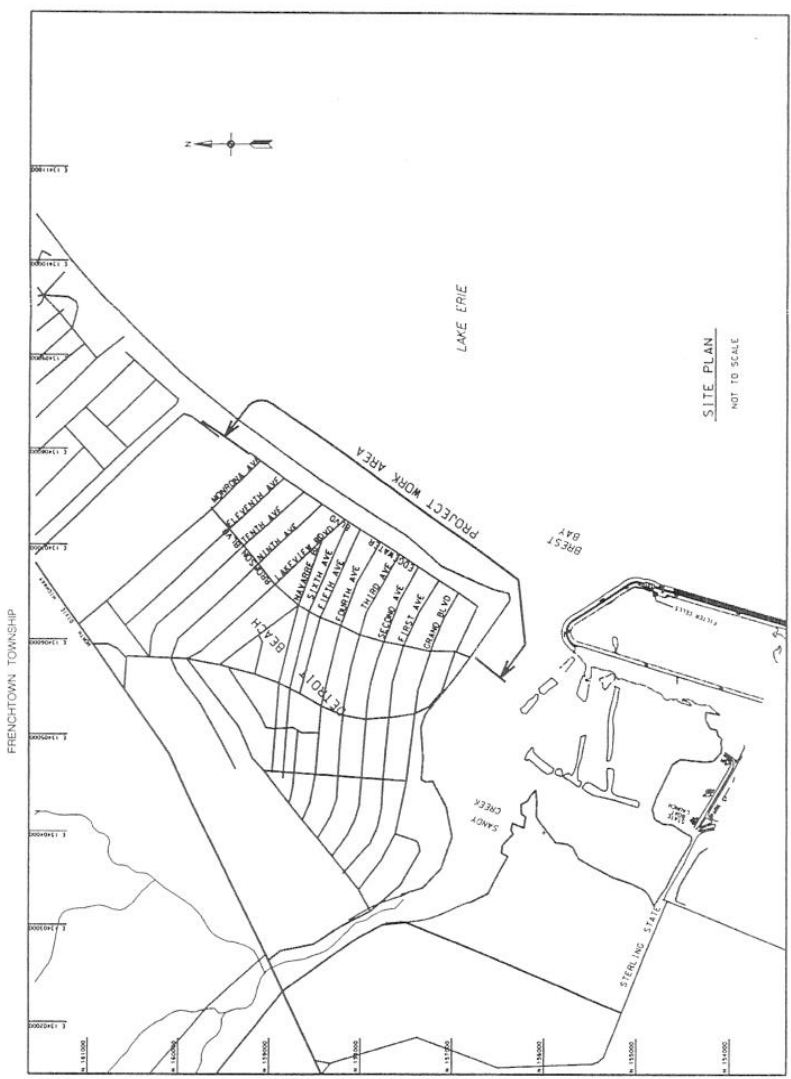
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Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX A FIGURES**

SHEET 1 SITE MAP  
SHEET 2 SOUTH END SOIL BORINGS  
SHEET 3 NORTH END SOIL BORINGS









Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
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Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX A FIGURES**

### **AERIAL PHOTOGRAPH SHOWING SOIL BORING LOCATIONS**





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Frenchtown (Detroit Beach)  
 Section 205  
 Geotechnical Investigation  
 Frenchtown Township, Monroe Michigan

DRAWN:	KGK	5/16/2007
CHECKED:	BJE	5/16/2007
APPROVED:	JSM	5/16/2007
PROJECT NUMBER	200701266	
FIGURE NUMBER	1	

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX B**

GENERAL NOTES  
SOIL CLASSIFICATIONS  
FIELD AND LABORATORY PROCEDURES  
BORING LOG PROCEDURES

## STS General Notes



### **DRILLING & SAMPLING SYMBOLS:**

SS : Split Spoon - 1-3/8" I.D. 2" O.D.

Unless otherwise noted

ST : Shelby Tube-2" O.D.

Unless otherwise noted

PA : Power Auger

DB : Diamond Bit-NX, BX, AX

AS : Auger Sample

JS : Jar Sample

VS : Vane Shear

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

OS : Osterberg Sampler

HS : Hollow Stem Auger

WS : Wash Sample

FT : Fish Tail

RB : Rock Bit

BS : Bulk Sample

PM : Pressuremeter Test

GS : Giddings Sampler

### **WATER LEVEL MEASUREMENT SYMBOLS:**

WL : Water Level

WS : While Sampling

WD : While Drilling

AB : After Boring

WCI : Wet Cave In

DCI : Dry Cave In

BCR : Before Casing Removal

ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

### **GRADATION DESCRIPTION AND TERMINOLOGY:**

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

#### **Description of Other**

<b><u>Major Component of</u></b>		<b><u>Components</u></b>	
<b><u>Sample</u></b>	<b><u>Size Range</u></b>	<b><u>Present in Sample</u></b>	<b><u>Percent Dry Weight</u></b>
Boulders	Over 8 in. (200 mm)	Trace	1-9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10-19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20-34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35-50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

### **CONSISTENCY OF COHESIVE SOILS:**

#### **Unconfined Compressive**

<b><u>Strength, Qu, tsf</u></b>	<b><u>Consistency</u></b>
<0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Medium (firm)
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
4.00 - 8.00	Hard
>8.00	Very Hard

### **RELATIVE DENSITY OF GRANULAR SOILS:**

<b><u>N-Blows per foot</u></b>	<b><u>Relative Density</u></b>
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
>80	Extremely Dense

# STS Soil Classification System <sup>(1)</sup>



Major Divisions					Group Symbols	Typical Names	Laboratory Classification Criteria											
<p>Coarse-grained soils (More than half of material is <i>larger</i> than No. 200 sieve size)</p> <p><b>Gravel</b> (More than half of coarse fraction is larger than No. 4 sieve size)</p> <p><b>Sand</b> (More than half of coarse fraction is smaller than No. 4 sieve size)</p> <p>Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent . . . . . GW, GP, SW, SP More than 5 percent . . . . . GM, GC, SM, SC 5 to 12 percent . . . . . Borderline cases requiring dual symbols <sup>(3)</sup></p>							Clean gravel (Little or no fines)	GW	Well-graded, gravel, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3								
							GP		Poorly graded gravel, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW								
							Gravel with fines (Appreciable amount of fines)	GM	Silty gravel, gravel-sand-silt mixtures	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are <b>borderline</b> cases requiring use of dual symbols							
								GC	Clayey gravel, gravel-sand-clay mixtures	Atterberg limits above "A" line or PI greater than 7								
							Clean sand (Little or no fines)	SW	Well-graded sand, gravelly sand, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3								
								SP		Poorly graded sand, gravelly sand, little or no fines	Not meeting all gradation requirements for SW							
							Sand with fines (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures	Atterberg limits below "A" line or PI less than 4	Limits plotting in hatched zone with PI between 4 and 7 are <b>borderline</b> cases requiring use of dual symbols							
								SC	Clayey sand, sand-clay mixtures	Atterberg limits above "A" line or PI greater than 7								
							<p>Fine-grained soils (More than half of material is <i>smaller</i> than No. 200 sieve size)</p> <p>Silt and clay (Liquid limit less than 50)</p> <p>Silt and clay (Liquid limit greater than 50)</p> <p>Highly organic soils</p>							ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity	<p>Plasticity Chart <sup>(2)</sup></p> <p>For classification of fine-grained soils and fine fraction of coarse-grained soils.</p> <p>Atterberg Limits plotting in hatched areas are borderline classifications requiring use of dual symbols.</p> <p>Equation of A-line: <math>PI = 0.73 (LL - 20)</math></p>		
														CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay			
OL	Organic silt and organic silty clay of low plasticity																	
MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt																	
CH	Inorganic clay of high plasticity, fat clay																	
OH	Organic clay of medium to high plasticity, organic silt																	
PT	Peat and other highly organic soil																	

- 1) See STS General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
- 2) Reference: Unified Soil Classification System
- 3) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

Y:\UEPL\ STS SOIL CLASSIFICATION SYSTEM.dwg



### **SUBSURFACE EXPLORATION FIELD PROCEDURES**

#### **Hand-Auger Drilling (HA)**

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

#### **Power Auger Drilling (PA)**

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

#### **Hollow Stem Auger Drilling (HS)**

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

#### **Rotary Drilling (RB)**

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

#### **Diamond Core Drilling (DB)**

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.



### **FIELD SAMPLING PROCEDURES**

#### **Auger Sampling (AS)**

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

#### **Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)**

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

#### **Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94**

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

#### **Giddings Sampler (GS)**

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.



### LABORATORY PROCEDURES

#### Water Content (Wc)

The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

#### Hand Penetrometer (Qp)

In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

#### Unconfined Compression Tests (Qu)

In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

#### Dry Density (Yd)

The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

#### Classification of Samples

In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the STS Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "STS General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the STS Soil Classification System.



### **STS STANDARD BORING LOG PROCEDURES**

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.



Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX B**

### **SOIL BORING LOGS**

DRILLING LOG		DIVISION ACOE		INSTALLATION Detroit District		SHEET 1 OF 1 SHEETS	
1. PROJECT Frenchtown (Detroit Beach)				10. SIZE AND TYPE OF BIT			
2. LOCATION (Coordinates or Station) N 156,394.32900 E 13,406,416.11600				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) IGLD 85			
3. DRILLING AGENCY STS				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) FT-01-07				13. TOTAL NO. OF OVERBURDEN : DISTURBED : UNDISTURBED SAMPLES TAKEN			
5. NAME OF DRILLER				14. TOTAL NUMBER CORE BOXES			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN				16. DATE HOLE : STARTED : COMPLETED 4/10/2007 4/10/2007			
8. DEPTH DRILLED INTO ROCK				17. ELEVATION TOP OF HOLE <del>+580.9</del> 578.3			
9. TOTAL DEPTH OF HOLE 30.2				18. TOTAL CORE RECOVERY FOR BORING %			
				19. GEOLOGIST BJE			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+580.7	0.2		Topsoil	50	1	SS: 3-5-6-7	
+578.4	2.5		Sandy clay, some, trace gravel and organics - brown (CL)		0.0 2.0	Qp: 4.0	
			Silty clay, trace gravel - brown (CL)	50	2 2.5 4.5	SS: 4,5,6,6 Qp: 2.0	
+575.4	5.5			50	3	SS: 11,20,7,14	
+574.9	6.0		Encountered LS gravel		5.0	Qp: 2.0	
+574.4	6.5		Sandy clay, trace gravel - brown (CL)		7.0		
+573.9	7.0		Fine to coarse wet sand - brown (SW)				
+573.1	7.8		Silty clay - brown (CL)	50	4 7.5 9.5	SS: 5,1,2,3	
			Silty fine to coarse sand, wet, trace clay and gravel - dark brown (SM)				
+570.9	10.0			92	5 10.0 13.0	ST	
			Clayey organic silt, some fine to medium sand - dark brown and black (ML)				
+567.9	13.0			100	6 13.0 15.0	SS: 3,5,6,9 Qp: 1.5	
			Clayey silt, trace sand and gravel - gray (ML)				
+565.2	15.8			0	7 15.0 18.0	OS: No recovery	
+563.9	17.0		Silty clay - gray/brown (CL)				
			Sandy silty clay, trace gravel - gray, brown, red (CL)	100	8 18.0 20.0	SS: 6,8,12,15 Qp: 2.0	
+560.9	20.0		Rock bit to 18.0 feet				
			Silty clay, some fine to coarse sande, trace fine gravel - brown (CL)	100	9 20.0 22.0	SS: 6,16,22,27 Qp: 4.5	
+558.4	22.5			50	10 22.5 24.5	SS: 10,19,28,39	
+556.4	24.5		Silty clay, trace fine sand - gray (CL)				
+555.4	25.5		Gravel and cobbles				
+554.9	26.0		Silty clay, sandy - grayish brown (CL)	100	11 25.5 27.5	SS: 18,25,40,31	
			Weathered limestone - dark gray	17	12 27.5 29.5	SS : 75 for 4"	
+550.7	30.2			83	13 30.0 30.2	SS: 75 for 2"	
			End of Boring.				

DRILLING LOG		DIVISION ACOE		INSTALLATION Detroit District		SHEET 1 OF 1 SHEETS	
1. PROJECT Frentchtown (Detroit Beach)				10. SIZE AND TYPE OF BIT			
2. LOCATION (Coordinates or Station) N 157,215.07900 E 13,406,830.36400				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) IGLD 85			
3. DRILLING AGENCY STS				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) FT-02-07				13. TOTAL NO. OF OVERBURDEN : DISTURBED : UNDISTURBED SAMPLES TAKEN			
5. NAME OF DRILLER				14. TOTAL NUMBER CORE BOXES			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN				16. DATE HOLE : STARTED : COMPLETED 4/10/2007 4/10/2007			
8. DEPTH DRILLED INTO ROCK				17. ELEVATION TOP OF HOLE <del>+582.3</del> 579.7			
9. TOTAL DEPTH OF HOLE 28.5				18. TOTAL CORE RECOVERY FOR BORING %			
				19. GEOLOGIST BJE			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+581.8	0.5		Silty clayey sand - dark brown (TOPSOIL)	50	1	SS: 2,3,3,3	
			Sandy silt, trace brick - dark brown (ML)		0.0		
+580.3	2.0				2.0		
			Gravel, trace silt and clay - dark gray to brown (GP)	25	2	SS: 2,2,4,9	
					2.5		
+577.3	5.0				4.5		
+576.3	6.0		Sandy clay, trace gravel - brown (CL)	75	3	SS: 4,5,7,11	
+575.8	6.5		Fine to medium moist sand - brown (SP)		5.0		
			Sandy clay, trace gravel - brown (CL)		7.0		
+574.3	8.0			100	4	SS: 4,7,6,7	
			Fine to coarse wet sand, some shell - brown (SW)		7.5		
+572.3	10.0				9.5		
			Silty clay, trace fine sand - grayish brown (CH)	63	5	SS: 2,2,3,5	
+570.3	12.0				10.0		
			Silty clay - greenish gray to brown (CL)	33	6	OS	
					12.0		
+567.3	15.0				15.0		
			Silty clay, trace fine to coarse sand, trace fine gravel, trace shale - brown (CL)	92	7a	ST	
+565.8	16.5				15.0		
			Silty clay, little fine to coarse sand, little fine gravel - gray (CH)	60	7b	ST	
+564.3	18.0			100	16.5	SS: 13,18,21,28	
			Sandy clay, trace silt and gravel - brown (CL)		19.0		
					8		
					17.5		
+560.8	21.5			100	19.5	SS: 9,15,18,19	
					9		
+560.7	21.6		Clayey fine to medium sand - brown (SM)		20.0		
+559.8	22.5		Sandy clay, trace silt and gravel - dark gray (CL)	100	22.0	SS: 10,24,22,27	
			Clayey silt, trace fine sand - gray (ML)		10	Qp: 4.0	
+557.8	24.5				22.5		
			Silt, trace gravel - dark gray (ML)	50	11	SS: 15,64	
					25.0	Qp: 4.5	
+554.3	28.0				26.0		
+553.8	28.5		Silty limestone - dark gray (BEDROCK)		12	SS: 75 for 6"	
			EOB 28'		28.0		
					28.5		

DRILLING LOG		DIVISION ACOE		INSTALLATION Detroit District		SHEET 1 OF 1 SHEETS		
1. PROJECT Frenchtown (Detroit Beach)				10. SIZE AND TYPE OF BIT				
2. LOCATION (Coordinates or Station) N 157,745.38500 E 13,407,048.88500				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) IGLD 85				
3. DRILLING AGENCY STS				12. MANUFACTURER'S DESIGNATION OF DRILL				
4. HOLE NO. (As shown on drawing title and file number) FT-03-07				13. TOTAL NO. OF OVERBURDEN : DISTURBED : UNDISTURBED SAMPLES TAKEN				
5. NAME OF DRILLER				14. TOTAL NUMBER CORE BOXES				
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.				15. ELEVATION GROUND WATER				
7. THICKNESS OF OVERBURDEN				16. DATE HOLE : STARTED : COMPLETED 4/10/2007 4/10/2007				
8. DEPTH DRILLED INTO ROCK				17. ELEVATION TOP OF HOLE <del>+582.7</del> 580.1				
9. TOTAL DEPTH OF HOLE 30.0				18. TOTAL CORE RECOVERY FOR BORING %				
				19. GEOLOGIST BJE				
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g		
+582.5	0.2		Topsoil	50	1	SS: 2,2,3,4		
			Sandy clay, trace gravel - brown (CL)		0.0			
					2.0			
				75	2	SS: 4,4,5,5 Qp: 3.5		
					2.5			
					4.5			
+576.7	6.0		Fine to coarse sand, trace silt - brown (SW)	75	3	SS: 4,5,9,7		
					5.0			
					7.0			
+575.0	7.8		Fine to coarse sand, moist - brown to light brown (SW)	88	4	SS: 4,4,6,6 Qp: 3.5		
+574.7	8.0				7.5			
					9.5			
+572.7	10.0		Silty clay, trace gravel - brown (CL)					
			Silty clay, trace fine to coarse sand - brown (CL)	58	5	OS Qp: 1.0		
					10.0			
					13.0			
+569.7	13.0		Silty clay, trace fine to medium sand, trace fine gravel - brownish gray (CL)	83	6	ST Qp: 2.5		
						12.5		
						15.5		
+567.7	15.0		Silty clay, trace gravel - brown (CL)					
				88	7	SS: 0,6,9,10 Qp: 2.5		
					15.5			
					17.5			
+565.2	17.5		Silty clay, little fine to coarse sand, brown (CL)	100	8	SS: 7,10,11,13 Qp: 2.5 - 3.0		
						17.5		
						19.5		
+563.2	19.5		Silty clay, trace gravel - brown (CL)					
				100	9	SS: 8,10,10,18 Qp: 1.5		
					20.0			
					22.0			
+558.7	24.0		Silty clay, trace gravel and sand - gray to brown (CL)	100	10	SS: 20,25,32,35		
						22.5		
						24.5		
+557.7	25.0		Silty clay - dark gray, trace cobbles (CL)					
				100	11	SS: 8,14,17,23		
					25.0			
					27.0			
+555.7	27.0		Silty clay, some fine to coarse sand, little fine to coarse gravel - gray (CL)					
+554.7	28.0		Silty clay - gray (CL)					
			BEDROCK	21	12	SS: 105 for 5"		
					28.0			
+552.7	30.0				30.0			
			EOB 30'					



DRILLING LOG		DIVISION ACOE		INSTALLATION Detroit District		SHEET 1 OF 1 SHEETS	
1. PROJECT Frenchtown (Detroit Beach)				10. SIZE AND TYPE OF BIT			
2. LOCATION (Coordinates or Station) N 158,094.71500 E 13,407,289.39300				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) IGLD 85			
3. DRILLING AGENCY STS				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) FT-04-07				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER				14. TOTAL NUMBER CORE BOXES			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN				16. DATE HOLE		STARTED : COMPLETED : 4/11/2007 4/11/2007	
8. DEPTH DRILLED INTO ROCK				17. ELEVATION TOP OF HOLE		-581.0 578.4	
9. TOTAL DEPTH OF HOLE 29.0				18. TOTAL CORE RECOVERY FOR BORING %			
				19. GEOLOGIST BJE			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+580.9	0.1		Organic topsoil	50	1	SS: 3,2,2,2	
			Sandy clay, trace gravel and wood - brown (CL)		0.0 2.0		
+577.5	3.5			75	2	SS: 3,7,17,8	
+577.0	4.0		Limestone, gravel, and/or cobbles encountered		2.5 4.5		
			Sandy clay, trace gravel - brown (CL)	58	3	SS: 4,8,9,10	
+574.5	6.5				5.0 7.0		
+573.5	7.5		Fractured limestone				
+572.5	8.5		Silty clay - dark gray (CL)	83	4	SS: 1,1,3,3	
			Organic peat, trace silt and clay - dark brown		7.5 9.5		
+571.0	10.0						
			Silty clay, trace fine to medium sand - gray (CL)	53	5	OS Qp: 2.5	
					10.0 13.0		
+568.0	13.0						
			Silty clay, trace fine to coarse sand - grayish brown (CH)	67	6	ST Qp: 1.0	
+566.0	15.0				13.0 15.0		
+565.0	16.0		Clay, trace gravel and silt - gray to greenish gray (CL)	100	7	SS: 5,15,15,18	
+564.0	17.0		Clay, trace gravel and silt - gray to brown (CL)		15.0 17.0		
			Clay, trace gravel and silt - gray (CL)	100	8	SS: 7,9,11,14 Qp: 3.0	
					17.5 19.5		
+561.0	20.0						
			Silty clay, some fine to coarse sand, trace fine gravel - gray (CL)	75	9	SS: 6,9,17,35	
+559.0	22.0				20.0 22.0		
			Silt, trace clay and gravel - gray (ML)	100	10	SS: 17,38,36,41 Qp: 4.0	
					22.5 24.5		
+556.0	25.0						
+555.0	26.0		Silty clay - gray (CL)	88	11	SS: 25,25,37,70 Qp: 4.0	
					25.0 27.0		
			Limestone, trace clay and silt - gray (BEDROCK)		12		
+552.0	29.0				27.0 29.0		
			EOB 29'				

DRILLING LOG		DIVISION ACOE		INSTALLATION Detroit District		SHEET 1 OF 1 SHEETS	
1. PROJECT Frenchtown (Detroit Beach)				10. SIZE AND TYPE OF BIT			
2. LOCATION (Coordinates or Station) N 159,053.98700 E 13,407,799.34500				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) IGLD 85			
3. DRILLING AGENCY STS				12. MANUFACTURER'S DESIGNATION OF DRILL			
4. HOLE NO. (As shown on drawing title and file number) FT-05-07				13. TOTAL NO. OF OVERBURDEN : DISTURBED : UNDISTURBED SAMPLES TAKEN			
5. NAME OF DRILLER				14. TOTAL NUMBER CORE BOXES			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED --- DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN				16. DATE HOLE : STARTED : COMPLETED 4/11/2007 4/11/2007			
8. DEPTH DRILLED INTO ROCK				17. ELEVATION TOP OF HOLE <del>+582.6</del> 580			
9. TOTAL DEPTH OF HOLE 30.0				18. TOTAL CORE RECOVERY FOR BORING %			
				19. GEOLOGIST BJE			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g	
+582.4	0.2		Organic topsoil	63	1 0.0 2.0	SS: 2,2,4,5	
				75	2 2.5 4.5	SS: 4,3,3,4	
				58	3 5.0 7.0	SS: 8,5,4,4	
				83	4 7.5 9.5	SS: 5,7,5,5	
+572.6	10.0			Silty clay, trace fine to coarse sand, trace fine gravel - dark gray (CL)	61	5 10.0 13.0	OS
+569.6	13.0						
+567.6	15.0						
+565.1	17.5						
+562.6	20.0						
			Silty clay, trace fine to coarse sand, trace fine gravel - brown (CL)	38	6 13.0 15.0	ST	
			Silty clay, some fine to coarse sand, trace fine gravel - dark gray (CL)	88	7 15.0 17.0	SS: 4,6,7,11	
			Silty clay, trace gravel and cobbles - brown (CL)	100	8 17.5 19.5	SS: 11,9,11,16	
			Silty clay, some fine to coarse sand, trace fine gravel - brown (CL-ML)	75	9 20.0 22.0	SS: 7,7,8,13	
			Clay, trace gravel and sand - brownish gray (CL)	100	10 22.5 24.5	SS: 30,30,21,84	
			Weathered limestone - dark gray				
			Silt - dark brown (ML)				
			Bedrock				
			EOB 30'				

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX D**

### **SITE PHOTO LOG**

**PHOTOGRAPH LOG – FRENCHTOWN (DETROIT BEACH)  
SECTION 205  
GEOTECHNICAL INVESTIGATION**



1. Photograph showing seawall, photo facing north from approximate location of FT-01-07.



2. Photograph showing drilling operations at FT-01-07, photo facing south-southeast.



**PHOTOGRAPH LOG – FRENCHTOWN (DETROIT BEACH)  
SECTION 205  
GEOTECHNICAL INVESTIGATION**



3. Photograph showing bedrock sample collected from 27.5 to 29.5 feet below grade at FT-01-07.



4. Photograph showing rig set up at boring location FT-02-07; photo taken facing east.

**PHOTOGRAPH LOG – FRENCHTOWN (DETROIT BEACH)  
SECTION 205  
GEOTECHNICAL INVESTIGATION**



5. Photograph showing bedrock sample fragments from boring location FT-02-07.



6. Photograph showing area between seawall and berm at approximate location of FT-03-07.

**PHOTOGRAPH LOG – FRENCHTOWN (DETROIT BEACH)  
SECTION 205  
GEOTECHNICAL INVESTIGATION**



7. Photograph showing rig set-up at boring location SB-03-07; photo taken facing southeast.



8. Photograph showing portion of sample taken from FT-03-07 between 17.5 and 19.5 feet below grade.



**PHOTOGRAPH LOG – FRENCHTOWN (DETROIT BEACH)  
SECTION 205  
GEOTECHNICAL INVESTIGATION**



9. Photograph taken at boring location FT-04-07, photo taken facing north.



10. Photograph showing bottom of Osterberg Sample taken at boring location FT-04-07 at a depth Between 10 and 13 feet below grade.



**PHOTOGRAPH LOG – FRENCHTOWN (DETROIT BEACH)  
SECTION 205  
GEOTECHNICAL INVESTIGATION**



11. Photograph showing area between berm and seawall, photo facing north from approximate location of FT-05-07.

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX E**

### **TABLE 1 LABORATORY TEST SUMMARY**



STS Consultants, Ltd.

Table 1 - Laboratory Test Summary

Project Name: Frenchtown (Detroit Beach) Geotechnical Investigation STS Project No.: 200701266 Location: Monroe, Michigan												
COE Contract Number: W912P6-06-D-00011 COE Delivery Order #DC07												
Boring	Sample No.	Sample Depth (ft. bbs)	USCS/Visual Soil Description	Dry Density (pcf)	Natural Moisture Content (%)	Estimated Specific Gravity (Gs)	Atterberg Limits			Sieve #4 - P-200 and Hydrometer	Remarks/Comments	
							LL	PL	PI			
FT-01-07	5	10.0 - 13.0	Clayey organic silt, some fine to medium sand - dark brown and black (ML)	63.9	61.7	2.6	44	6	38	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	9	20.0 - 22.0	Silty clay, some fine to coarse sand, trace fine gravel - brown (CL)				27	16	11	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	10	22.5 - 24.5	Silty clay, trace fine sand - gray (CL)				23	14	9	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
FT-02-07	5	10.0 - 12.0	Silty clay, trace fine sand - grayish brown (CH)				51	20	31	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	7A	Osterberg	Silty clay, trace fine to coarse sand, fine gravel, trace shale - Brown (CL)	121.1	19.0	2.7				See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	7B	15.0 - 18.0	Silty clay, little fine to coarse sand, little fine gravel - gray (CH)				50	20	30	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	10	22.5 - 24.5	Clayey silt, trace fine sand - gray (ML)				18	16	2	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
FT-03-07	5	Shelby	Silty clay, trace fine to coarse sand - brown (CL)	99.5	26.5	2.7				See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	6	12.5 - 15.5	Silty clay, trace fine to medium sand, trace fine gravel - brownish gray (CL)				39	21	18	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	8	17.5 - 19.5	Silty clay, little fine to coarse sand - brown (CL)				29	17	12	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
	11	25.0 - 27.0	Silty clay, fine to coarse sand, little fine to coarse gravel - gray (CL)				23	14	9	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	
FT-04-07	5	10.0 - 13.0	Silty clay, trace fine to medium sand - gray (CL)				48	17	29	See enclosed laboratory data	For specific test results, see enclosed laboratory data.	

STS Consultants, Ltd.



**Table 1 - Laboratory Test Summary**

Project Name: Frenchtown (Detroit Beach) Geotechnical Investigation		COE Contract Number: W912PE-06-D-00011							
STS Project No.: 200701266		COE Delivery Order #DC07							
Location: Monroe, Michigan									
Boring	Sample No.	Sample Depth (ft. bgs)	USCS/Visual Soil Description	Dry Density (pcf)	Natural Moisture Content (%)	Estimated Specific Gravity (Gs)	Atterburg Limits LL PL PI	Sieve #4 - P-200 and Hydrometer	Remarks/Comments
	6	13.0 - 15.0	Silty clay, trace fine to coarse sand - grayish brown (CH)	98.2	27.7	2.7	57 22 35	See enclosed laboratory data	For specific test results, see enclosed laboratory data.
	9	20.0 - 22.0	Silty clay, some fine to coarse sand, trace fine gravel - gray (CL)				26 14 12	See enclosed laboratory data	For specific test results, see enclosed laboratory data.
FT-05-07	5	10.0 - 13.0	Silty clay, some fine to coarse sand, trace fine gravel - dark gray (CH)	85.2	35.9	2.7	70 28 42	See enclosed laboratory data	For specific test results, see enclosed laboratory data.
	6	13.0 - 16.0	Silty clay, trace fine to coarse sand, trace fine gravel - brown (CL)					See enclosed laboratory data	For specific test results, see enclosed laboratory data.
	7	15.0 - 17.0	Silty clay, some fine to coarse sand, trace fine gravel - dark gray (CL)				44 21 23	See enclosed laboratory data	For specific test results, see enclosed laboratory data.
	9	20.0 - 22.0	Silty clay, some fine to coarse sand, trace fine gravel - gray (CL - ML)				21 14 7	See enclosed laboratory data	For specific test results, see enclosed laboratory data.

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX F LABORATORY TEST RESULTS**

## DATA SUMMARY

Project No.: 200701266

Project: FRENCHTOWN

Boring No.	Sample No.	Depth (ft.)	Description	USCS	LL	PL	PI	% Gravel	% Sand	% Silt	% Clay	WC (%)	Density (pcf)	Qu tsf
FT-01-07	5	10.0'- 13.0'	CLAYEY ORGANIC SILT SOME FINE TO MEDIUM SAND - DARK BROWN AND BLACK	ML	44	38	6	0.0	25.5	53.7	20.8	61.7	63.9	0.53
	9	20.0'- 22.0'	SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - BROWN	CL	27	16	11	2.4	23.3	37.8	36.5			
	10	22.5'- 24.5'	SILTY CLAY TRACE FINE SAND - GRAY	CL	23	14	9							
FT-02-07	5	10.0'- 12.0'	SILTY CLAY TRACE FINE SAND - GRAYISH BROWN	CH	51	20	31	0.0	4.4	38.4	57.2			
	7A	15.0'- 16.5'	SILTY CLAY TRACE F-C SAND TRACE F GRAVEL TRACE SHAPE - BROWN	CL								19.0	121.1	4.31
	7B	15.0'- 18.0'	SILTY CLAY LITTLE FINE TO COARSE SAND LITTLE FINE GRAVEL - GRAY	CH	50	20	30	14.2	12.8	29.8	43.2	26.6	101.3	
	10	22.5'- 24.5'	CLAYEY SILT TRACE FINE SAND - GRAY	ML	18	16	2	0.0	3.3	56.4	40.3			
FT-03-07	5	10.0'- 13.0'	SILTY CLAY TRACE F-C SAND - BROWN	CL								26.5	99.5	1.05
	6	12.5'- 15.5'	SILTY CLAY TRACE FINE TO MEDIUM SAND TRACE FINE GRAVEL - BROWNISH GRAY	CL	39	21	18	1.1	9.2	36.2	53.5	23.3	104.8	
	8	17.5'- 19.5'	SILTY CLAY LITTLE FINE TO COARSE SAND - BROWN	CL	29	17	12	0.0	16.3	34.6	49.1			
	11	25.0'- 27.0'	SILTY CLAY SOME FINE TO COARSE SAND LITTLE FINE TO COARSE GRAVEL - GRAY	CL	23	14	9	16.3	24.1	29.9	29.7			
FT-04-07	5	10.0'- 13.0'	SILTY CLAY TRACE FINE TO MEDIUM SAND - GRAY	CL	46	17	29	0.0	3.2	48.8	48.0			
	6	13.0'- 15.0'	SILTY CLAY TRACE FINE TO COARSE SAND - GRAYISH BROWN	CH	57	22	35	0.1	3.1	31.6	65.2	27.7	98.2	1.57
	9	20.0'- 22.0'	SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - GRAY	CL	26	14	12	4.6	22.7	35.6	37.1			
FT-05-07	5	10.0'- 13.0'	SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - DARK GRAY	CH	70	28	42	3.7	27.6	36.5	32.2	42.8/ 35.9	80.0 / 85.2	0.41

## DATA SUMMARY

Project No.: 200701266

Project: FRENCHTOWN

Boring No.	Sample No.	Depth (ft.)	Description	USCS	LL	PL	PI	% Gravel	% Sand	% Silt	% Clay	WC (%)	Density (pcf)	Qu tsf
	6	13.0-16.0	SILTY CLAY TRACE FINE - COARSE SAND TRACE FINE GRAVEL - BROWN	CL								25.9	101.3	
	7	15.0'- 17.0'	SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - DARK GRAY	CL	44	21	23							
	9	20.0'- 22.0'	SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - GRAY	CL-ML	21	14	7	4.2	24.2	40.1	31.5			

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



**APPENDIX F**  
**LABORATORY TEST RESULTS**  
**SPECIFIC GRAVITY**





STS Consultants Ltd.  
Consulting Engineers

## Specific Gravity of Soils ASTM D-854

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, IL 60061 Phone: (847) 279-2500 Fax: (847) 279-2550

STS Project No.: **200701266**  
Project Name: **Frenchtown**

Test Date: **4/27/07**

Boring/Source: FT-01-07  
Sample No.: 5  
Depth (ft.): 10.0'-13.0'  
Description: Clayey Organic Silt Some F-M  
Sand - Dk Brown & Black ML

Boring/Source: \_\_\_\_\_  
Sample No.: \_\_\_\_\_  
Depth (ft.): \_\_\_\_\_  
Description: \_\_\_\_\_

	Test 1
Flask No.	SG-3
Wt. Flask + Soil + Water (W2)	721.43
Wt. Flask + Water (W3)	677.38
Temperature ( C )	22.4
Density of Water @ test Tem.	0.99791
Tare No.	ED-10
Wt. Tare	619.12
Wt. Tare + Soil	689.58
Wt. Soil (W2-W3)	70.46
(k) Temp. Correction	0.99970
Specific Gravity (Gs)	2.667

	Test 2
Flask No.	
Wt. Flask + Soil + Water (W2)	
Wt. Flask + Water (W3)	
Temperature ( C )	
Density of Water @ test Tem.	
Tare No.	
Wt. Tare	
Wt. Tare + Soil	
Wt. Soil (W2-W3)	
(k) Temp. Correction	
Specific Gravity (Gs)	

Boring/Source: \_\_\_\_\_  
Sample No.: \_\_\_\_\_  
Depth (ft.): \_\_\_\_\_  
Description: \_\_\_\_\_

Boring/Source: \_\_\_\_\_  
Sample No.: \_\_\_\_\_  
Depth (ft.): \_\_\_\_\_  
Description: \_\_\_\_\_

	Test 3
Flask No.	
Wt. Flask + Soil + Water (W2)	
Wt. Flask + Water (W3)	
Temperature ( C )	
Density of Water @ test Tem.	
Tare No.	
Wt. Tare	
Wt. Tare + Soil	
Wt. Soil (W2-W3)	
(k) Temp. Correction	
Specific Gravity (Gs)	

	Test 4
Flask No.	
Wt. Flask + Soil + Water (W2)	
Wt. Flask + Water (W3)	
Temperature ( C )	
Density of Water @ test Tem.	
Tare No.	
Wt. Tare	
Wt. Tare + Soil	
Wt. Soil (W2-W3)	
(k) Temp. Correction	
Specific Gravity (Gs)	

Technician **BCM**  
Date **4/26/07**

Calculated **BCM**  
Date **4/26/07**

Checked **WPQ**  
Date **4/26/07**



STS Consultants Ltd.  
Consulting Engineers

Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, IL 60061 Phone: (847) 279-2500 Fax: (847) 279-2550

## Specific Gravity of Soils ASTM D-854

STS Project No.: **200701266**  
Project Name: **Frenchtown**

Test Date: **4/23/07**

Boring/Source: FT-02-07  
Sample No.: 7A  
Depth (ft.): 15.0'-16.5'  
Description: Silty Clay Trace F-C Sand  
Trace F Gravel - Brown CL

Boring/Source: FT-03-07  
Sample No.: 5  
Depth (ft.): 10.0'-13.0'  
Description: Silty Clay Trace F-M Sand  
- Brown CL

	Test 1
Flask No.	SG-3
Wt. Flask + Soil + Water (W2)	742.84
Wt. Flask + Water (W3)	677.42
Temperature ( C )	22.1
Density of Water @ test Tem.	0.99775
Tare No.	ED-3
Wt. Tare	623.45
Wt. Tare + Soil	726.96
Wt. Soil (W2-W3)	103.51
(k) Temp. Correction	0.99954
Specific Gravity (Gs)	2.716

	Test 2
Flask No.	SG-2
Wt. Flask + Soil + Water (W2)	735.47
Wt. Flask + Water (W3)	678.84
Temperature ( C )	22.0
Density of Water @ test Tem.	0.99777
Tare No.	ED-8
Wt. Tare	611.02
Wt. Tare + Soil	700.68
Wt. Soil (W2-W3)	89.66
(k) Temp. Correction	0.99957
Specific Gravity (Gs)	2.713

Boring/Source: FT-04-07  
Sample No.: 6  
Depth (ft.): 13.0'-16.0'  
Description: Silty Clay Trace F-C Sand  
Grayish Brown CL

Boring/Source: FT-05-07  
Sample No.: 6  
Depth (ft.): 13.0'-16.0'  
Description: Silty Clay Trace F-C Sand  
Trace F Gravel - Brown CL

	Test 3
Flask No.	SG-1
Wt. Flask + Soil + Water (W2)	705.68
Wt. Flask + Water (W3)	669.97
Temperature ( C )	22.0
Density of Water @ test Tem.	0.99777
Tare No.	ED-6
Wt. Tare	602.16
Wt. Tare + Soil	658.70
Wt. Soil (W2-W3)	56.54
(k) Temp. Correction	0.99957
Specific Gravity (Gs)	2.713

	Test 4
Flask No.	SG-4
Wt. Flask + Soil + Water (W2)	722.18
Wt. Flask + Water (W3)	669.58
Temperature ( C )	22.1
Density of Water @ test Tem.	0.99775
Tare No.	ED-6
Wt. Tare	602.08
Wt. Tare + Soil	685.43
Wt. Soil (W2-W3)	83.35
(k) Temp. Correction	0.99954
Specific Gravity (Gs)	2.709

Technician BCM  
Date 4/23/07

Calculated  
Date

BCM  
4/23/07

Checked WPQ  
Date 4/23/07

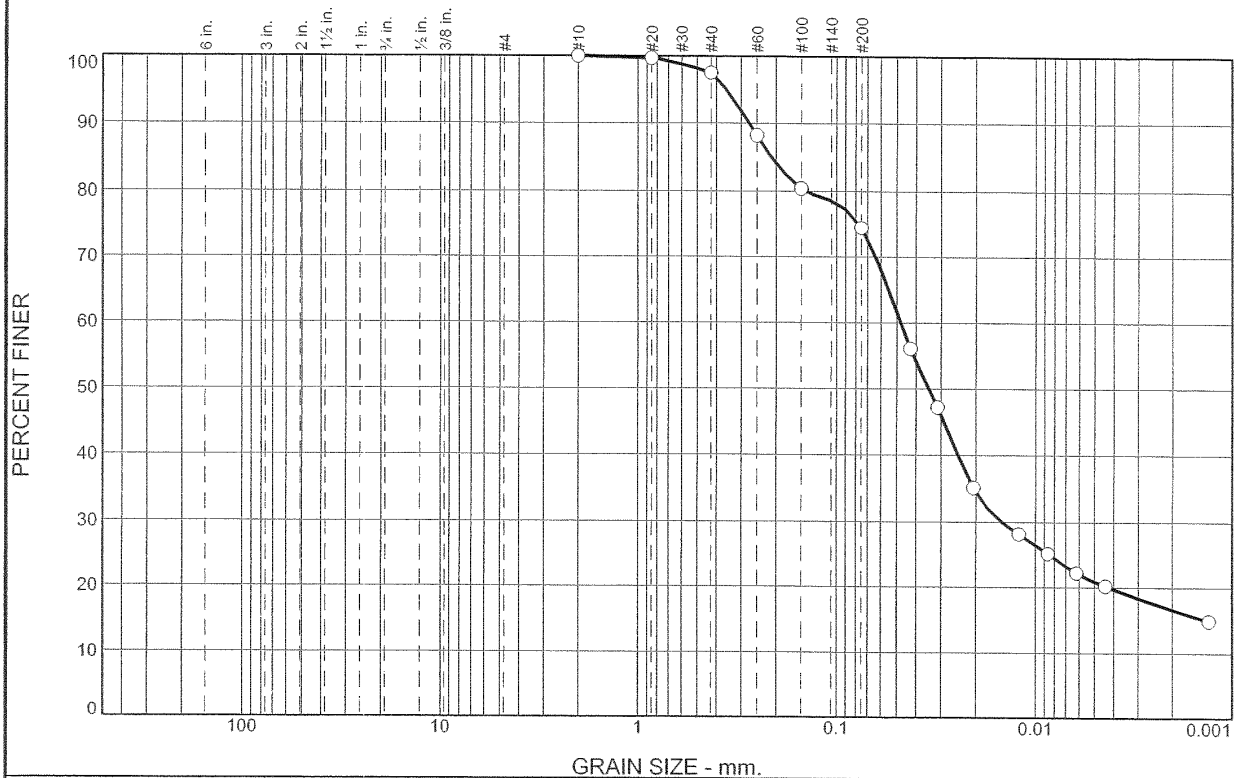
Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX F LABORATORY TEST RESULTS**

**ATTERBERG LIMITS  
AND COMBINED ANALYSIS  
(SIEVE #4 TO #200 AND HYDROMETER)**

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	2.5	23.0	53.7	20.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.7		
#40	97.5		
#60	88.2		
#100	80.4		
#200	74.5		

\* (no specification provided)

**Material Description**  
CLAYEY ORGANIC SILT SOME FINE TO MEDIUM SAND  
- DARK BROWN AND BLACK

**Atterberg Limits**  
PL= 38 LL= 44 PI= 6

**Coefficients**  
D<sub>85</sub>= 0.2107 D<sub>60</sub>= 0.0479 D<sub>50</sub>= 0.0345  
D<sub>30</sub>= 0.0148 D<sub>15</sub>= 0.0013 D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= ML AASHTO= A-5(6)

**Remarks**

Sample Number: 5  
Source of Sample: FT-01-07

Depth: 10.0'-13.0'

Date: 4/27/07



**STS Consultants Ltd.**  
750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

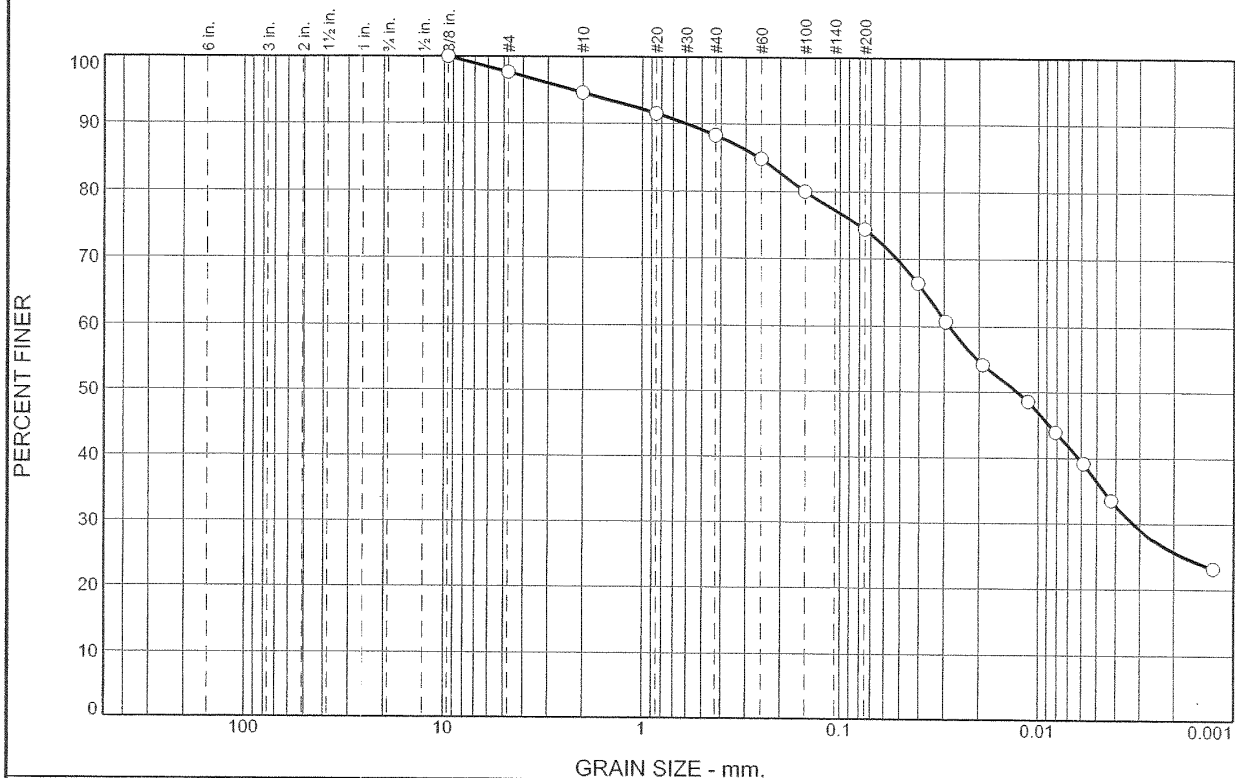
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.4	3.1	6.2	14.0	37.8	36.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.6		
#10	94.5		
#20	91.5		
#40	88.3		
#60	84.8		
#100	80.0		
#200	74.3		

\* (no specification provided)

**Material Description**  
SILTY CLAY SOME FINE TO COARSE SAND TRACE  
FINE GRAVEL - BROWN

**Atterberg Limits**  
PL= 16 LL= 27 PI= 11

**Coefficients**  
D<sub>85</sub>= 0.2552 D<sub>60</sub>= 0.0282 D<sub>50</sub>= 0.0128  
D<sub>30</sub>= 0.0033 D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-6(6)

**Remarks**

Sample Number: 9  
Source of Sample: FT-01-07

Depth: 20.0'-22.0'

Date: 4/20/07



**STS Consultants Ltd.**  
750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

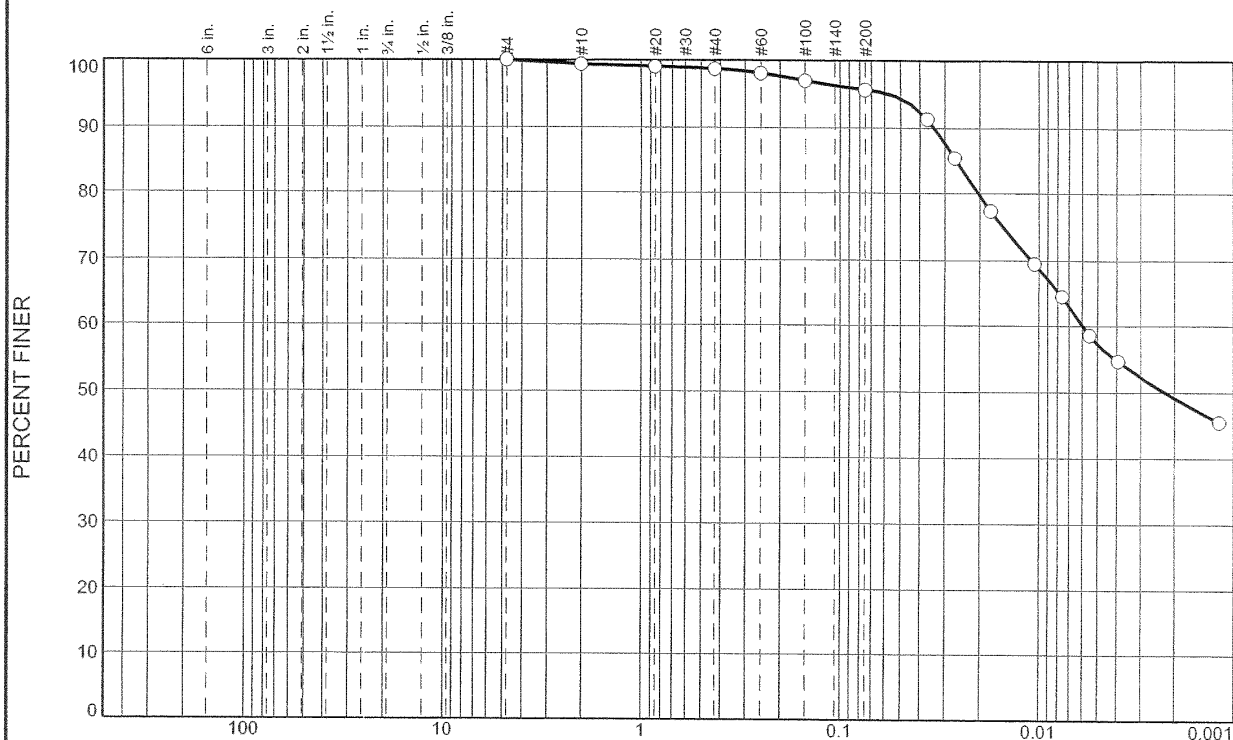
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	0.7	3.1	38.4	57.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	99.0		
#40	98.7		
#60	98.0		
#100	97.0		
#200	95.6		

\* (no specification provided)

**Material Description**  
SILTY CLAY TRACE FINE SAND - GRAY

**Atterberg Limits**  
PL= 14 LL= 23 PI= 9

**Coefficients**  
D<sub>85</sub>= 0.0263 D<sub>60</sub>= 0.0060 D<sub>50</sub>= 0.0022  
D<sub>30</sub>= D<sub>15</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-4(6)

**Remarks**

Sample Number: 10  
Source of Sample: FT-01-07

Depth: 22.5'-24.5'

Date: 4/20/07



**STS Consultants Ltd.**  
750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

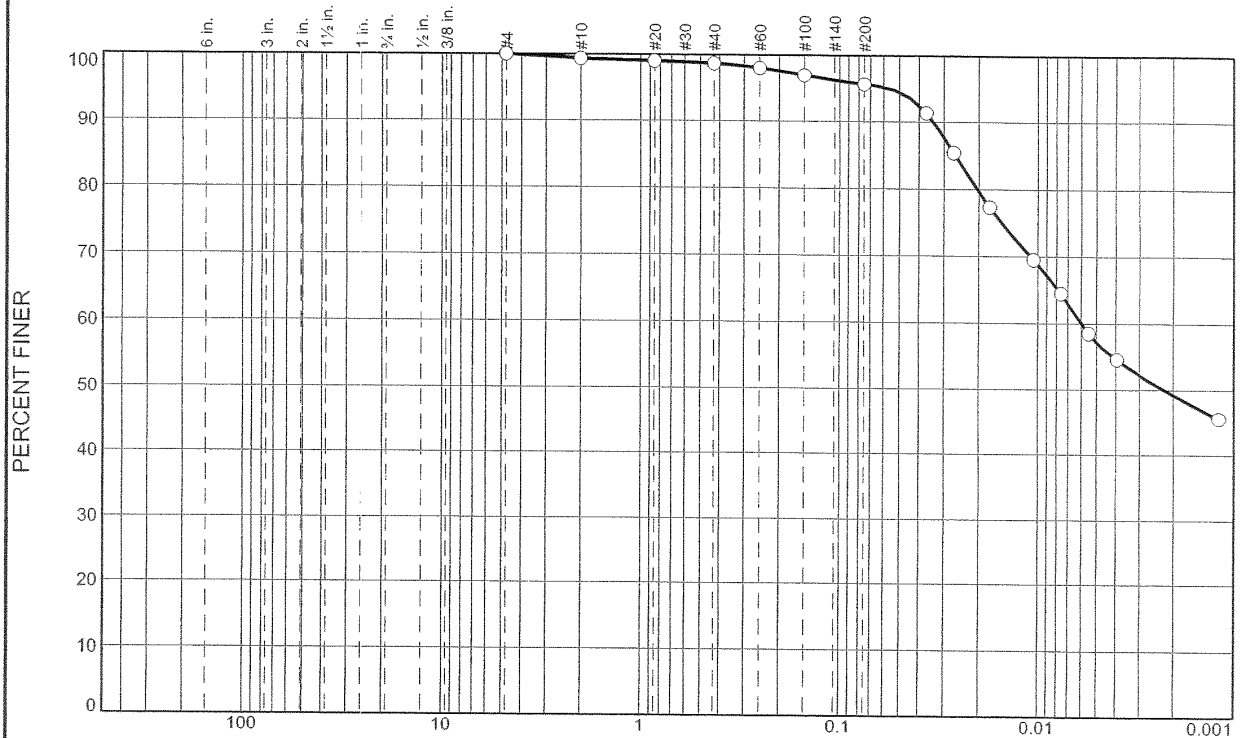
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	0.7	3.1	38.4	57.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	99.0		
#40	98.7		
#60	98.0		
#100	97.0		
#200	95.6		

\* (no specification provided)

**Material Description**  
SILTY CLAY TRACE FINE SAND - GRAYISH BROWN

**Atterberg Limits**  
PL= 20 LL= 51 PI= 31

**Coefficients**  
D<sub>85</sub>= 0.0263 D<sub>60</sub>= 0.0060 D<sub>50</sub>= 0.0022  
D<sub>30</sub>= D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CH AASHTO= A-7-6(33)

**Remarks**

Sample Number: 5  
Source of Sample: FT-02-07

Depth: 10.0'-12.0'

Date: 4/20/07



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750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

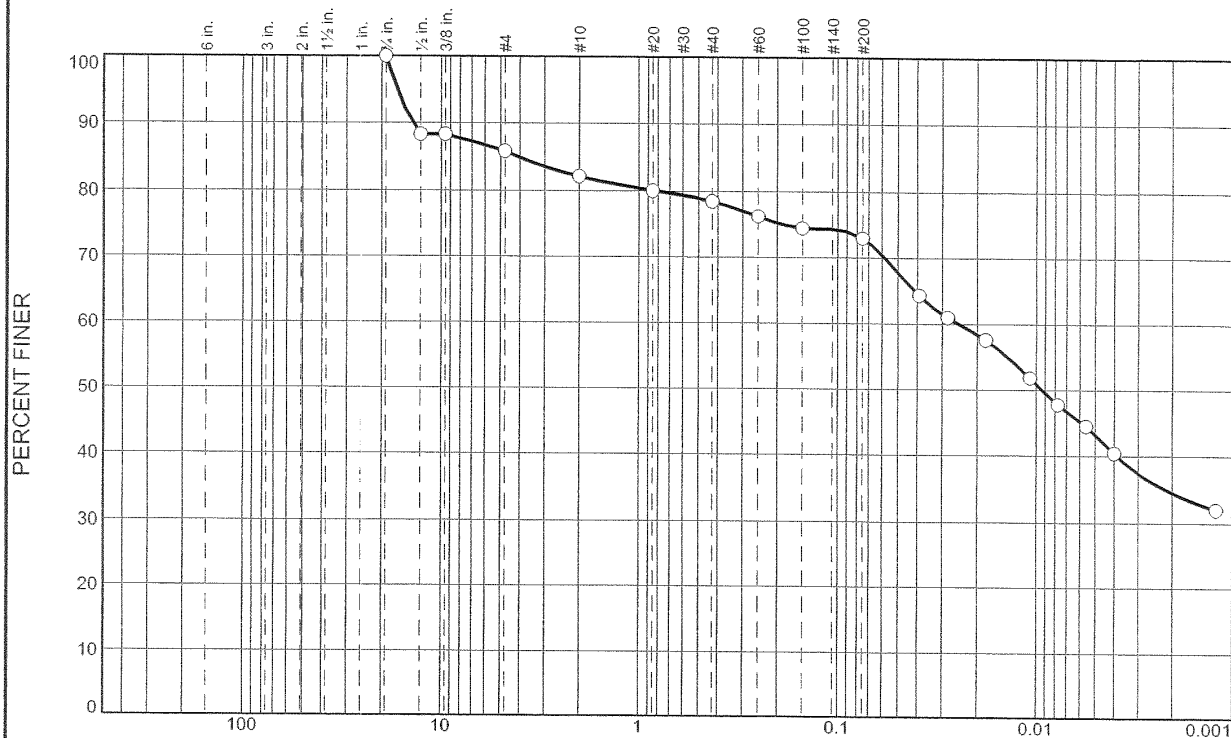
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.2	3.7	3.6	5.5	29.8	43.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	88.3		
.375	88.3		
#4	85.8		
#10	82.1		
#20	80.1		
#40	78.5		
#60	76.3		
#100	74.4		
#200	73.0		

\* (no specification provided)

**Material Description**  
SILTY CLAY LITTLE FINE TO COARSE SAND LITTLE FINE GRAVEL - GRAY

**Atterberg Limits**  
PL= 20 LL= 50 PI= 30

**Coefficients**  
D<sub>85</sub>= 4.1175 D<sub>60</sub>= 0.0248 D<sub>50</sub>= 0.0093  
D<sub>30</sub>= D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CH AASHTO= A-7-6(21)

**Remarks**

Sample Number: 7B  
Source of Sample: FT-02-07

Depth: 15.0'-18.0'

Date: 4/20/07



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Project: FRENCHTOWN

Project No: 200701266

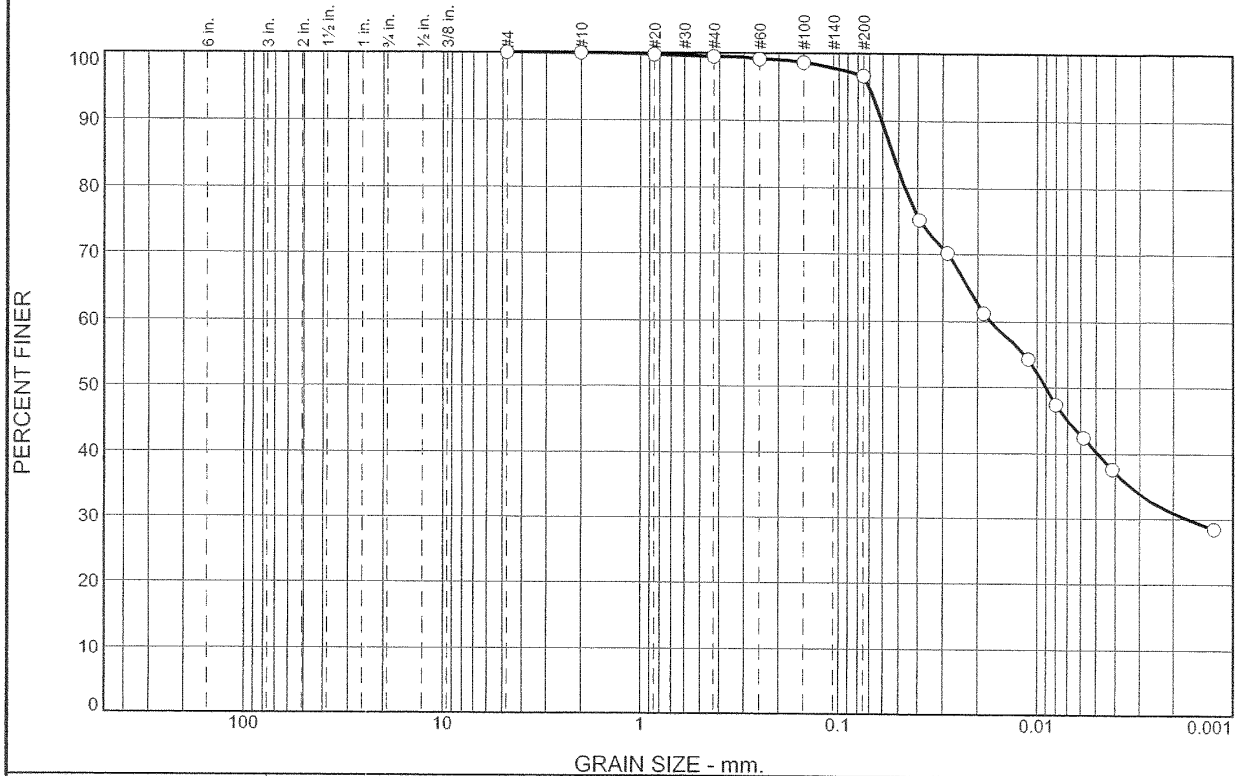
Plate

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Checked By: WPQ



# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	2.8	56.4	40.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.7		
#40	99.5		
#60	99.1		
#100	98.7		
#200	96.7		

\* (no specification provided)

**Material Description**  
CLAYEY SILT TRACE FINE SAND - GRAY

**Atterberg Limits**  
PL= 16 LL= 18 PI= 2

**Coefficients**  
D<sub>85</sub>= 0.0530 D<sub>60</sub>= 0.0173 D<sub>50</sub>= 0.0091  
D<sub>30</sub>= 0.0017 D<sub>15</sub>= C<sub>u</sub>= D<sub>10</sub>= C<sub>c</sub>=

**Classification**  
USCS= ML AASHTO= A-4(0)

**Remarks**

Sample Number: 10  
Source of Sample: FT-02-07

Depth: 22.5'-24.5'

Date: 4/20/07



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Project: FRENCHTOWN

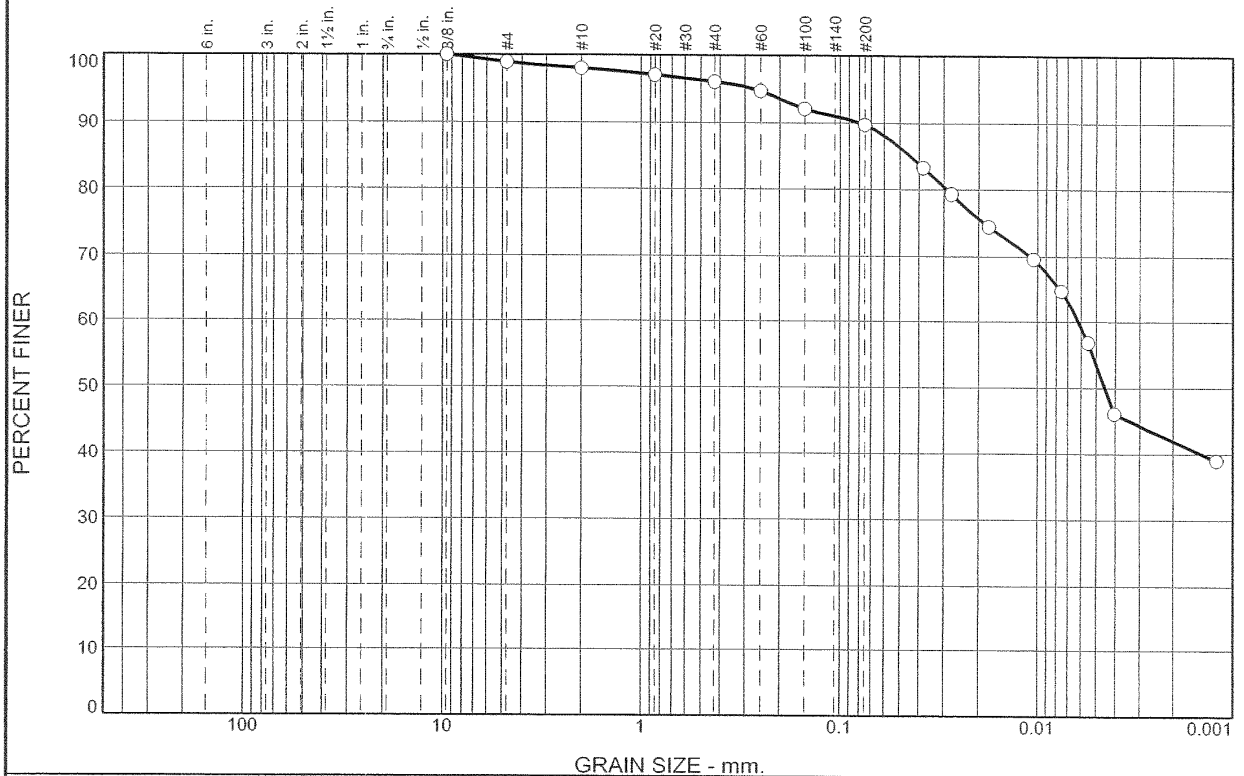
Project No: 200701266

Plate

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Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	0.9	2.0	6.3	36.2	53.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.9		
#10	98.0		
#20	97.0		
#40	96.0		
#60	94.7		
#100	92.1		
#200	89.7		

\* (no specification provided)

**Material Description**  
SILTY CLAY TRACE FINE TO MEDIUM SAND TRACE FINE GRAVEL - BROWNISH GRAY

**Atterberg Limits**  
PL= 21 LL= 39 PI= 18

**Coefficients**  
D<sub>85</sub>= 0.0442 D<sub>60</sub>= 0.0061 D<sub>50</sub>= 0.0045  
D<sub>30</sub>= D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-6(17)

**Remarks**

Sample Number: 6  
Source of Sample: FT-03-07

Depth: 12.5'-15.5'

Date: 4/20/07



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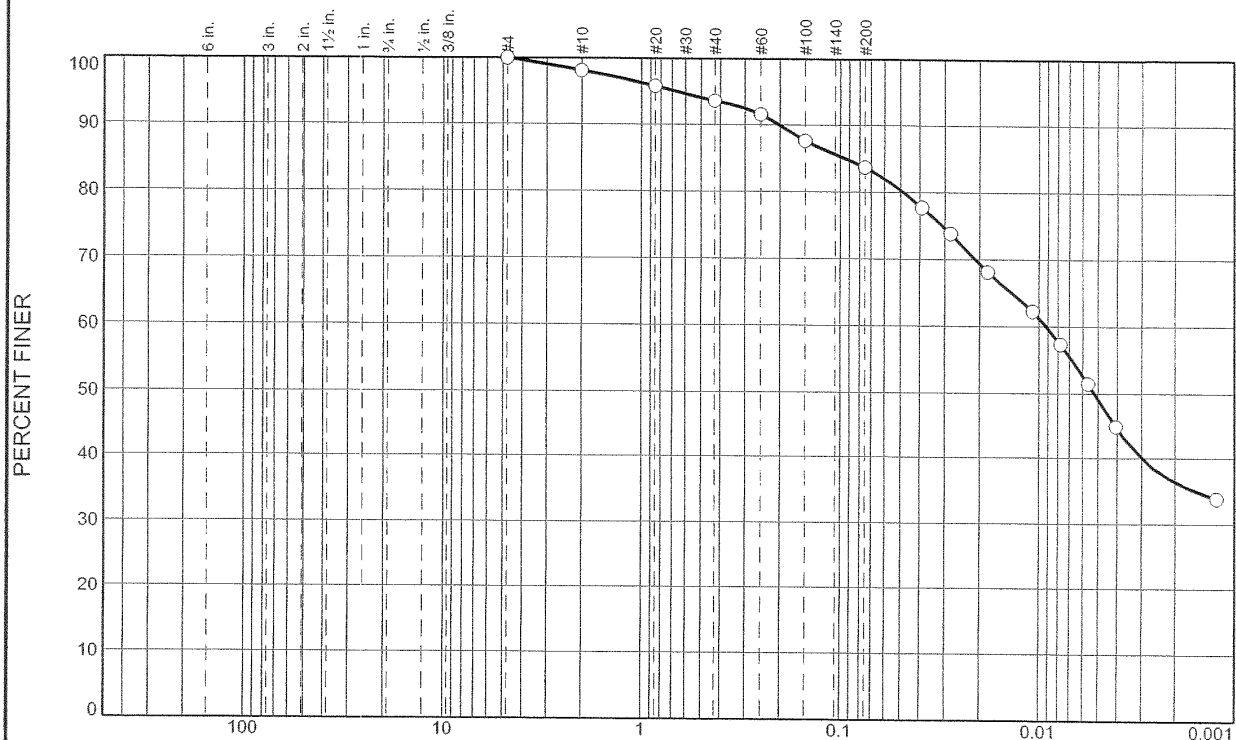
**Client:** US ARMY CORPS OF ENGINEERS  
**Project:** FRENCHTOWN

**Project No:** 200701266

**Plate**

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# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.8	4.6	9.9	34.6	49.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.2		
#20	95.9		
#40	93.6		
#60	91.6		
#100	87.6		
#200	83.7		

\* (no specification provided)

**Material Description**  
SILTY CLAY LITTLE FINE TO COARSE SAND - BROWN

**Atterberg Limits**  
PL= 17 LL= 29 PI= 12

**Coefficients**  
D<sub>85</sub>= 0.0946 D<sub>60</sub>= 0.0092 D<sub>50</sub>= 0.0052  
D<sub>30</sub>= D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-6(8)

**Remarks**

Sample Number: 8  
Source of Sample: FT-03-07

Depth: 17.5'-19.5'

Date: 4/20/07



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Project: FRENCHTOWN

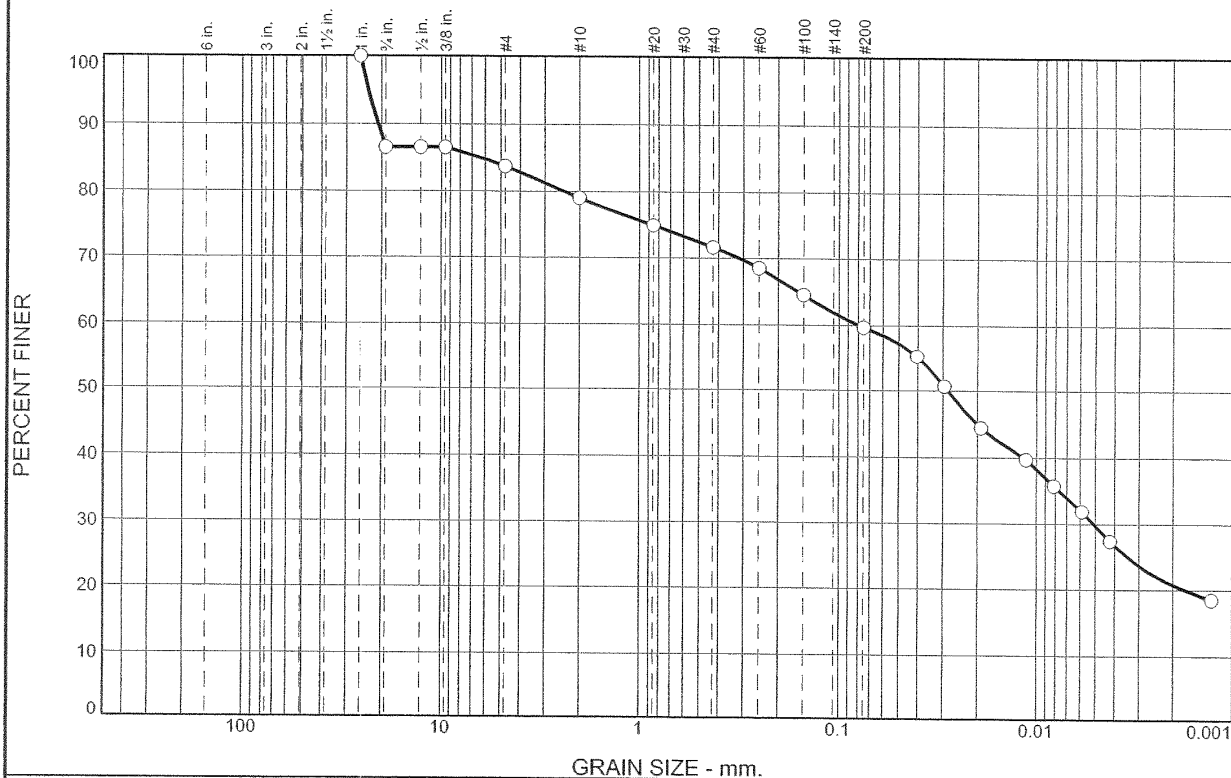
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.5	2.8	4.7	7.4	12.0	29.9	29.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75	86.5		
.50	86.5		
.375	86.5		
#4	83.7		
#10	79.0		
#20	74.9		
#40	71.6		
#60	68.5		
#100	64.5		
#200	59.6		

\* (no specification provided)

**Material Description**  
SILTY CLAY SOME FINE TO COARSE SAND LITTLE FINE TO COARSE GRAVEL - GRAY

**Atterberg Limits**  
PL= 14 LL= 23 PI= 9

**Coefficients**  
D<sub>85</sub>= 6.3041 D<sub>60</sub>= 0.0797 D<sub>50</sub>= 0.0282  
D<sub>30</sub>= 0.0051 D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-4(2)

**Remarks**

Sample Number: 11  
Source of Sample: FT-03-07

Depth: 25.0'-27.0'

Date: 4/20/07



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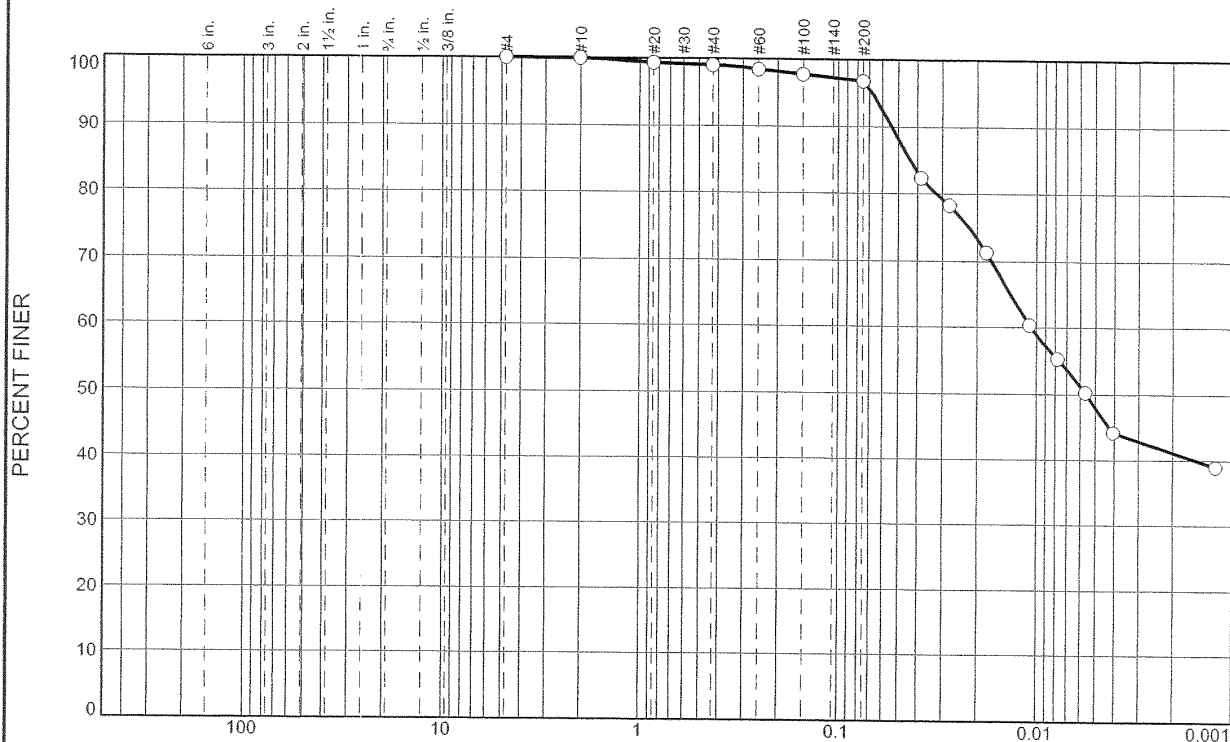
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.0	2.2	48.8	48.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.4		
#40	99.0		
#60	98.5		
#100	97.8		
#200	96.8		

\* (no specification provided)

**Material Description**  
SILTY CLAY TRACE FINE TO MEDIUM SAND - GRAY

**Atterberg Limits**  
PL= 17 LL= 46 PI= 29

**Coefficients**  
D<sub>85</sub>= 0.0438 D<sub>60</sub>= 0.0107 D<sub>50</sub>= 0.0056  
D<sub>30</sub>= D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-7-6(30)

**Remarks**

Sample Number: 5  
Source of Sample: FT-04-07

Depth: 10.0'-13.0'

Date: 4/27/07



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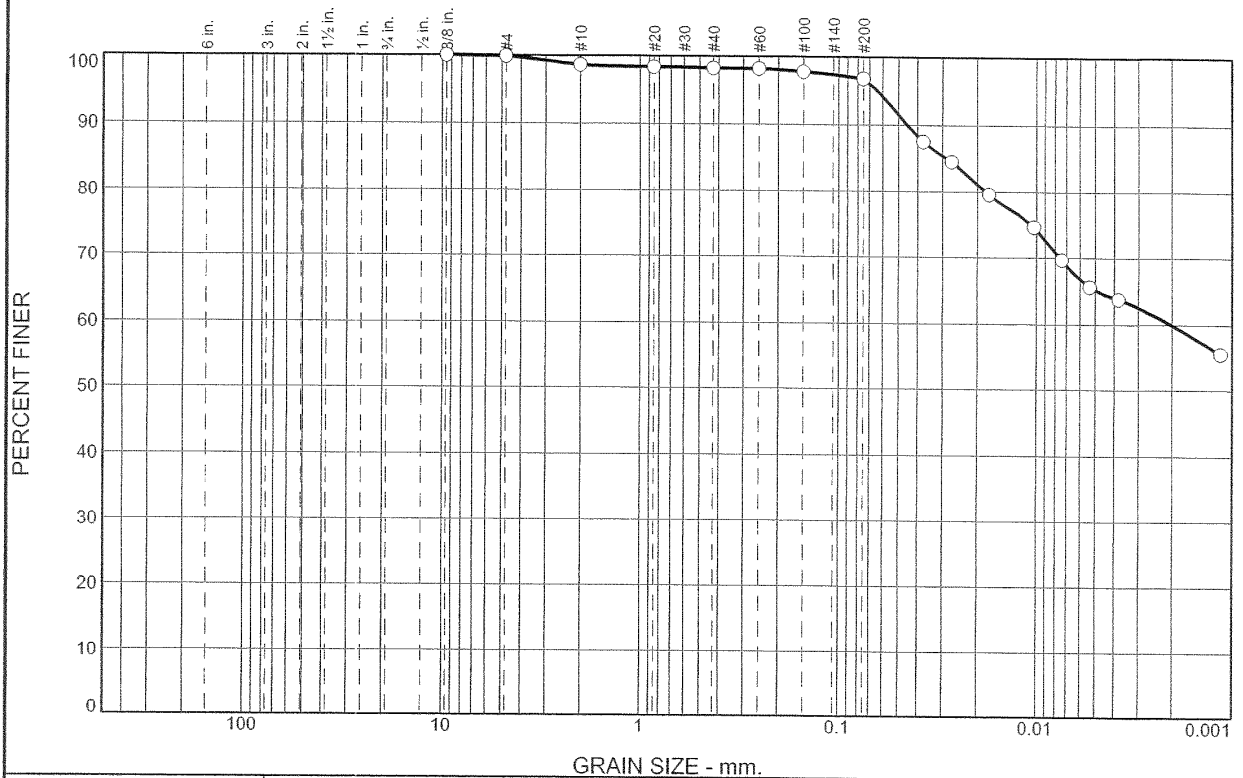
Project No: 200701266

Plate

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# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.2	0.4	1.5	31.6	65.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	98.7		
#20	98.4		
#40	98.3		
#60	98.2		
#100	97.8		
#200	96.8		

\* (no specification provided)

<u><b>Material Description</b></u>		
SILTY CLAY TRACE FINE TO COARSE SAND - GRAYISH BROWN		
<u><b>Atterberg Limits</b></u>		
PL= 22	LL= 57	PI= 35
<u><b>Coefficients</b></u>		
D <sub>85</sub> = 0.0281	D <sub>60</sub> = 0.0020	D <sub>50</sub> =
D <sub>30</sub> =	D <sub>15</sub> =	D <sub>10</sub> =
C <sub>u</sub> =	C <sub>c</sub> =	
<u><b>Classification</b></u>		
USCS= CH	AASHTO= A-7-6(38)	
<u><b>Remarks</b></u>		

Sample Number: 6  
Source of Sample: FT-04-07

Depth: 13.0'-15.0'

Date: 4/20/07



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Vernon Hills, IL 60061

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Project: FRENCHTOWN

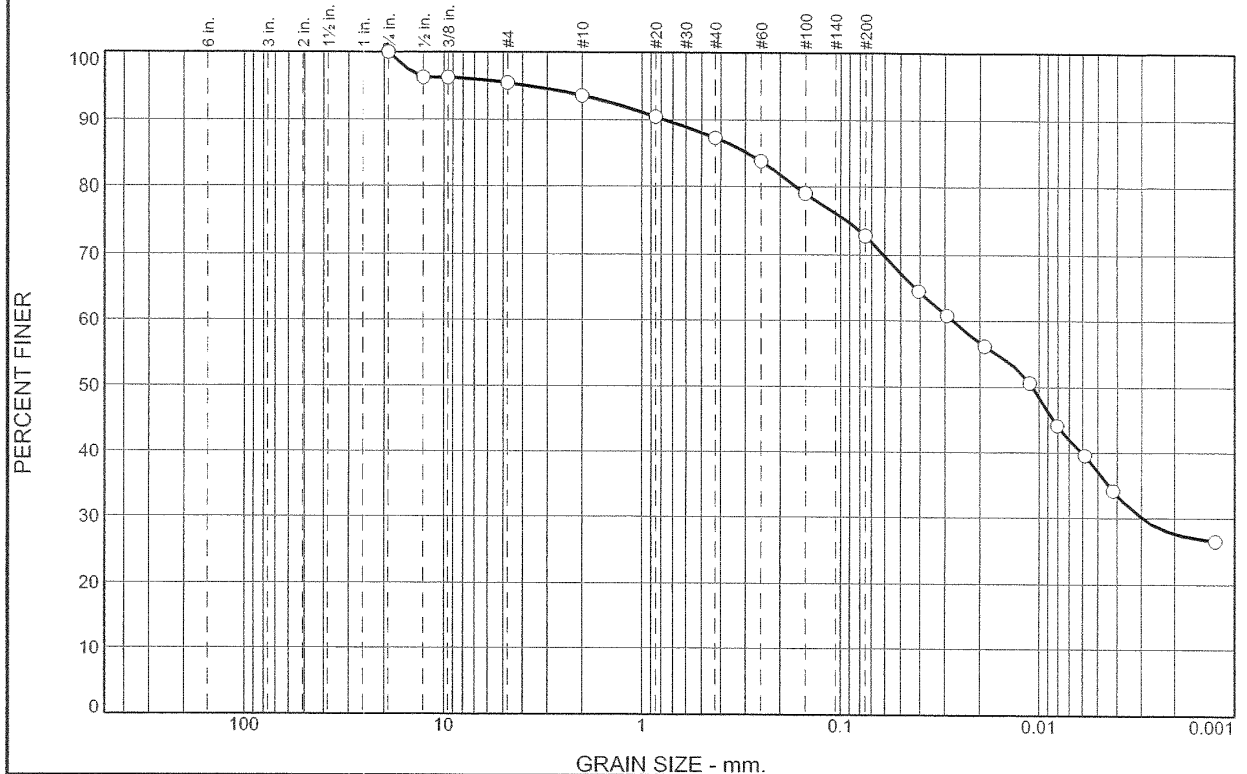
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.6	1.8	6.4	14.5	35.6	37.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.50	96.2		
.375	96.2		
#4	95.4		
#10	93.6		
#20	90.4		
#40	87.2		
#60	83.7		
#100	79.0		
#200	72.7		

\* (no specification provided)

**Material Description**  
SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - GRAY

**Atterberg Limits**  
PL= 14 LL= 26 PI= 12

**Coefficients**  
D<sub>85</sub>= 0.2956 D<sub>60</sub>= 0.0273 D<sub>50</sub>= 0.0108  
D<sub>30</sub>= 0.0029 D<sub>15</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL AASHTO= A-6(6)

**Remarks**

Sample Number: 9  
Source of Sample: FT-04-07

Depth: 20.0'-22.0'

Date: 4/20/07



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Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

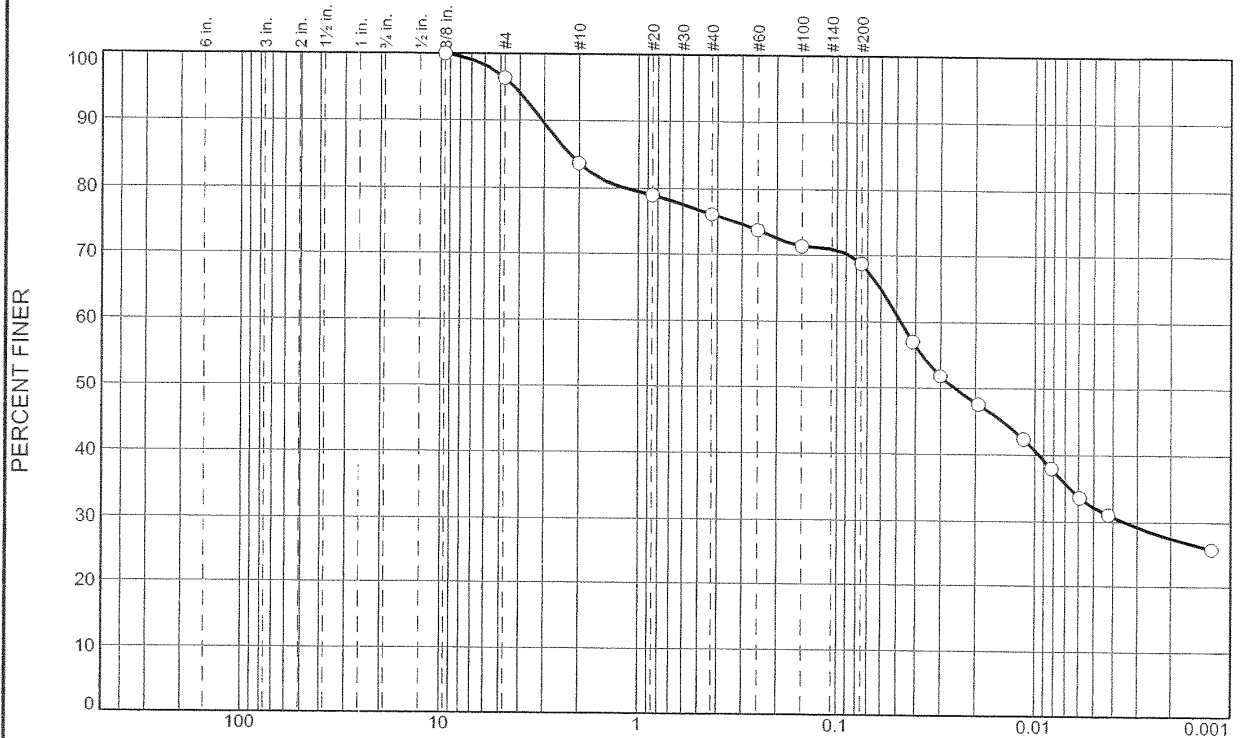
Project No: 200701266

Plate

Tested By: BCM

Checked By: WPQ

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.7	12.7	7.5	7.4	36.5	32.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.3		
#10	83.6		
#20	79.0		
#40	76.1		
#60	73.7		
#100	71.3		
#200	68.7		

\* (no specification provided)

**Material Description**  
SILTY CLAY SOME FINE TO COARSE SAND TRACE  
FINE GRAVEL - DARK GRAY

**Atterberg Limits**  
PL= 28 LL= 70 PI= 42

**Coefficients**  
D<sub>85</sub>= 2.2306 D<sub>60</sub>= 0.0477 D<sub>50</sub>= 0.0255  
D<sub>30</sub>= 0.0035 D<sub>15</sub>= C<sub>u</sub>= C<sub>c</sub>= D<sub>10</sub>=

**Classification**  
USCS= CH AASHTO= A-7-6(29)

**Remarks**

Sample Number: 5  
Source of Sample: FT-05-07

Depth: 10.0'-13.0'

Date: 4/20/07



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750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

Project No: 200701266

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Checked By: WPQ



# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422

The graph plots Percent Finer (Y-axis, 0 to 100) against Grain Size in millimeters (X-axis, logarithmic scale from 100 to 0.001). Sieve sizes are indicated along the top of the graph.

Sieve / Size (mm)	Percent Finer (%)
6 in.	100
3 in.	100
2 in.	100
1 1/2 in.	100
1 in.	100
3/4 in.	100
1/2 in.	100
3/8 in.	100
#4	96.3
#10	83.6
#20	79.0
#30	76.1
#40	73.7
#60	71.3
#100	68.7
#140	55.0
#200	47.0
0.075 mm (#200)	37.2
0.0475 mm (#30)	31.5
0.025 mm (#60)	25.0

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.7	12.7	7.5	7.4	37.2	31.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.3		
#10	83.6		
#20	79.0		
#40	76.1		
#60	73.7		
#100	71.3		
#200	68.7		

**Material Description**  
 SILTY CLAY SOME FINE TO COARSE SAND TRACE  
 FINE GRAVEL - DARK GRAY

**Atterberg Limits**  
 PL= 21      LL= 44      PI= 23

**Coefficients**  
 D<sub>85</sub>= 2.2306      D<sub>60</sub>= 0.0477      D<sub>50</sub>= 0.0255  
 D<sub>30</sub>= 0.0030      D<sub>15</sub>=                  D<sub>10</sub>=  
 C<sub>u</sub>=                    C<sub>c</sub>=

**Classification**  
 USCS= CL                  AASHTO= A-7-6(14)

**Remarks**

\* (no specification provided)

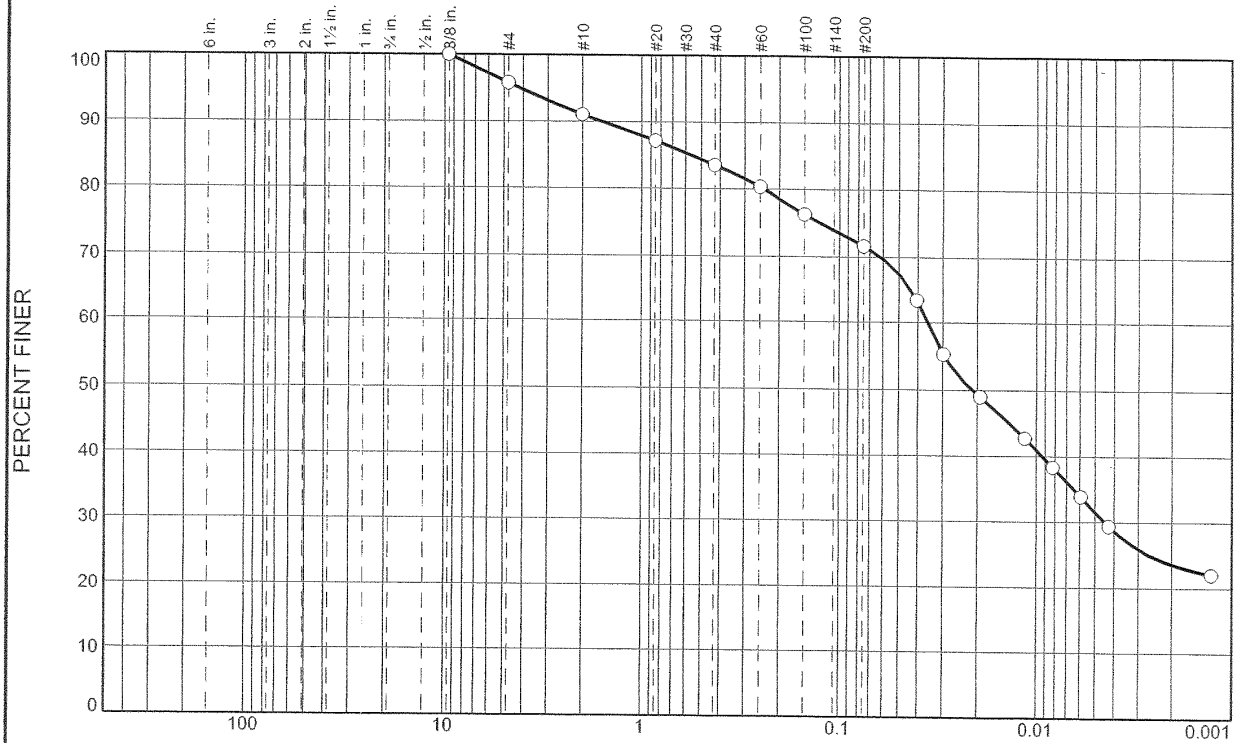
Sample Number: 7      Source of Sample: FT-05-07      Depth: 15.0'-17.0'      Date: 4/20/07

	<b>STS Consultants Ltd.</b>	<b>Client:</b> US ARMY CORPS OF ENGINEERS
	750 Corporate Woods Parkway	<b>Project:</b> FRENCHTOWN
	Vernon Hills, IL 60C61	<b>Project No:</b> 200701266

**Plate**

B-67

# PARTICLE SIZE DISTRIBUTION REPORT ASTM D 422



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	4.7	7.6	11.9	40.1	31.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.8		
#10	91.1		
#20	87.1		
#40	83.5		
#60	80.3		
#100	76.3		
#200	71.6		

\* (no specification provided)

**Material Description**  
SILTY CLAY SOME FINE TO COARSE SAND TRACE  
FINE GRAVEL - GRAY

**Atterberg Limits**  
PL= 14 LL= 21 PI= 7

**Coefficients**  
D<sub>85</sub>= 0.5608 D<sub>60</sub>= 0.0357 D<sub>50</sub>= 0.0211  
D<sub>30</sub>= 0.0045 D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

**Classification**  
USCS= CL-ML AASHTO= A-4(2)

**Remarks**

Sample Number: 9  
Source of Sample: FT-05-07

Depth: 20.0'-22.0'

Date: 4/20/07



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750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Client: US ARMY CORPS OF ENGINEERS  
Project: FRENCHTOWN

Project No: 200701266

Plate

Tested By: BCM

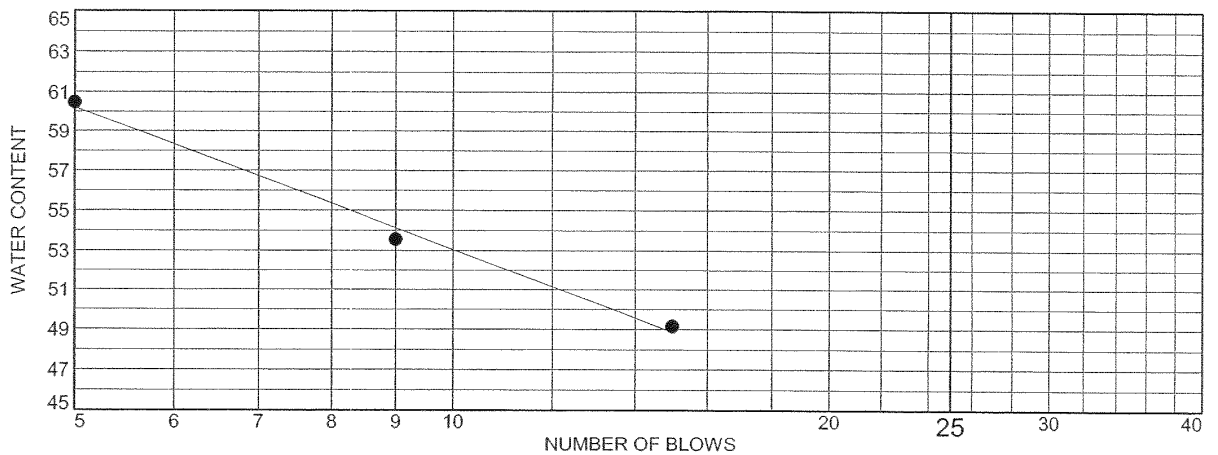
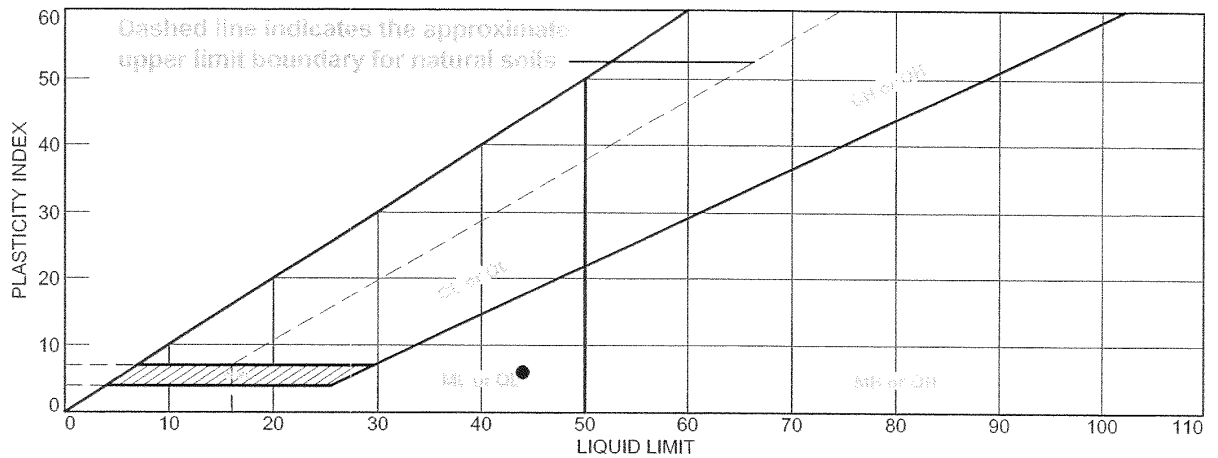
Checked By: WPQ

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



**APPENDIX F**  
**LABORATORY TEST RESULTS**  
MOISTURE CONTENT AND DRY DENSITY

# LIQUID AND PLASTIC LIMITS ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	CLAYEY ORGANIC SILT SOME FINE TO MEDIUM SAND - DARK BROWN AND BLACK	44	38	6	97.5	74.5	ML

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

• Source of Sample: FT-01-07 Depth: 10.0'-13.0' Sample Number: 5

Remarks:

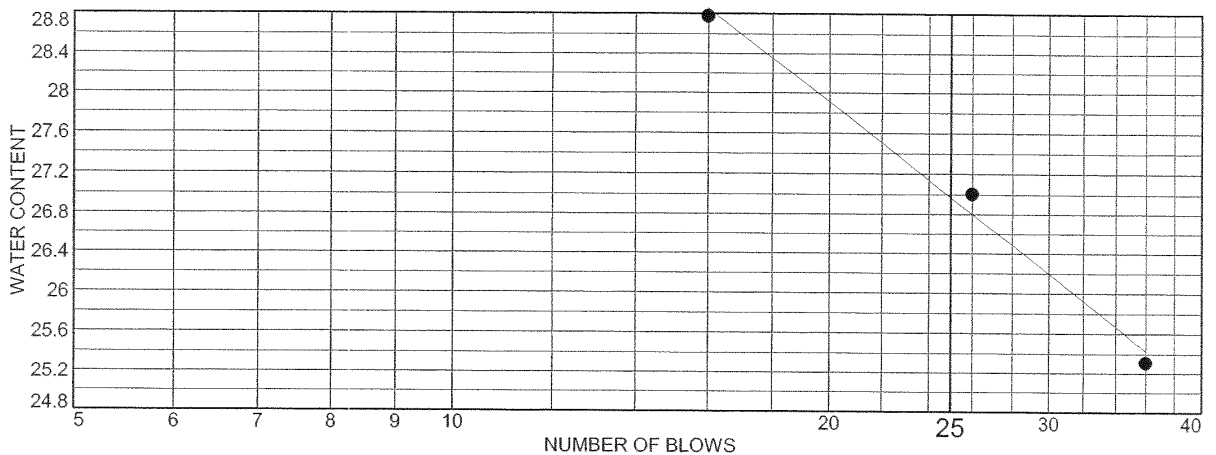
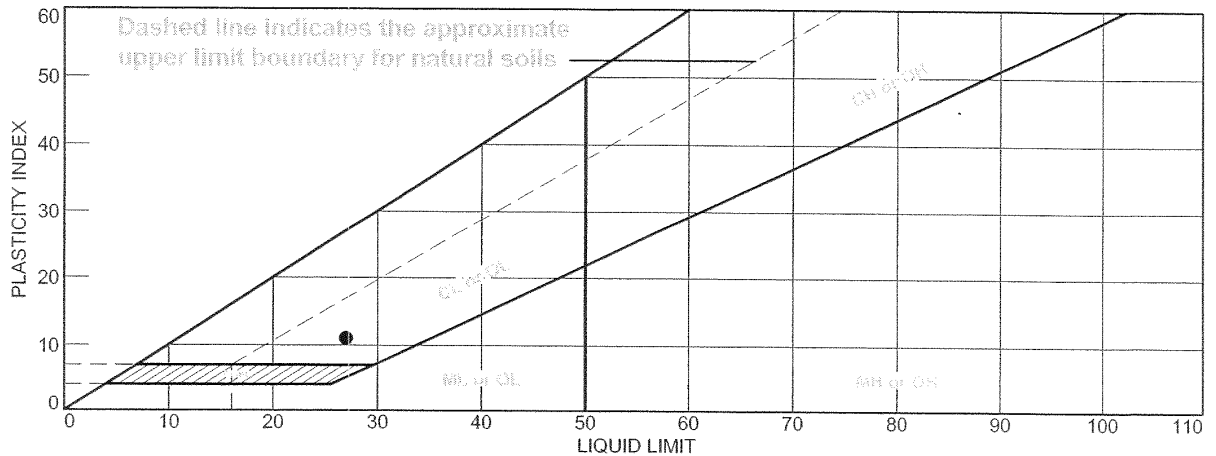


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750 Corporate Woods Parkway  
Vernon Hills, IL 60061

Plate

Tested By: BCM Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - BROWN	27	16	11	88.3	74.3	CL

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-01-07 Depth: 20.0'-22.0' Sample Number: 9

Remarks:

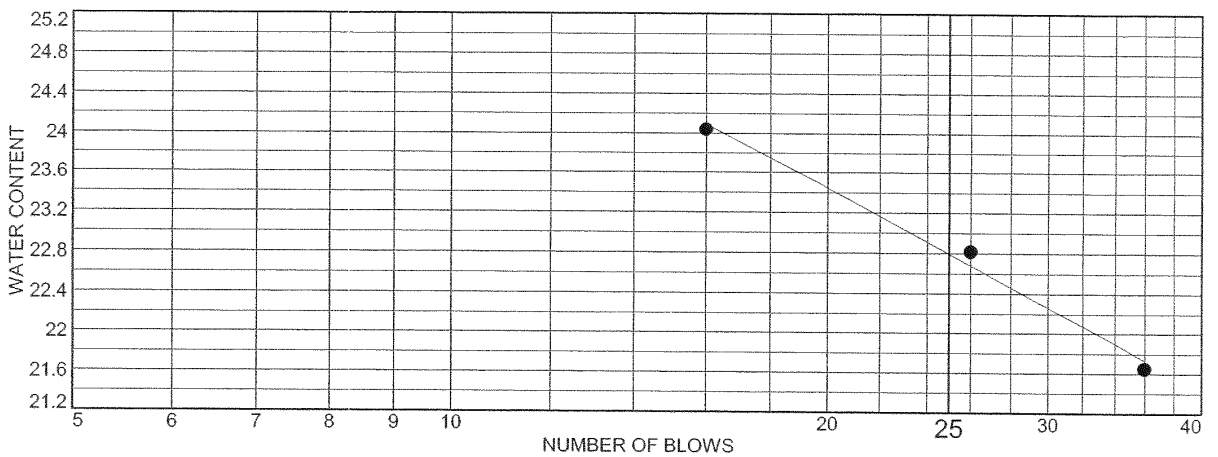
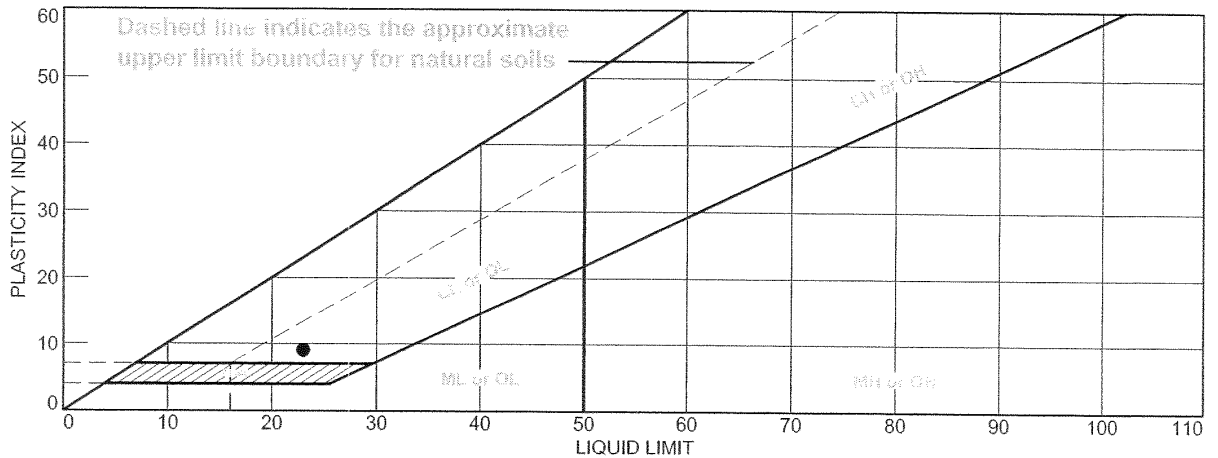


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Vernon Hills, IL 60061

Plate

Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



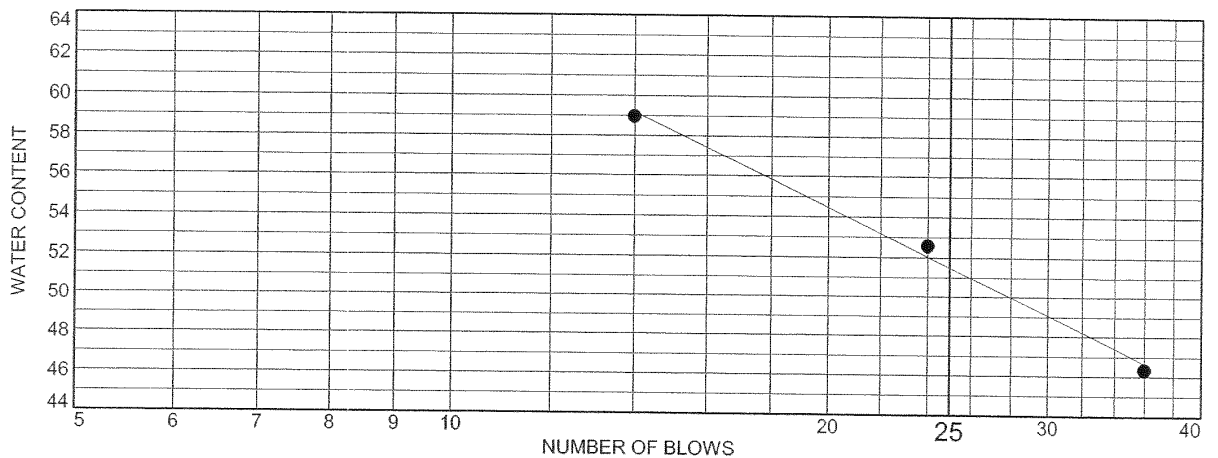
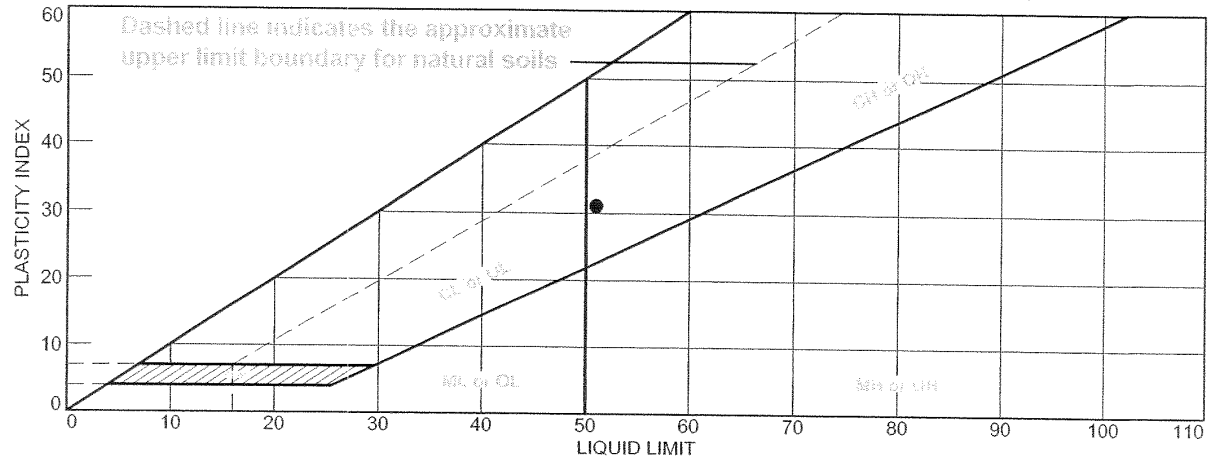
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	SILTY CLAY TRACE FINE SAND - GRAY	23	14	9	98.7	95.6	CL

<b>Project No.</b> 200701266 <b>Client:</b> US ARMY CORPS OF ENGINEERS <b>Project:</b> FRENCHTOWN  <b>• Source of Sample:</b> FT-01-07 <b>Depth:</b> 22.5'-24.5' <b>Sample Number:</b> 10	<b>Remarks:</b>          
<div style="display: flex; align-items: center;"> <div> <b>STS Consultants Ltd.</b>            750 Corporate Woods Parkway            Vernon Hills, IL 60061         </div> </div>	

Plate

Tested By: \_\_\_\_\_ Checked By: \_\_\_\_\_

# LIQUID AND PLASTIC LIMITS ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SILTY CLAY TRACE FINE SAND - GRAYISH BROWN	51	20	31	98.7	95.6	CH

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-02-07 Depth: 10.0'-12.0' Sample Number: 5

Remarks:

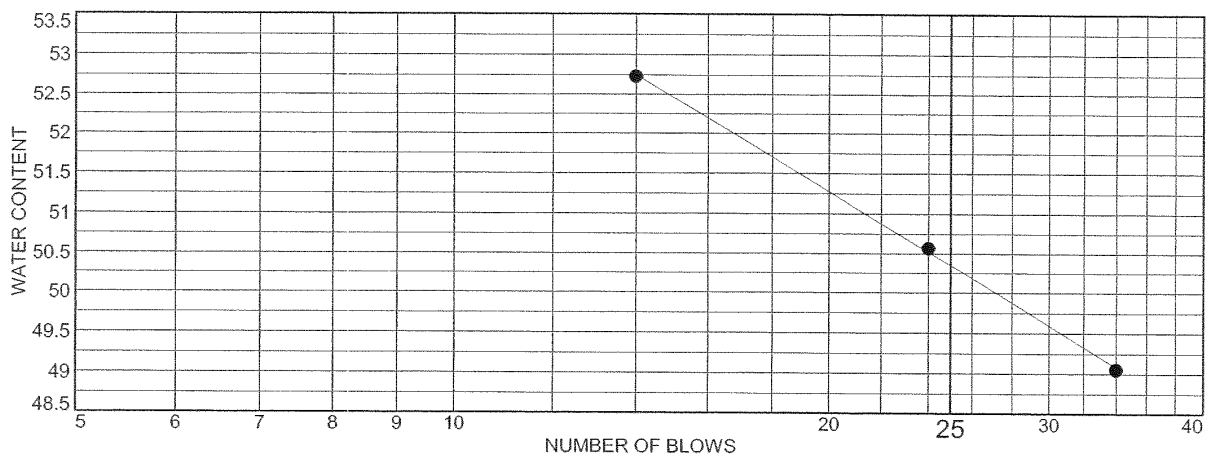
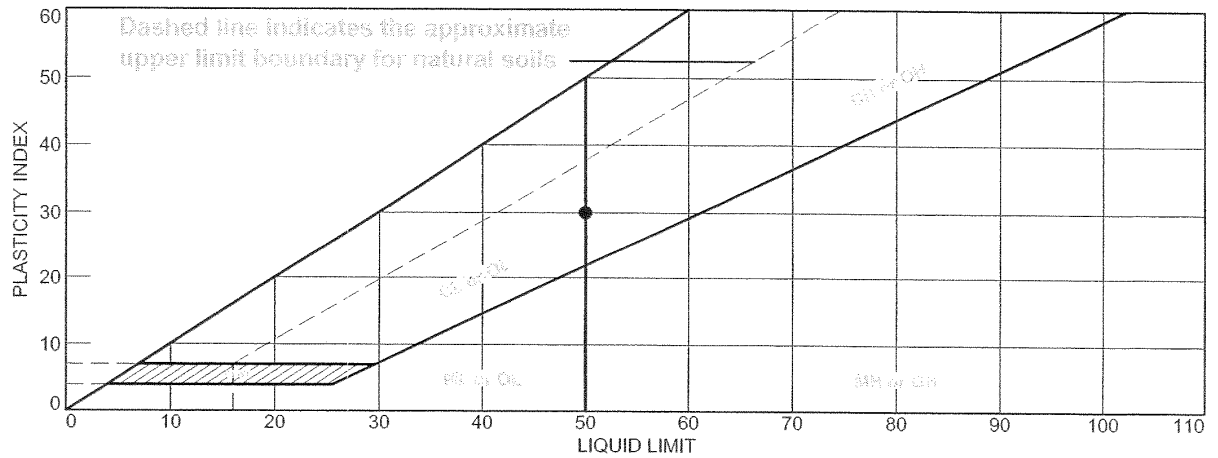


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750 Corporate Woods Parkway  
Vernon Hills, IL 60061

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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	SILTY CLAY LITTLE FINE TO COARSE SAND LITTLE FINE GRAVEL - GRAY	50	20	30	78.5	73.0	CH

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

• Source of Sample: FT-02-07 Depth: 15.0'-18.0' Sample Number: 7B



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Remarks:

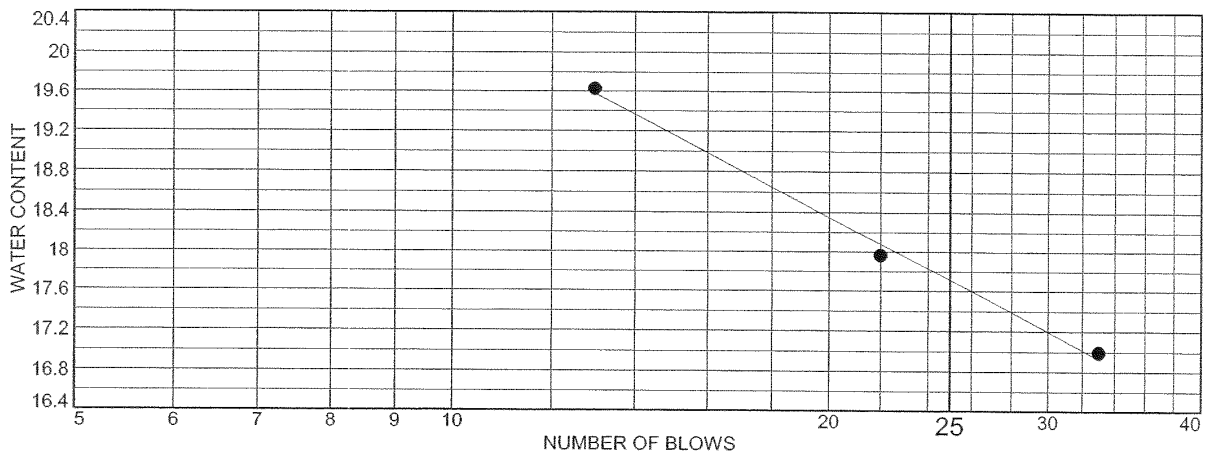
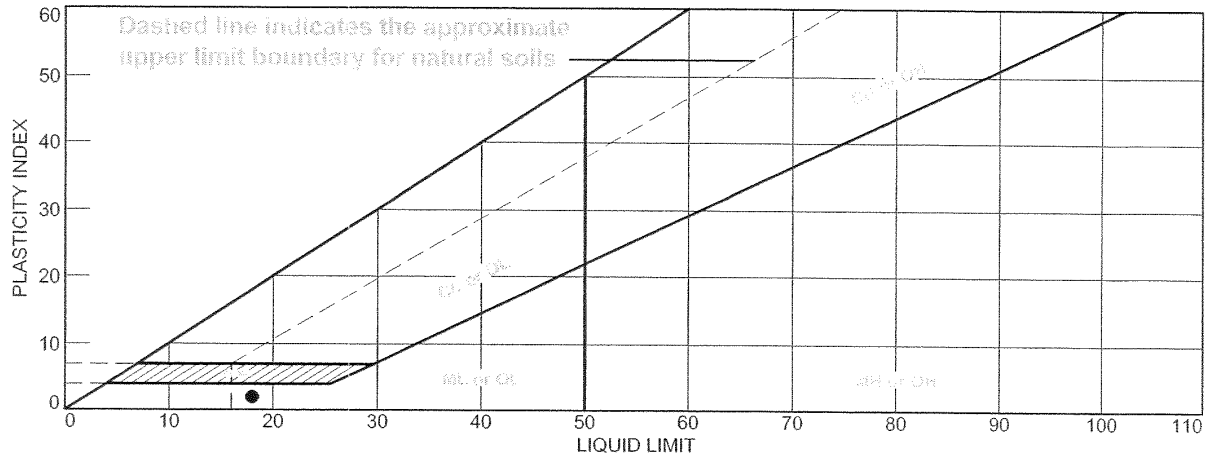
Plate

Tested By: MS

Checked By: WPQ



# LIQUID AND PLASTIC LIMITS ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	CLAYEY SILT TRACE FINE SAND - GRAY	18	16	2	99.5	96.7	ML

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

• Source of Sample: FT-02-07 Depth: 22.5'-24.5' Sample Number: 10

Remarks:

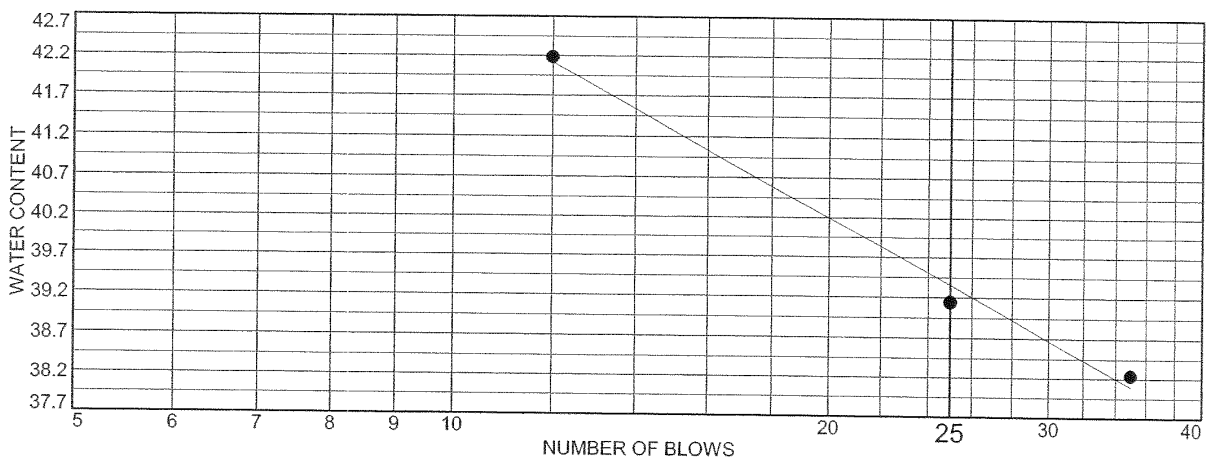
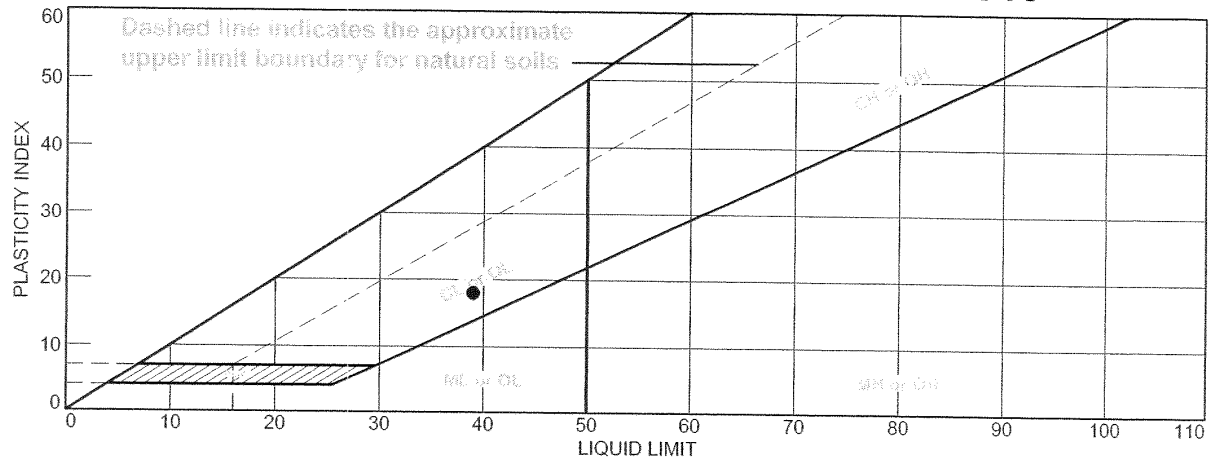


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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
• SILTY CLAY TRACE FINE TO MEDIUM SAND TRACE FINE GRAVEL - BROWNISH GRAY	39	21	18	96.0	89.7	CL

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

• Source of Sample: FT-03-07 Depth: 12.5'-15.5' Sample Number: 6

Remarks:

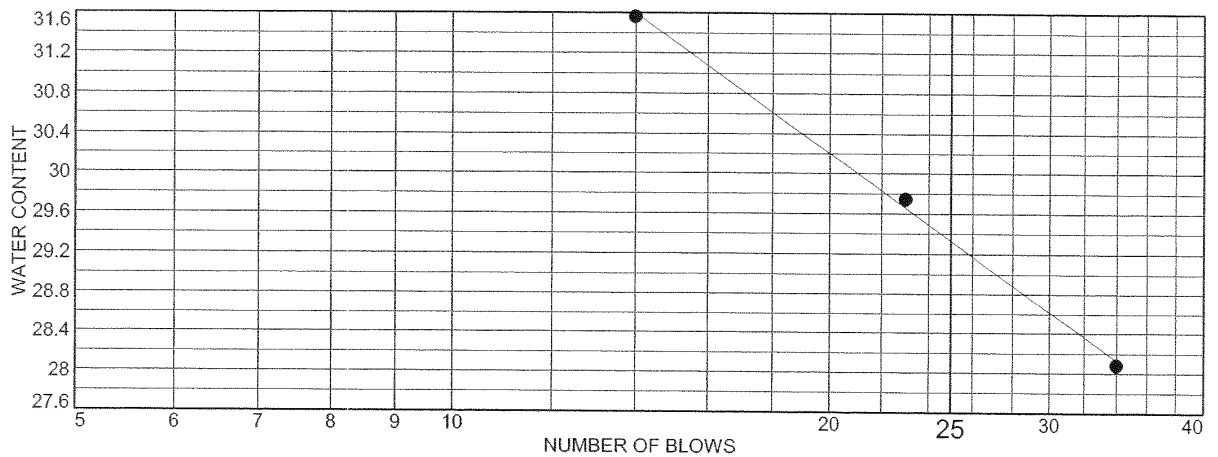
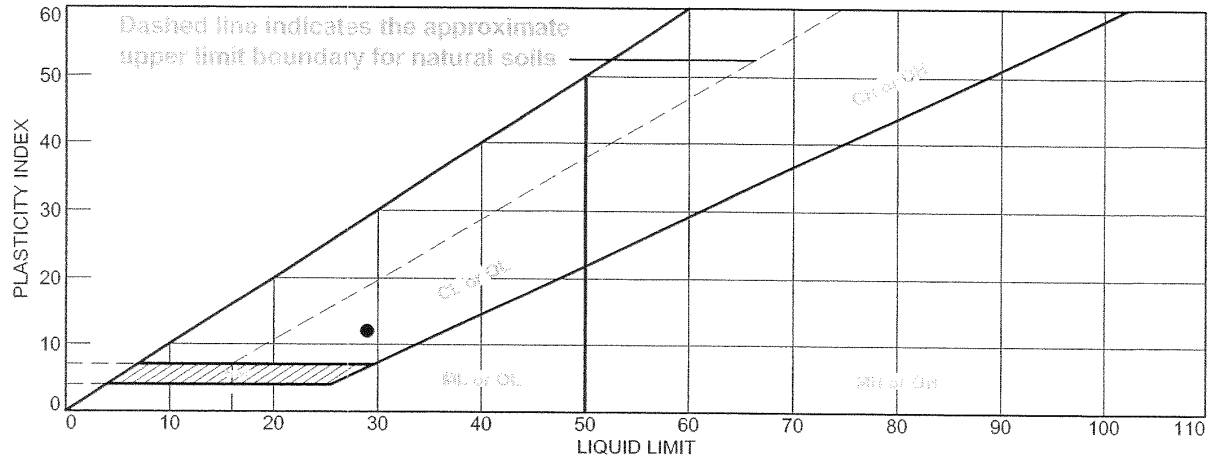


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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● SILTY CLAY LITTLE FINE TO COARSE SAND - BROWN	29	17	12	93.6	83.7	CL

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-03-07 Depth: 17.5'-19.5' Sample Number: 8

Remarks:

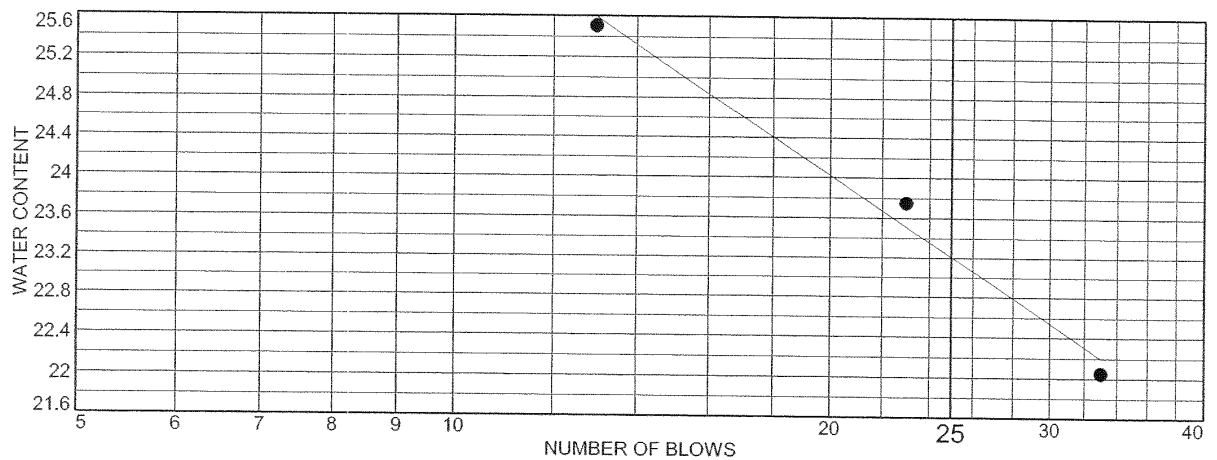
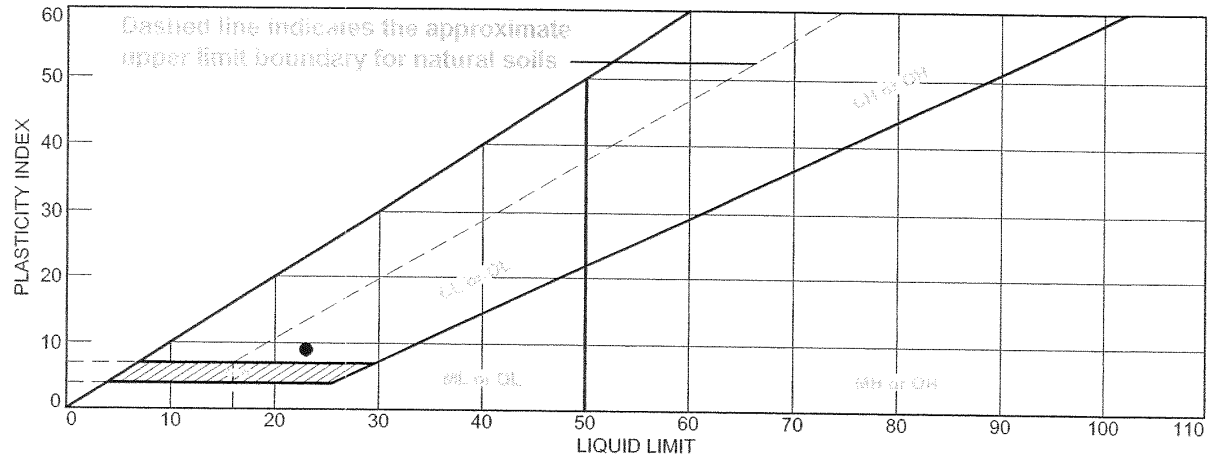


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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● SILTY CLAY SOME FINE TO COARSE SAND LITTLE FINE TO COARSE GRAVEL - GRAY	23	14	9	71.6	59.6	CL

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-03-07 Depth: 25.0'-27.0' Sample Number: 11

Remarks:

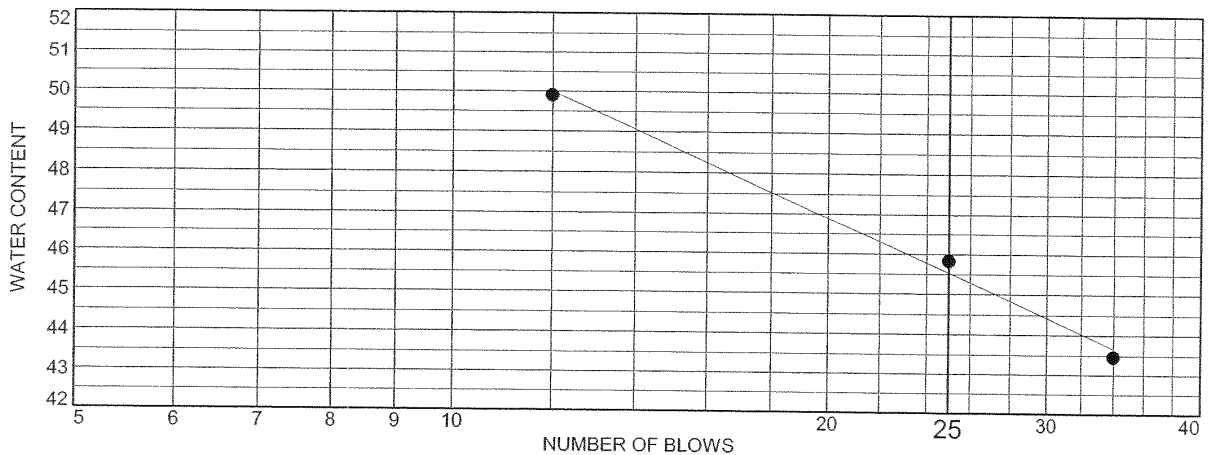
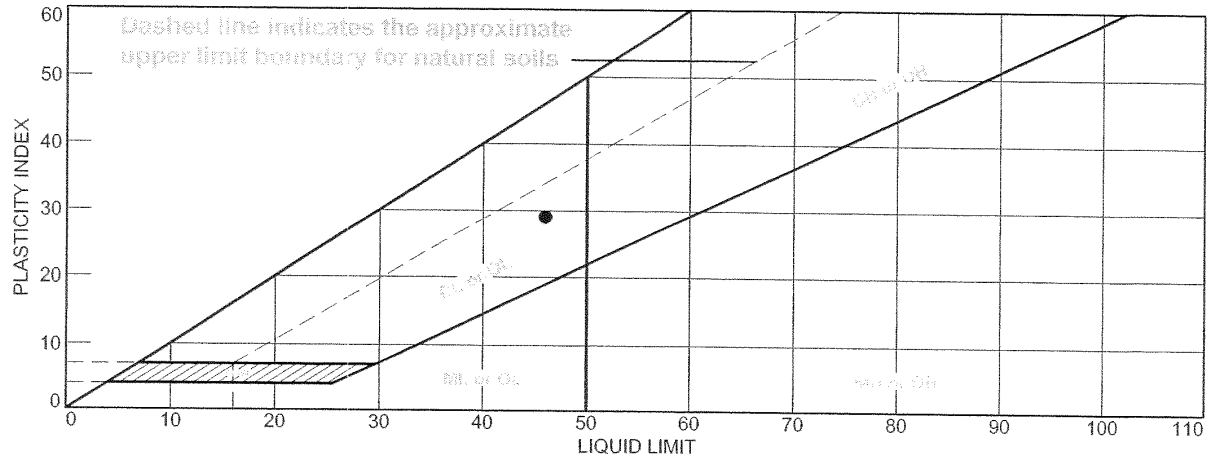


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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SILTY CLAY TRACE FINE TO MEDIUM SAND - GRAY	46	17	29	99.0	96.8	CL

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-04-07 Depth: 10.0'-13.0' Sample Number: 5

Remarks:

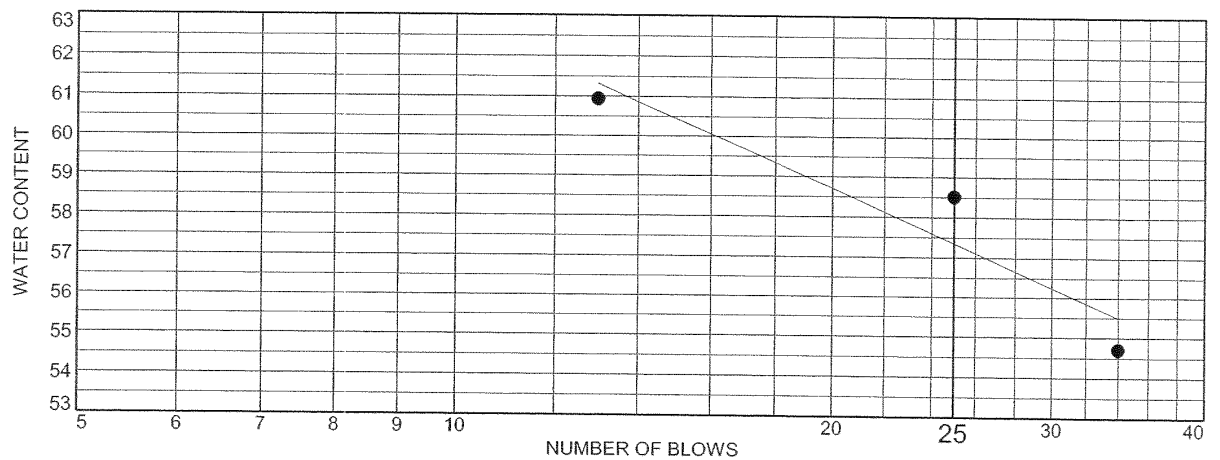
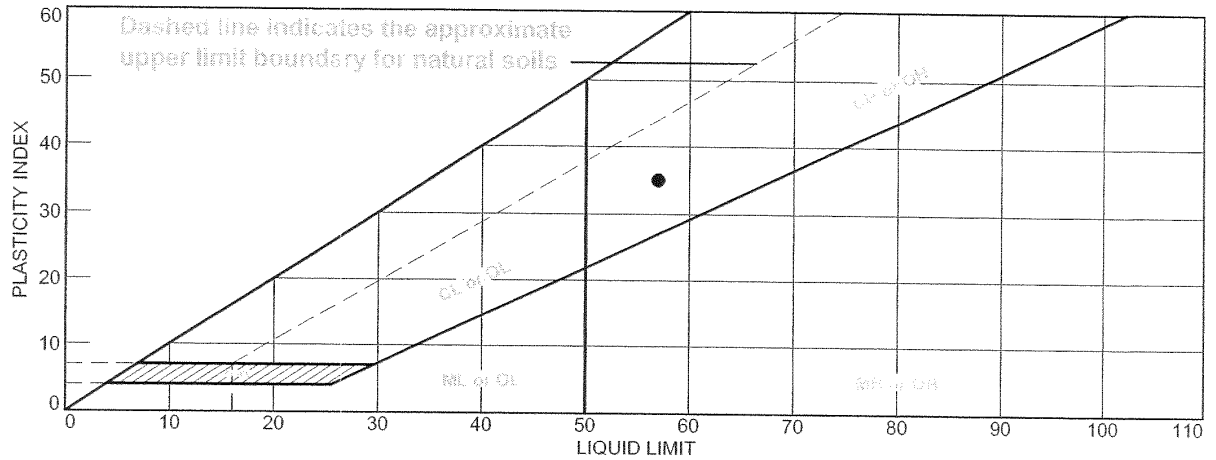


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Vernon Hills, IL 60061

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Tested By: BCM Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
SILTY CLAY TRACE FINE TO COARSE SAND - GRAYISH BROWN	57	22	35	98.3	96.8	CH

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

• Source of Sample: FT-04-07 Depth: 13.0'-15.0' Sample Number: 6

Remarks:

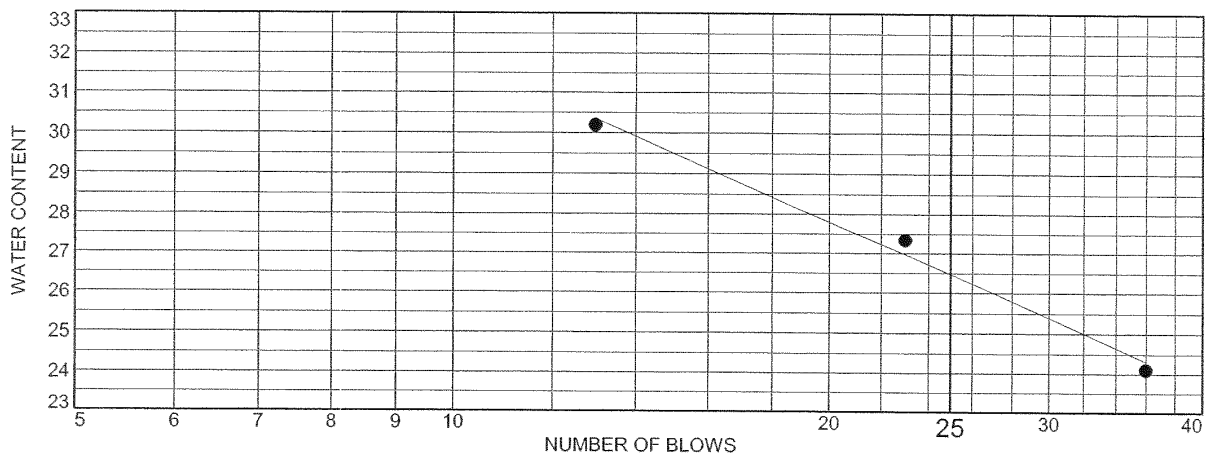
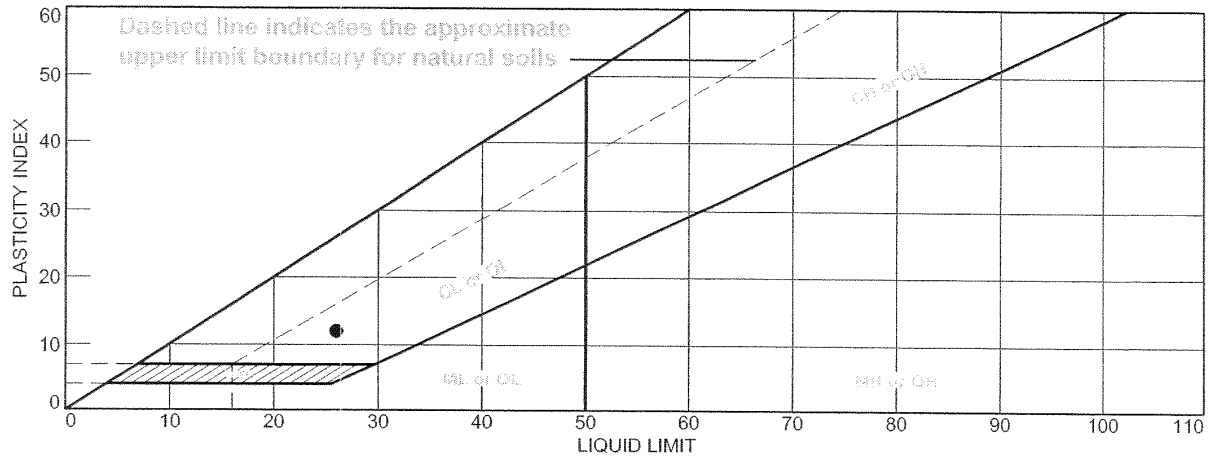


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Vernon Hills, IL 60061

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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - GRAY	26	14	12	87.2	72.7	CL

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-04-07 Depth: 20.0'-22.0' Sample Number: 9

Remarks:

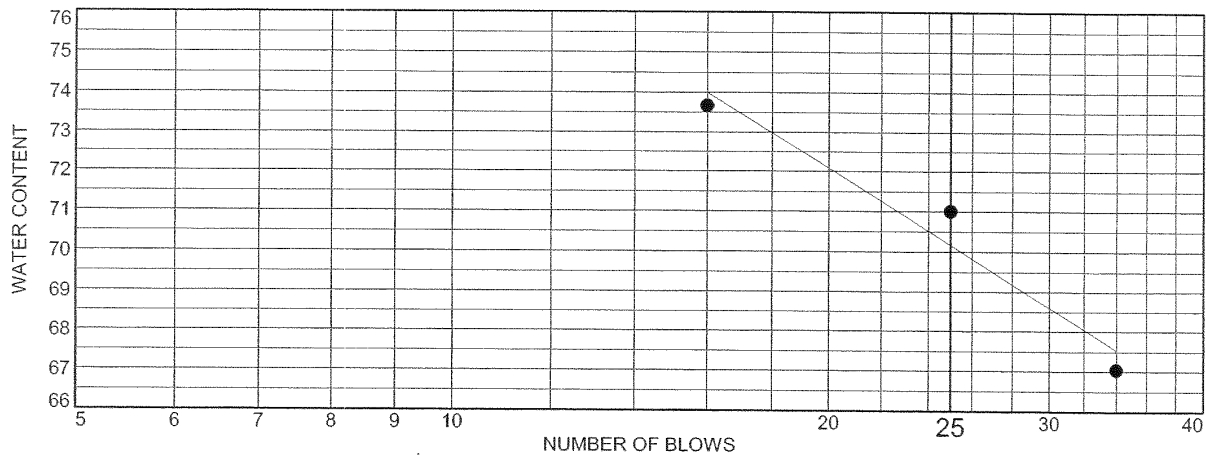
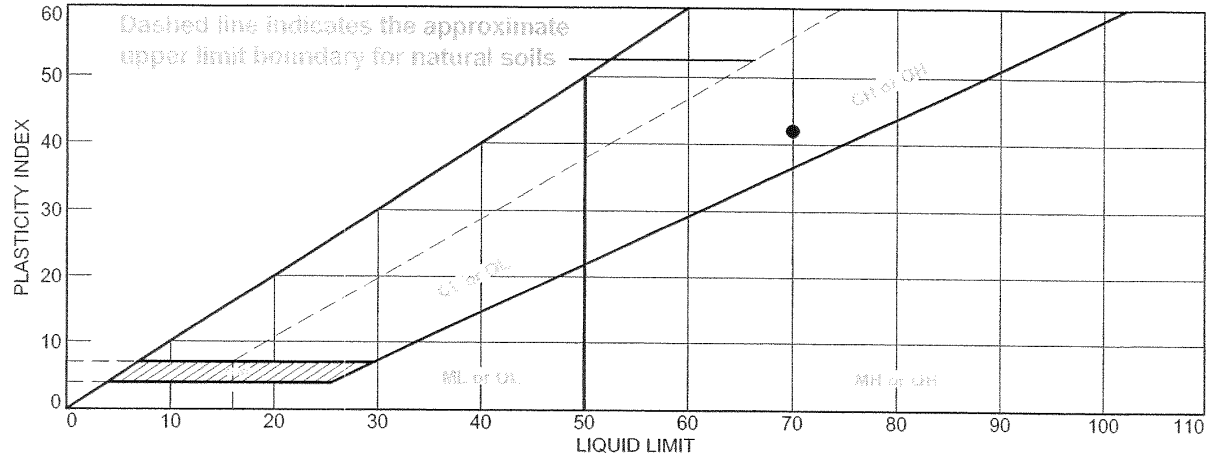


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Tested By: MS Checked By: WPQ

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - DARK GRAY	70	28	42	76.1	68.7	CH

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-05-07 Depth: 10.0'-13.0' Sample Number: 5

Remarks:

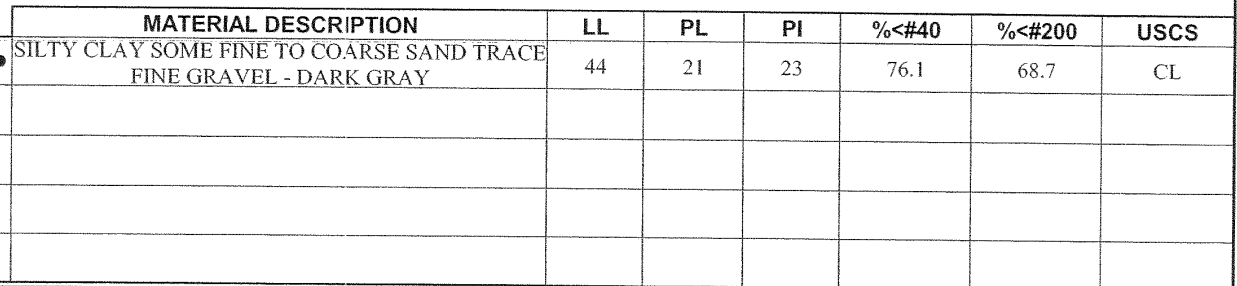


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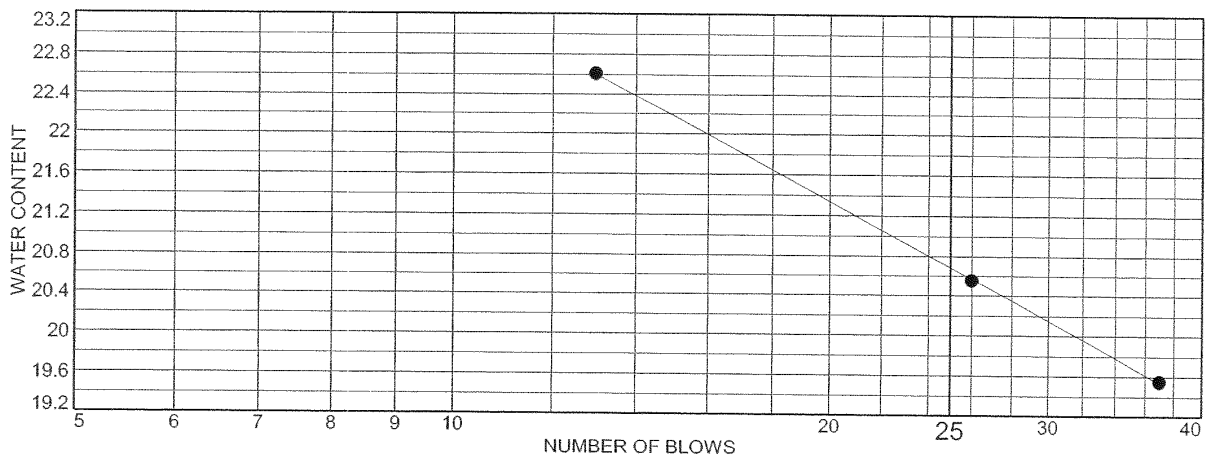
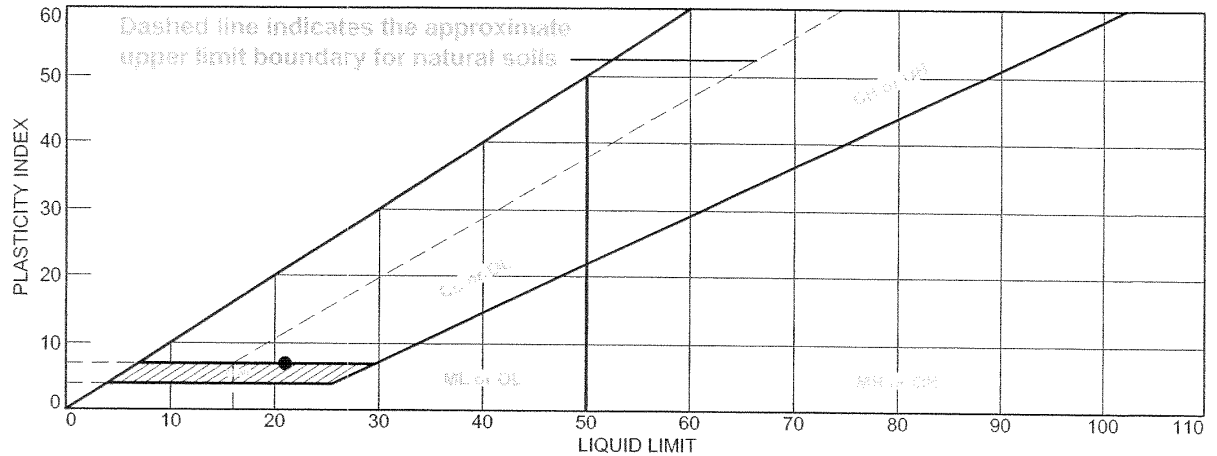
Tested By: MS Checked By: WPQ





B-83

# LIQUID AND PLASTIC LIMITS ASTM D 4318



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● SILTY CLAY SOME FINE TO COARSE SAND TRACE FINE GRAVEL - GRAY	21	14	7	83.5	71.6	CL-ML

Project No. 200701266 Client: US ARMY CORPS OF ENGINEERS

Project: FRENCHTOWN

● Source of Sample: FT-05-07 Depth: 20.0'-22.0' Sample Number: 9

Remarks:



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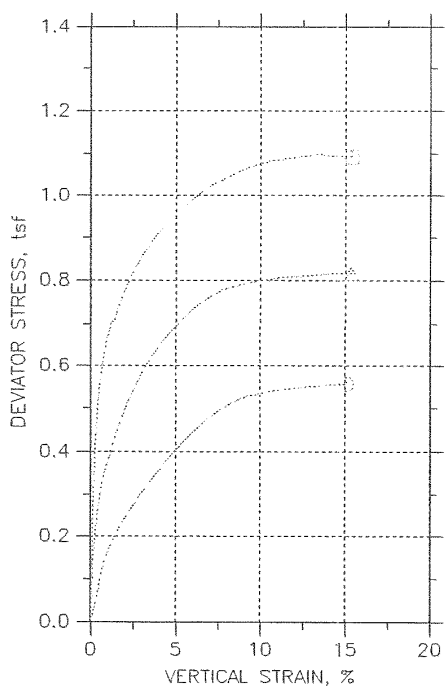
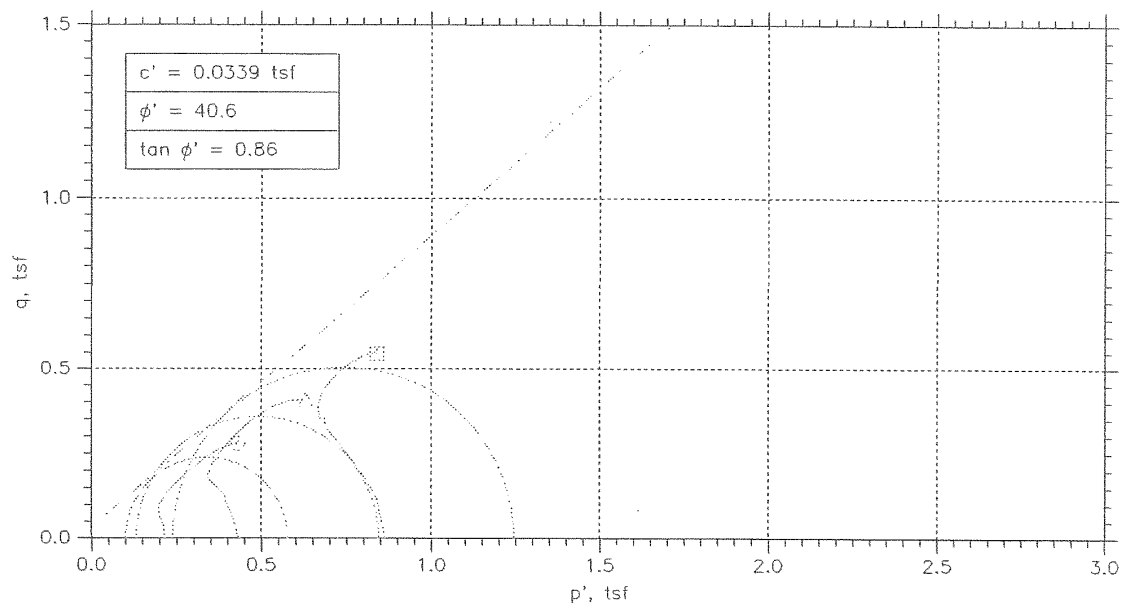
Tested By: MS Checked By: WPQ





Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



**APPENDIX F**  
**LABORATORY TEST RESULTS**  
  
CU TRIAXIAL

# TRIAxIAL COMPRESSION TEST REPORT

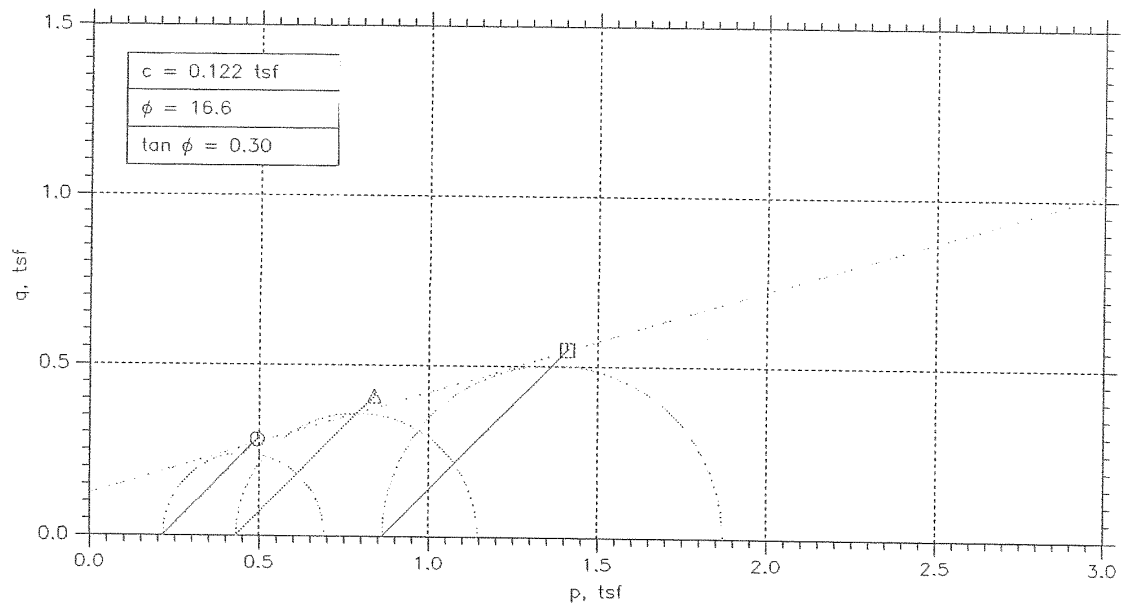
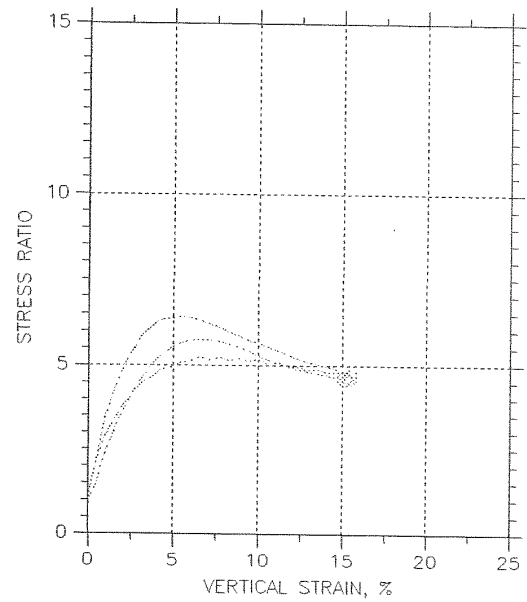
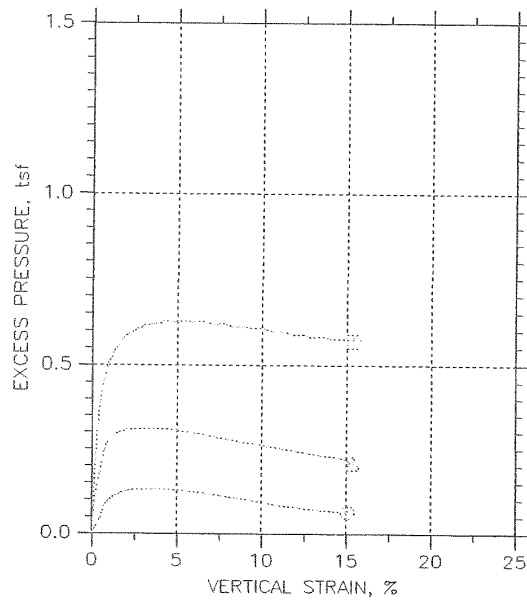


Symbol	⊙	△	⊠	
Test No.	FT01S5T1	FT01S5T2	FT01S5T3	
Initial	Diameter, in	2.8063	2.8004	2.8102
	Height, in	5.7094	5.7528	5.7276
	Water Content, %	44.27	37.09	46.04
	Dry Density, pcf	73.12	81.55	75.76
	Saturation, %	94.37	97.36	104.78
	Void Ratio	1.2197	0.9904	1.1425
Before Shear	Water Content, %	47.21	37.68	41.09
	Dry Density, pcf	73.68	83.27	78.85
	Saturation, %	102.04	103.21	100.93
	Void Ratio	1.2029	0.94935	1.0586
	Back Press., tsf	5.0402	5.04	5.0402
	Minor Prin. Stress, tsf	0.21583	0.432	0.86376
Max. Dev. Stress, tsf	0.55563	0.8155	1.0978	
Time to Failure, min	204	204	188	
Strain Rate, %/min	0.0695	0.0693	0.0702	
B-Value	---	---	---	
Estimated Specific Gravity	2.60	2.60	2.60	
Liquid Limit	44	44	44	
Plastic Limit	38	38	38	
Plasticity Index	6	6	6	
Failure Sketch				
SAND -- DARK BROWN AND BLACK CL-ML				
RATIO TEST PERFORMED AS PER ASTM D4767				

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-01-07 S5
Sample Type: 3 INCH ST

Mon, 30-APR-2007 13:57:11

# TRIAxIAL COMPRESSION TEST REPORT



Project: FRENCHTOWN	Location:	Project No.: 200701266
Boring No.: FT-01-07	Tested By: MJS	Checked By: WPQ
Sample No.: S-5	Test Date: 4/26/07	Depth: 10.0'-13.0'
Test No.: FT01S5T1	Sample Type: 3 INCH ST	Elevation:
Description: CLAYEY ORGANIC SILT SOME FINE - COARSE SAND -- DARK BROWN AND BLACK CL-ML		
Remarks: FAILURE CRITERIA=MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

Mon, 30-APR-2007 13:57:52

TRIAXIAL TEST

Project: FRENCHTOWN				Location:				Project No.: 200701266			
Boring No.: FT-01-07				Tested By: MJS				Checked By: WPK			
Sample No.: S-5				Test Date: 4/26/07				Depth: 10.0' -13.0'			
Test No.: FT01S5T1				Sample Type: 3 INCH ST				Elevation:			
Soil Description: CLAYEY ORGANIC SILT SOME FINE - COARSE SAND -- DARK BROWN AND BLACK CL-ML				Piston Area: 0.00 in <sup>2</sup>				Filter Strip Correction: 0.00 tsf			
Remarks: FAILURE CRITERIA=MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767				Piston Friction: 0.00 lb				Membrane Correction: 0.00 lb/in			
Specimen Height: 5.71 in				Piston weight: 0.00 lb				Correction Type: Uniform			
Specimen Area: 6.19 in <sup>2</sup>				Plastic Limit: 38				Estimated Specific Gravity: 2.60			
Specimen Volume: 578.70 cc											
Liquid Limit: 44											
	Time min	Vertical Strain %	Corrected Area in <sup>2</sup>	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf			
1	0	0	6.1853	0	0	5.0402	5.256	5.256	5.256	5.256	5.256
2	2.004	0.47232	6.2146	6.7842	0.078599	5.0841	5.256	5.256	5.256	5.256	5.256
3	4.004	0.61593	6.2236	9.5595	0.11059	5.1075	5.256	5.256	5.256	5.256	5.256
4	6.004	0.75794	6.2325	11.505	0.13291	5.1221	5.256	5.256	5.256	5.256	5.256
5	8.004	0.90155	6.2415	13.046	0.1505	5.1326	5.256	5.256	5.256	5.256	5.256
6	10.004	1.0432	6.2506	14.351	0.16531	5.1408	5.256	5.256	5.256	5.256	5.256
7	12.004	1.192	6.2599	15.466	0.17789	5.1467	5.256	5.256	5.256	5.256	5.256
8	14.004	1.334	6.2689	16.581	0.19044	5.1514	5.256	5.256	5.256	5.256	5.256
9	16.004	1.4808	6.2782	17.625	0.20212	5.1549	5.256	5.256	5.256	5.256	5.256
10	18.004	1.626	6.2875	18.621	0.21323	5.1578	5.256	5.256	5.256	5.256	5.256
11	20.004	1.7728	6.2969	19.499	0.22295	5.1607	5.256	5.256	5.256	5.256	5.256
12	22.004	2.0632	6.3156	21.278	0.24257	5.1642	5.256	5.256	5.256	5.256	5.256
13	24.004	2.3488	6.334	23.033	0.26182	5.1672	5.256	5.256	5.256	5.256	5.256
14	26.004	2.636	6.3527	24.646	0.27933	5.1689	5.256	5.256	5.256	5.256	5.256
15	28.004	2.9248	6.3716	26.235	0.29646	5.1695	5.256	5.256	5.256	5.256	5.256
16	30.004	3.2089	6.3903	27.773	0.31245	5.1701	5.256	5.256	5.256	5.256	5.256
17	32.004	3.4961	6.4093	29.177	0.32776	5.1707	5.256	5.256	5.256	5.256	5.256
18	34.004	3.7833	6.4285	30.671	0.34352	5.1707	5.256	5.256	5.256	5.256	5.256
19	36.004	4.0721	6.4478	32.118	0.35865	5.1701	5.256	5.256	5.256	5.256	5.256
20	38.004	4.3609	6.4673	33.423	0.37209	5.1689	5.256	5.256	5.256	5.256	5.256
21	40.004	4.6514	6.487	34.799	0.38623	5.1683	5.256	5.256	5.256	5.256	5.256
22	42.004	4.9426	6.506	36.177	0.40037	5.1666	5.256	5.256	5.256	5.256	5.256
23	44.004	5.2226	6.5261	37.289	0.4144	5.1631	5.256	5.256	5.256	5.256	5.256
24	46.004	5.5026	6.5459	38.661	0.42849	5.1595	5.256	5.256	5.256	5.256	5.256
25	48.004	5.7826	6.5654	40.033	0.44252	5.1554	5.256	5.256	5.256	5.256	5.256
26	50.004	6.0626	6.585	41.406	0.45654	5.1514	5.256	5.256	5.256	5.256	5.256
27	52.004	6.3426	6.604	42.779	0.47057	5.1467	5.256	5.256	5.256	5.256	5.256
28	54.004	6.6226	6.623	44.152	0.48459	5.142	5.256	5.256	5.256	5.256	5.256
29	56.004	6.9026	6.642	45.525	0.49862	5.1373	5.256	5.256	5.256	5.256	5.256
30	58.004	7.1826	6.661	46.898	0.51264	5.132	5.256	5.256	5.256	5.256	5.256
31	60.004	7.4626	6.680	48.271	0.52667	5.1274	5.256	5.256	5.256	5.256	5.256
32	62.004	7.7426	6.699	49.644	0.54070	5.1227	5.256	5.256	5.256	5.256	5.256
33	64.004	8.0226	6.718	51.017	0.55473	5.1180	5.256	5.256	5.256	5.256	5.256
34	66.004	8.3026	6.737	52.390	0.56876	5.1132	5.256	5.256	5.256	5.256	5.256
35	68.004	8.5826	6.756	53.763	0.58279	5.1084	5.256	5.256	5.256	5.256	5.256
36	70.004	8.8626	6.775	55.136	0.59682	5.1036	5.256	5.256	5.256	5.256	5.256
37	72.004	9.1426	6.794	56.509	0.61085	5.0988	5.256	5.256	5.256	5.256	5.256
38	74.004	9.4226	6.813	57.882	0.62488	5.0940	5.256	5.256	5.256	5.256	5.256
39	76.004	9.7026	6.832	59.255	0.63891	5.0892	5.256	5.256	5.256	5.256	5.256

# TRIAXIAL TEST

Project: FRENCHTOWN  
 Boring No.: FT-01-07  
 Sample No.: S-5  
 Test No.: FT01S5T1

Location:  
 Tested By: MJS  
 Test Date: 4/26/07  
 Sample Type: 3 INCH ST

Project No.: 200701266  
 Checked By: WPO  
 Depth: 10.0'-13.0'  
 Elevation:

Soil Description: CLAYEY ORGANIC SILT SOME FINE - COARSE SAND -- DARK BROWN AND BLACK CL-ML  
 Remarks: FAILURE CRITERIA=MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.71 in  
 Specimen Area: 6.19 in<sup>2</sup>  
 Specimen Volume: 578.70 cc

Piston Area: 0.00 in<sup>2</sup>  
 Piston Friction: 0.00 lb  
 Piston weight: 0.00 lb

Filter Strip Correction: 0.00 tsf  
 Membrane Correction: 0.00 lb/in  
 Correction Type: Uniform

Liquid Limit: 44

Plastic Limit: 38

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.256	5.256	0	0.000	0.21583	0.21583	1.000	0.21583	0
2	0.47	5.3346	5.256	0.043889	0.558	0.25054	0.17195	1.457	0.21124	0.039299
3	0.62	5.3666	5.256	0.067296	0.608	0.25913	0.14854	1.745	0.20383	0.055297
4	0.76	5.3889	5.256	0.081925	0.616	0.26881	0.13391	1.993	0.20036	0.066453
5	0.90	5.4065	5.256	0.094459	0.614	0.27388	0.12338	2.220	0.19863	0.07525
6	1.05	5.4213	5.256	0.10065	0.609	0.28049	0.11518	2.435	0.19784	0.082655
7	1.19	5.4339	5.256	0.1065	0.599	0.28722	0.10933	2.627	0.19827	0.088944
8	1.33	5.4464	5.256	0.11147	0.584	0.29509	0.10465	2.820	0.19987	0.095218
9	1.48	5.4581	5.256	0.1147	0.567	0.30326	0.10114	2.998	0.2022	0.10106
10	1.63	5.4692	5.256	0.11762	0.552	0.31145	0.098213	3.171	0.20483	0.10662
11	1.77	5.479	5.256	0.12055	0.541	0.31824	0.095287	3.340	0.20676	0.11148
12	2.06	5.4986	5.256	0.12406	0.511	0.33435	0.091776	3.643	0.21306	0.12129
13	2.35	5.5178	5.256	0.12698	0.485	0.35067	0.08885	3.947	0.21976	0.13091
14	2.64	5.5353	5.256	0.12874	0.461	0.36643	0.087094	4.207	0.22676	0.13967
15	2.92	5.5525	5.256	0.12933	0.436	0.38297	0.086509	4.427	0.23474	0.14823
16	3.21	5.5684	5.256	0.12991	0.416	0.39836	0.085924	4.636	0.24214	0.15622
17	3.50	5.5838	5.256	0.1305	0.398	0.4131	0.085339	4.841	0.24922	0.16388
18	3.78	5.5995	5.256	0.1305	0.380	0.42886	0.085339	5.025	0.2571	0.17176
19	4.07	5.6146	5.256	0.12991	0.362	0.44457	0.085924	5.174	0.26525	0.17932
20	4.36	5.6281	5.256	0.12874	0.346	0.45919	0.087094	5.272	0.27314	0.18605
21	4.65	5.6422	5.256	0.12815	0.332	0.47391	0.087679	5.405	0.2808	0.19312
22	5.22	5.6674	5.256	0.12581	0.306	0.50142	0.09002	5.570	0.29572	0.2057
23	5.80	5.6909	5.256	0.12289	0.283	0.52786	0.092946	5.679	0.3104	0.21746
24	6.37	5.7118	5.256	0.11938	0.262	0.55223	0.096457	5.725	0.32435	0.22789
25	6.95	5.7318	5.256	0.11528	0.242	0.57638	0.10055	5.732	0.33846	0.23791
26	7.53	5.7475	5.256	0.11118	0.226	0.59616	0.10465	5.697	0.3504	0.24575
27	8.11	5.7614	5.256	0.1065	0.211	0.61478	0.10933	5.623	0.36205	0.25272
28	8.69	5.7734	5.256	0.10182	0.197	0.63141	0.11401	5.538	0.37271	0.2587
29	9.26	5.7824	5.256	0.09714	0.185	0.64511	0.11869	5.435	0.3819	0.26321
30	9.89	5.7877	5.256	0.091873	0.173	0.6557	0.12396	5.290	0.3893	0.26587
31	10.46	5.7928	5.256	0.087192	0.162	0.66543	0.12884	5.173	0.39703	0.26839
32	11.03	5.7962	5.256	0.082511	0.153	0.67353	0.13332	5.052	0.40343	0.27011
33	11.61	5.7995	5.256	0.078999	0.145	0.68037	0.13683	4.972	0.4086	0.27177
34	12.19	5.8045	5.256	0.075488	0.138	0.68637	0.14035	4.891	0.41336	0.27301
35	12.77	5.8066	5.256	0.072562	0.132	0.69174	0.14327	4.828	0.4175	0.27423
36	13.34	5.8066	5.256	0.069637	0.126	0.69678	0.1462	4.766	0.42149	0.27529
37	13.92	5.8084	5.256	0.067296	0.122	0.7009	0.14854	4.719	0.42472	0.27618
38	14.50	5.8103	5.256	0.065785	0.115	0.70637	0.15205	4.646	0.42921	0.27716
39	15.09	5.8116	5.256	0.063785	0.112	0.70944	0.1538	4.613	0.43162	0.27782

# TRIAXIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-01-07  
Sample No.: S-5  
Test No.: FT01S5T2

Location:  
Tested By: MJS  
Test Date: 4/26/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPO  
Depth: 10.0' -13.0'  
Elevation:

Soil Description: CLAYEY ORGANIC SILT SOME FINE -- COARSE SAND -- DARK BROWN AND BLACK CL-ML  
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.75 in  
Specimen Area: 6.16 in<sup>2</sup>  
Specimen Volume: 580.64 cc

Piston Area: 0.00 in<sup>2</sup>  
Piston Friction: 0.00 lb  
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform

Liquid Limit: 44

Plastic Limit: 38

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in <sup>2</sup>	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1593	0	0	5.04	5.472	5.472
2	2.0042	0.12844	6.1672	11.855	0.1384	5.1267	5.472	5.6104
3	4.0042	0.26812	6.1758	18.238	0.21263	5.1823	5.472	5.6846
4	6.0042	0.41102	6.1847	22.587	0.26063	5.2116	5.472	5.7326
5	8.0042	0.55551	6.1937	25.442	0.29576	5.245	5.472	5.7678
6	10.004	0.69841	6.2026	28.041	0.3255	5.2784	5.472	5.7975
7	12.004	0.84451	6.2117	30.275	0.35092	5.3041	5.472	5.8229
8	14.004	0.98901	6.2208	32.236	0.3731	5.3182	5.472	5.8451
9	16	1.1351	6.23	34.014	0.3931	5.3235	5.472	5.8651
10	18.001	1.2828	6.2393	35.656	0.41146	5.3287	5.472	5.8835
11	20.002	1.4289	6.2485	37.251	0.42924	5.334	5.472	5.9012
12	24.002	1.7195	6.267	40.261	0.46254	5.3393	5.472	5.9345
13	28.002	2.0085	6.2855	43.042	0.49304	5.344	5.472	5.965
14	32.002	2.2975	6.3041	45.55	0.52023	5.3451	5.472	5.9922
15	36.002	2.5865	6.3228	47.875	0.54517	5.3469	5.472	6.0172
16	40.002	2.8707	6.3413	50.064	0.56843	5.3481	5.472	6.0404
17	44.002	3.1565	6.36	52.252	0.59153	5.3498	5.472	6.0635
18	48.002	3.4471	6.3791	54.076	0.61034	5.3492	5.472	6.0823
19	52.002	3.7377	6.3984	55.763	0.62749	5.3487	5.472	6.0995
20	56.002	4.0251	6.4176	57.45	0.64454	5.3481	5.472	6.1165
21	60.002	4.3173	6.4372	59.046	0.66043	5.3475	5.472	6.1324
22	68.002	4.8888	6.4758	61.873	0.68792	5.3434	5.472	6.1599
23	76.002	5.454	6.5146	64.472	0.71255	5.3399	5.472	6.1846
24	84.002	6.0272	6.5543	66.667	0.73227	5.3352	5.472	6.2043
25	92.002	6.6068	6.595	68.667	0.74966	5.3305	5.472	6.2217
26	100	7.1912	6.6365	70.399	0.76377	5.3246	5.472	6.2358
27	108	7.7676	6.678	72.086	0.77721	5.3188	5.472	6.2492
28	116	8.3359	6.7194	73.135	0.78366	5.3135	5.472	6.2557
29	124	8.9107	6.7618	74.184	0.78991	5.3082	5.472	6.2619
30	132	9.4903	6.8051	75.05	0.79405	5.3036	5.472	6.2661
31	140	10.072	6.8491	75.916	0.79806	5.2995	5.472	6.2701
32	148	10.64	6.8926	76.6	0.80016	5.2948	5.472	6.2722
33	156	11.21	6.9369	77.603	0.80547	5.2895	5.472	6.2775
34	164	11.788	6.9823	78.242	0.80681	5.2842	5.472	6.2788
35	172	12.371	7.0288	78.971	0.80895	5.2784	5.472	6.281
36	180	12.937	7.0745	79.564	0.80975	5.2743	5.472	6.2818
37	188	13.507	7.1211	80.43	0.81321	5.2696	5.472	6.2852
38	196	14.085	7.169	81.023	0.81373	5.2661	5.472	6.2857
39	204	14.667	7.2179	81.752	0.8155	5.262	5.472	6.2875
40	214	15.378	7.2785	82.391	0.81502	5.2479	5.472	6.287



# TRIAXIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-01-07  
Sample No.: S-5  
Test No.: FT01S5T2

Location:  
Tested By: MJS  
Test Date: 4/26/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPO  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: CLAYEY ORGANIC SILT SOME FINE - COARSE SAND --- DARK BROWN AND BLACK CL-ML  
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.75 in  
Specimen Area: 6.16 in<sup>2</sup>  
Specimen Volume: 580.64 cc  
Piston Area: 0.00 in<sup>2</sup>  
Piston Friction: 0.00 lb  
Piston Weight: 0.00 lb

Liquid Limit: 44

Plastic Limit: 38

Estimated Specific Gravity: 2.60

Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	Parameter A	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.472	5.472	0	0.000	0.432	0.432	1.000	0.432	0
2	0.13	5.6104	5.472	0.086684	0.626	0.432	0.34532	1.401	0.41452	0.069201
3	0.27	5.6846	5.472	0.14233	0.669	0.50231	0.28968	1.734	0.39599	0.10631
4	0.41	5.7326	5.472	0.17161	0.658	0.52102	0.26039	2.001	0.39071	0.13031
5	0.56	5.7678	5.472	0.205	0.693	0.52277	0.22701	2.303	0.37489	0.14788
6	0.70	5.7975	5.472	0.23838	0.732	0.51913	0.19362	2.681	0.35637	0.16275
7	0.84	5.8229	5.472	0.26415	0.753	0.51877	0.16785	3.091	0.34331	0.17546
8	0.99	5.8451	5.472	0.2821	0.746	0.51877	0.13379	3.426	0.34035	0.18555
9	1.14	5.8651	5.472	0.28348	0.721	0.5269	0.13379	3.647	0.34035	0.19655
10	1.28	5.8835	5.472	0.28875	0.702	0.54163	0.14852	3.872	0.34507	0.20573
11	1.43	5.9012	5.472	0.29402	0.685	0.55471	0.13798	4.111	0.34898	0.21462
12	1.72	5.9345	5.472	0.2993	0.647	0.56722	0.13271	4.485	0.3526	0.23127
13	2.01	5.965	5.472	0.30398	0.617	0.59525	0.12802	4.851	0.36398	0.24652
14	2.30	5.9922	5.472	0.30515	0.587	0.62107	0.12685	5.101	0.37455	0.26012
15	2.59	6.0172	5.472	0.30691	0.563	0.64708	0.1251	5.358	0.38697	0.27259
16	2.87	6.0404	5.472	0.30808	0.542	0.67027	0.12392	5.587	0.39768	0.28422
17	3.16	6.0635	5.472	0.30984	0.524	0.69235	0.12217	5.842	0.40814	0.29577
18	3.45	6.0823	5.472	0.30925	0.507	0.7137	0.12275	5.972	0.41793	0.30517
19	3.74	6.0995	5.472	0.30867	0.492	0.7331	0.12334	6.088	0.43708	0.31375
20	4.03	6.1165	5.472	0.30808	0.478	0.75083	0.12392	6.201	0.4462	0.32227
21	4.32	6.1324	5.472	0.3075	0.466	0.76847	0.12451	6.304	0.45473	0.33022
22	4.59	6.1599	5.472	0.3075	0.441	0.78494	0.12861	6.349	0.47257	0.34396
23	5.45	6.1846	5.472	0.29988	0.421	0.81653	0.13212	6.393	0.4884	0.35628
24	6.03	6.2043	5.472	0.2952	0.403	0.84468	0.13681	6.353	0.50295	0.36614
25	6.61	6.2217	5.472	0.29051	0.388	0.86908	0.14149	6.298	0.51633	0.37483
26	7.19	6.2358	5.472	0.28465	0.373	0.89116	0.14735	6.183	0.52924	0.38188
27	7.77	6.2492	5.472	0.2788	0.359	0.91112	0.15321	6.073	0.54182	0.38861
28	8.34	6.2557	5.472	0.27352	0.349	0.93042	0.15848	5.945	0.55031	0.39183
29	8.91	6.2619	5.472	0.26825	0.340	0.94214	0.16375	5.824	0.55871	0.39496
30	9.49	6.2661	5.472	0.26357	0.332	0.95367	0.16844	5.714	0.56546	0.39703
31	10.07	6.2701	5.472	0.25947	0.325	0.96249	0.17254	5.625	0.57157	0.39903
32	10.64	6.2722	5.472	0.25478	0.318	0.9706	0.17722	5.515	0.5773	0.40008
33	11.21	6.2775	5.472	0.24951	0.310	0.97738	0.18249	5.414	0.58523	0.40273
34	11.79	6.2788	5.472	0.24424	0.303	0.98796	0.18777	5.297	0.59117	0.4034
35	12.37	6.281	5.472	0.23838	0.295	1.0026	0.19362	5.178	0.5981	0.40448
36	12.94	6.2818	5.472	0.2328	0.289	1.0075	0.19772	5.095	0.6026	0.40488
37	13.51	6.2852	5.472	0.2266	0.282	1.0156	0.20241	5.018	0.60901	0.4066
38	14.09	6.2857	5.472	0.22608	0.278	1.0197	0.20592	4.952	0.61279	0.40686
39	14.67	6.2875	5.472	0.22198	0.272	1.0255	0.21002	4.883	0.61777	0.40775
40	15.38	6.287	5.472	0.20793	0.255	1.0391	0.22408	4.637	0.63159	0.40751

# TRIAXIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-01-07 S5  
Sample No.: S-5  
Test No.: FT01S5T3

Location:  
Tested By: MS  
Test Date: 4/26/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPO  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: CLAYEY ORGANIC SILT SOME FINE - COARSE SAND -- DARK BROWN AND BLACK CL-ML  
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.73 in  
Specimen Area: 6.20 in<sup>2</sup>  
Specimen Volume: 582.17 cc  
Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform

Liquid Limit: 44  
Plastic Limit: 38  
Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in <sup>2</sup>	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2026	0	0	5.0402	5.904	5.904
2	2.0041	0.10685	6.2093	20.889	0.24223	5.1854	5.904	6.1462
3	4.0023	0.24719	6.218	34.307	0.59725	5.3112	5.904	6.3013
4	6.0023	0.38913	6.2269	41.989	0.48551	5.3903	5.904	6.3895
5	8.0023	0.53266	6.2358	47.409	0.54739	5.447	5.904	6.4514
6	10.002	0.67619	6.2449	51.408	0.59271	5.488	5.904	6.4967
7	12.002	0.81972	6.2539	54.407	0.62638	5.5185	5.904	6.5304
8	14.002	0.96484	6.2631	57.196	0.65732	5.543	5.904	6.5615
9	16.002	1.11	6.2722	59.439	0.68253	5.5594	5.904	6.5865
10	18.002	1.2551	6.2815	61.458	0.70445	5.5729	5.904	6.6085
11	20.002	1.3986	6.2906	61.405	0.70282	5.5852	5.904	6.6068
12	24.002	1.6873	6.3091	64.773	0.7392	5.6045	5.904	6.6432
13	28.002	1.9743	6.3276	67.667	0.76997	5.6232	5.904	6.674
14	32.002	2.2598	6.346	70.087	0.79519	5.6326	5.904	6.6992
15	36.002	2.5469	6.3647	72.35	0.81845	5.6402	5.904	6.7224
16	40.002	2.8371	6.3837	74.455	0.83975	5.6478	5.904	6.7437
17	44.002	3.1258	6.4028	76.402	0.85915	5.656	5.904	6.7631
18	48.002	3.4176	6.421	78.191	0.87662	5.6566	5.904	6.7806
19	52.002	3.7079	6.4415	79.874	0.8928	5.6572	5.904	6.7968
20	56.002	3.9949	6.4607	81.558	0.90891	5.6601	5.904	6.8129
21	60.002	4.2852	6.4803	82.926	0.92136	5.6654	5.904	6.8254
22	68.002	4.8593	6.5194	85.715	0.94663	5.663	5.904	6.8506
23	76.002	5.4382	6.5593	88.241	0.96859	5.6665	5.904	6.8726
24	84.002	6.0187	6.5999	90.766	0.9902	5.663	5.904	6.8942
25	92.002	6.596	6.6406	92.819	1.0064	5.666	5.904	6.9104
26	100	7.167	6.6815	95.081	1.0246	5.6566	5.904	6.9286
27	108	7.7395	6.7229	96.66	1.0352	5.6589	5.904	6.9392
28	116	8.3152	6.7652	98.449	1.0478	5.6496	5.904	6.9518
29	124	8.8925	6.808	100.03	1.0579	5.6519	5.904	6.9619
30	132	9.4714	6.8516	101.66	1.0683	5.6437	5.904	6.9723
31	140	10.052	6.8958	102.82	1.0735	5.6466	5.904	6.9775
32	148	10.628	6.9402	104.29	1.0819	5.6355	5.904	6.9859
33	156	11.205	6.9853	105.29	1.0852	5.6373	5.904	6.9892
34	164	11.781	7.0309	106.34	1.089	5.6279	5.904	6.993
35	172	12.355	7.077	107.29	1.0915	5.6279	5.904	6.9955
36	180	12.931	7.1238	108.39	1.0955	5.6191	5.904	6.9995
37	188	13.509	7.1714	109.34	1.0978	5.6221	5.904	7.0018
38	196	14.087	7.2196	109.76	1.0946	5.6139	5.904	6.9986
39	204	14.667	7.2687	110.29	1.0924	5.6156	5.904	6.9964
40	214	15.394	7.3312	111.13	1.0914	5.6098	5.904	6.9954

# TRIAXIAL TEST

Project: FRENCHTOWN  
 Boring No.: FT-01-07 S5  
 Sample No.: S-5  
 Test No.: FT01S5T3

Location:  
 Tested By: MS  
 Test Date: 4/26/07  
 Sample Type: 3 INCH ST

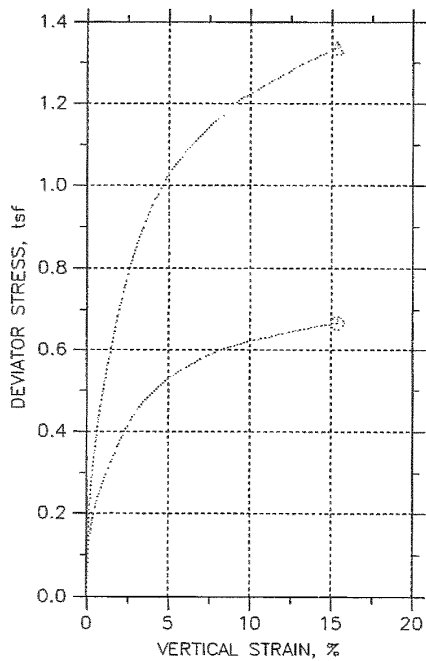
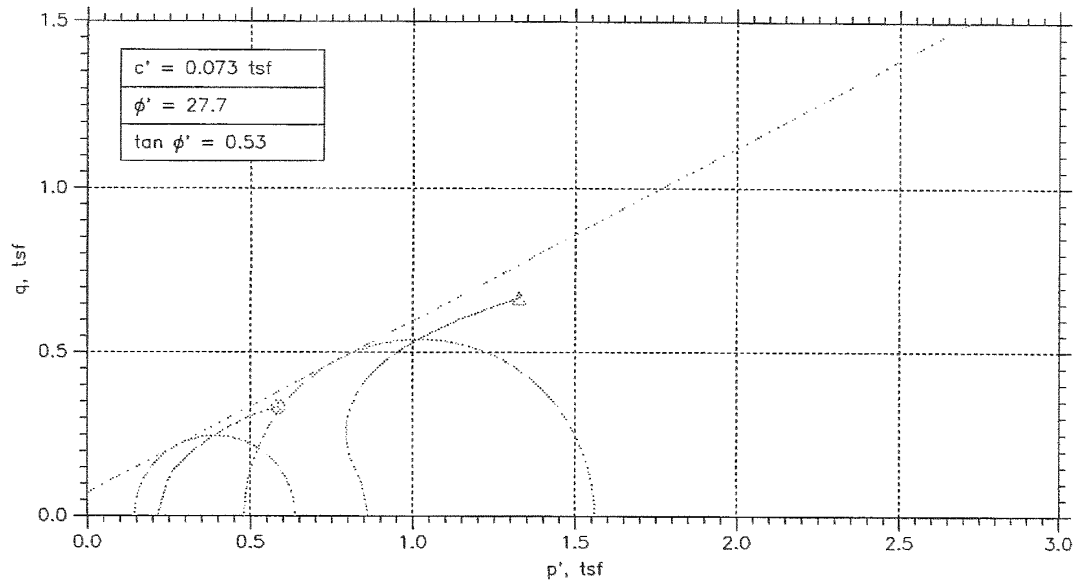
Project No.: 200701266  
 Checked By: WPO  
 Depth: 10.0'-13.0'  
 Elevation:





Soil Description: CLAYEY ORGANIC SILT SOME FINE - COARSE SAND -- DARK BROWN AND BLACK CL-ML  
 Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.73 in  
 Specimen Area: 6.20 in<sup>2</sup>  
 Specimen Volume: 582.17 cc  
 Filter Strip Correction: 0.00 tsf  
 Membrane Correction: 0.00 lb/in  
 Correction Type: Uniform

Estimated Specific Gravity: 2.60									
Liquid Limit: 44	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	Parameter A	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf
1	0.00	5.904	5.904	0	0.000	0.86376	0.86376	1.000	0.86376
2	0.11	6.1462	5.904	0.14516	0.599	0.96083	0.7186	1.337	0.83971
3	0.25	6.3013	5.904	0.27101	0.682	0.99001	0.59276	1.670	0.79138
4	0.39	6.3895	5.904	0.35002	0.721	0.99925	0.51374	1.945	0.75649
5	0.53	6.4514	5.904	0.4068	0.743	1.0044	0.45696	2.198	0.73066
6	0.68	6.4967	5.904	0.44777	0.755	1.0087	0.41599	2.425	0.71234
7	0.82	6.5304	5.904	0.47821	0.763	1.0119	0.38555	2.625	0.69874
8	0.96	6.5615	5.904	0.50279	0.765	1.0185	0.36097	2.822	0.68973
9	1.11	6.5865	5.904	0.51918	0.761	1.0271	0.34458	2.981	0.68584
10	1.26	6.6085	5.904	0.53265	0.756	1.0356	0.33111	3.128	0.68334
11	1.40	6.6068	5.904	0.54494	0.775	1.0216	0.31882	3.204	0.67023
12	1.69	6.6432	5.904	0.56425	0.763	1.0387	0.29951	3.468	0.66911
13	1.97	6.674	5.904	0.58298	0.757	1.0507	0.28078	3.742	0.66576
14	2.26	6.6992	5.904	0.59235	0.745	1.0666	0.27141	3.930	0.66901
15	2.55	6.7224	5.904	0.59996	0.733	1.0823	0.2638	4.103	0.67303
16	2.84	6.7437	5.904	0.60757	0.724	1.0959	0.25619	4.278	0.67607
17	3.13	6.7631	5.904	0.61576	0.717	1.1071	0.248	4.464	0.67757
18	3.42	6.7968	5.904	0.61635	0.703	1.124	0.24741	4.543	0.68572
19	3.71	6.8129	5.904	0.61693	0.691	1.1396	0.24683	4.617	0.69323
20	3.99	6.8254	5.904	0.61986	0.682	1.1528	0.2439	4.727	0.69835
21	4.29	6.8356	5.904	0.62513	0.678	1.16	0.23863	4.861	0.69931
22	4.86	6.8506	5.904	0.62279	0.658	1.1876	0.24097	4.928	0.71429
23	5.44	6.8726	5.904	0.6263	0.647	1.2061	0.23746	5.079	0.72176
24	6.02	6.8942	5.904	0.62279	0.629	1.2312	0.24097	5.109	0.73608
25	6.60	6.9104	5.904	0.62571	0.622	1.2444	0.23805	5.228	0.74123
26	7.17	6.9285	5.904	0.61635	0.602	1.272	0.24741	5.224	0.75971
27	7.74	6.9392	5.904	0.61869	0.598	1.2803	0.24507	5.224	0.76266
28	8.32	6.9518	5.904	0.60932	0.582	1.3022	0.25444	5.118	0.77832
29	8.89	6.9619	5.904	0.61167	0.578	1.31	0.2521	5.196	0.78103
30	9.47	6.9723	5.904	0.60347	0.565	1.3286	0.26029	5.104	0.79443
31	10.05	6.9775	5.904	0.6064	0.565	1.3309	0.25736	5.171	0.79412
32	10.63	6.9859	5.904	0.59528	0.550	1.3504	0.26848	5.030	0.80945
33	11.20	6.9892	5.904	0.59703	0.550	1.352	0.26763	5.069	0.80935
34	11.78	6.993	5.904	0.58767	0.540	1.3651	0.27609	4.944	0.82059
35	12.35	6.9955	5.904	0.58767	0.538	1.3676	0.27609	4.953	0.82186
36	12.93	6.9995	5.904	0.57889	0.528	1.3804	0.28487	4.846	0.83264
37	13.51	7.0018	5.904	0.58181	0.530	1.3797	0.28195	4.893	0.83083
38	14.09	6.9986	5.904	0.57362	0.524	1.3848	0.29014	4.773	0.83746
39	14.67	6.9964	5.904	0.57538	0.527	1.3808	0.28839	4.788	0.83461
40	15.39	6.9954	5.904	0.56952	0.522	1.3856	0.29424	4.709	0.83994

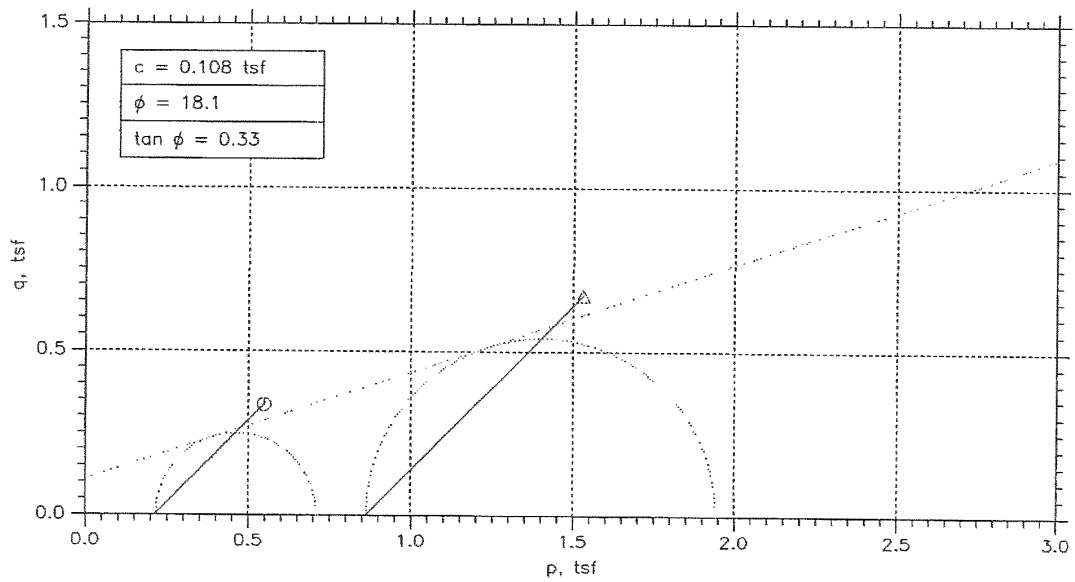
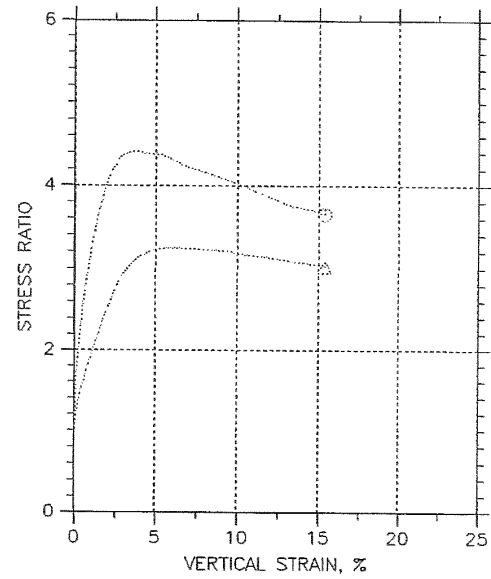
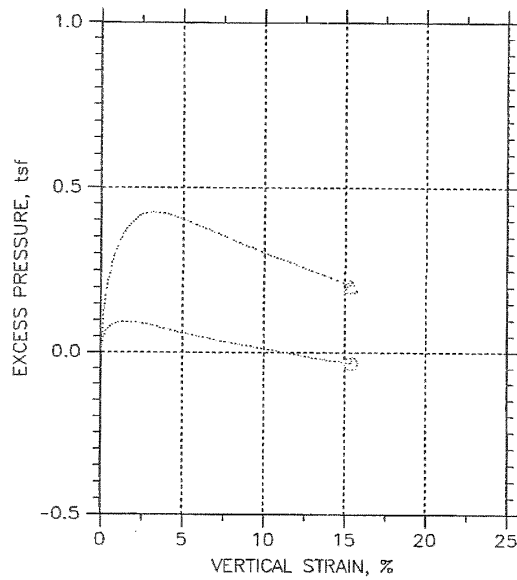
# TRIAXIAL COMPRESSION TEST REPORT



Symbol	⊖	Δ		
Test No.	FT04S5T1	FT04S5T2		
Initial	Diameter, in	2.8335	2.8398	
	Height, in	5.6984	5.7449	
	Water Content, %	28.77	26.93	
	Dry Density, pcf	95.7	97.01	
	Saturation, %	101.06	97.61	
	Void Ratio	0.77427	0.75043	
Before Shear	Water Content, %	28.42	25.60	
	Dry Density, pcf	96.05	99.73	
	Saturation, %	100.66	99.09	
	Void Ratio	0.7679	0.70271	
	Back Press., tsf	5.0401	5.0401	
Minor Prin. Stress, tsf	0.2159	0.86388		
Max. Dev. Stress, tsf	0.6658	1.3352		
Time to Failure, min	214	214		
Strain Rate, %/min	0.0694	0.0698		
B-Value	---	---		
Estimated Specific Gravity	2.72	2.72		
Liquid Limit	46	46		
Plastic Limit	17	17		
Plasticity Index	29	29		
Failure Sketch				
RAY CL				
SS RATIO TEST PERFORMED AS PER ASTM D 4767				

Mon, 30-APR-2007 14:16:31

# TRIAxIAL COMPRESSION TEST REPORT



Project: FRENCHTOWN	Location:	Project No.: 200701266
Boring No.: FT-04-07 S5	Tested By: MS	Checked By: WPQ
Sample No.: S-5	Test Date: 4/27/07	Depth: 10.0'-13.0'
Test No.: FT04S5T1	Sample Type: 3 INCH ST	Elevation:
Description: SILTY CLAY TRACE FINE - MEDIUM SAND - GRAY CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767		

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# TRIAXIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-04-07 S5  
Sample No.: S-5  
Test No.: FT045ST1

Location:  
Tested By: MS  
Test Date: 4/27/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPC  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: SILTY CLAY TRACE FINE - MEDIUM SAND - GRAY CL  
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.70 in  
Specimen Area: 6.31 in<sup>2</sup>  
Specimen Volume: 35.93 in<sup>3</sup>

Piston Area: 0.00 in<sup>2</sup>  
Piston Friction: 0.00 lb  
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform

Liquid Limit: 46

Plastic Limit: 17

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in <sup>2</sup>	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3056	0	0	5.0401	5.256	5.256
2	2.004	0.1311	6.3139	10.58	0.12064	5.0842	5.256	5.3766
3	4.004	0.27339	6.3229	14.683	0.1672	5.1011	5.256	5.4232
4	6.004	0.41408	6.3318	17.316	0.19691	5.1115	5.256	5.4529
5	8.004	0.55636	6.3409	19.316	0.21979	5.1185	5.256	5.4758
6	10	0.69705	6.3498	21.04	0.23857	5.1231	5.256	5.4946
7	12	0.84094	6.3591	22.606	0.25595	5.1272	5.256	5.512
8	14	0.98483	6.3683	24.1	0.27248	5.1295	5.256	5.5285
9	16	1.1287	6.3776	25.524	0.28815	5.1319	5.256	5.5442
10	18	1.2742	6.387	26.923	0.3035	5.1324	5.256	5.5595
11	20.004	1.4181	6.3963	28.323	0.31882	5.1336	5.256	5.5748
12	24.004	1.7059	6.415	30.837	0.34611	5.133	5.256	5.6021
13	28.004	1.9968	6.4341	33.217	0.37215	5.1324	5.256	5.6282
14	32.004	2.2862	6.4531	35.534	0.39647	5.1307	5.256	5.6525
15	36.004	2.574	6.4722	37.479	0.41694	5.1278	5.256	5.6729
16	40.004	2.8602	6.4912	39.329	0.43623	5.1255	5.256	5.6922
17	44.004	3.1447	6.5103	40.942	0.4528	5.122	5.256	5.7088
18	48.004	3.4325	6.5297	42.389	0.46741	5.1185	5.256	5.7234
19	52.004	3.7203	6.5492	43.718	0.48062	5.115	5.256	5.7366
20	56.004	4.0065	6.5688	44.975	0.49297	5.1115	5.256	5.749
21	60.004	4.2974	6.5887	46.09	0.50366	5.1075	5.256	5.7597
22	64.004	4.5746	6.6087	48.133	0.52304	5.1011	5.256	5.7779
23	68.004	4.8421	6.6287	50.027	0.54015	5.0953	5.256	5.7961
24	72.004	5.1113	6.6485	51.64	0.55421	5.0889	5.256	5.8102
25	76.004	5.3804	6.6685	53.111	0.56648	5.0819	5.256	5.8225
26	80.004	5.6492	6.6887	54.629	0.57912	5.0755	5.256	5.8351
27	84.004	5.9181	6.7089	56.052	0.59052	5.0703	5.256	5.8465
28	88.004	6.1871	6.7291	57.215	0.59902	5.0651	5.256	5.855
29	92.004	6.4561	6.7493	58.33	0.60688	5.0604	5.256	5.8629
30	96.004	6.7251	6.7695	59.373	0.61381	5.0552	5.256	5.8698
31	100.004	6.9941	6.7897	60.512	0.62157	5.05	5.256	5.8776
32	104.004	7.2631	6.8099	61.413	0.62681	5.0453	5.256	5.8828
33	108.004	7.5321	6.8301	62.315	0.63192	5.0395	5.256	5.8879
34	112.004	7.8011	6.8503	63.287	0.63759	5.0343	5.256	5.8936
35	116.004	8.0701	6.8705	64.284	0.64334	5.0285	5.256	5.8993
36	120.004	8.3391	6.8907	65.209	0.64832	5.0227	5.256	5.9043
37	124.004	8.6081	6.9109	66.063	0.65249	5.018	5.256	5.9083
38	128.004	8.8771	6.9311	66.933	0.65793	5.014	5.256	5.9139
39	132.004	9.1461	6.9513	67.784	0.66248	5.0105	5.256	5.9185
40	136.004	9.4151	6.9715	68.909	0.6658	5.0041	5.256	5.9218

# TRIAXIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-04-07 S5  
Sample No.: S-5  
Test No.: FT0455T1

Location:  
Tested By: MS  
Test Date: 4/27/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPO  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: SILTY CLAY TRACE FINE - MEDIUM SAND - GRAY CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.70 in  
Specimen Area: 6.31 in<sup>2</sup>  
Specimen Volume: 35.93 in<sup>3</sup>

Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform

Plastic Limit: 17

Estimated Specific Gravity: 2.72

Liquid Limit: 46

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.256	5.256	0	0.000	0.2159	0.2159	1.000	0.2159	0
2	0.13	5.3766	5.256	0.044135	0.366	0.29241	0.17177	1.702	0.23209	0.060322
3	0.27	5.4232	5.256	0.060976	0.365	0.32213	0.15493	2.079	0.23853	0.083601
4	0.41	5.4529	5.256	0.071429	0.363	0.34138	0.14447	2.363	0.24293	0.098453
5	0.56	5.4758	5.256	0.078398	0.357	0.35129	0.13751	2.598	0.2474	0.10989
6	0.70	5.4946	5.256	0.083043	0.348	0.37143	0.12866	2.796	0.25215	0.11929
7	0.84	5.512	5.256	0.087108	0.340	0.38475	0.12647	2.987	0.25677	0.12798
8	0.98	5.5285	5.256	0.089431	0.328	0.39895	0.12415	3.154	0.26271	0.13624
9	1.13	5.5442	5.256	0.091754	0.318	0.4123	0.12137	3.321	0.26822	0.14408
10	1.27	5.5595	5.256	0.092335	0.304	0.42707	0.11857	3.456	0.27532	0.15175
11	1.42	5.5748	5.256	0.093496	0.293	0.44122	0.11579	3.605	0.28181	0.15941
12	1.71	5.6021	5.256	0.092916	0.268	0.46909	0.11299	3.814	0.29604	0.17305
13	2.00	5.6282	5.256	0.092335	0.248	0.49573	0.11031	4.012	0.30965	0.18608
14	2.29	5.6525	5.256	0.090533	0.229	0.52178	0.10763	4.252	0.32334	0.19823
15	2.57	5.6729	5.256	0.087629	0.210	0.54515	0.10504	4.342	0.33668	0.20847
16	2.86	5.6922	5.256	0.085366	0.196	0.56677	0.10254	4.379	0.34865	0.21812
17	3.14	5.7088	5.256	0.081882	0.181	0.58682	0.13402	4.409	0.36042	0.2264
18	3.43	5.7234	5.256	0.078398	0.168	0.60491	0.13751	4.399	0.37121	0.2337
19	3.72	5.7366	5.256	0.074913	0.156	0.62161	0.14099	4.409	0.3813	0.24031
20	4.01	5.749	5.256	0.071429	0.145	0.63744	0.14447	4.412	0.39096	0.24648
21	4.30	5.7597	5.256	0.067364	0.134	0.6522	0.14854	4.391	0.40037	0.25185
22	4.87	5.7779	5.256	0.060976	0.117	0.67796	0.15493	4.376	0.41644	0.26152
23	5.44	5.7961	5.256	0.055169	0.102	0.70088	0.16073	4.360	0.43081	0.27007
24	6.01	5.8102	5.256	0.048781	0.088	0.72133	0.16712	4.316	0.44423	0.2771
25	6.59	5.8225	5.256	0.041812	0.074	0.74057	0.17409	4.254	0.45733	0.28324
26	7.16	5.8351	5.256	0.035424	0.061	0.7596	0.18048	4.209	0.47004	0.28956
27	7.74	5.8465	5.256	0.030198	0.051	0.77622	0.18571	4.180	0.48096	0.29526
28	8.31	5.855	5.256	0.024971	0.042	0.78996	0.19093	4.137	0.49044	0.29951
29	8.88	5.8629	5.256	0.020325	0.033	0.80246	0.19558	4.103	0.49902	0.30344
30	9.45	5.8698	5.256	0.015099	0.025	0.81461	0.2008	4.057	0.50771	0.3069
31	10.04	5.8776	5.256	0.0098723	0.016	0.8276	0.20603	4.017	0.51682	0.31078
32	10.61	5.8828	5.256	0.0052265	0.008	0.83749	0.21068	3.975	0.52408	0.31341
33	11.19	5.8879	5.256	-0.00058072	-0.001	0.8484	0.21648	3.919	0.53244	0.31596
34	11.77	5.8936	5.256	-0.0058072	-0.009	0.8593	0.22171	3.828	0.5405	0.31879
35	12.35	5.8993	5.256	-0.011614	-0.018	0.87086	0.22752	3.779	0.54919	0.32167
36	13.04	5.9043	5.256	-0.017422	-0.027	0.88164	0.23333	3.718	0.55748	0.32416
37	13.50	5.9085	5.256	-0.022067	-0.034	0.89046	0.23797	3.643	0.56421	0.32624
38	14.08	5.9139	5.256	-0.026133	-0.040	0.89997	0.24204	3.571	0.571	0.32897
39	14.66	5.9185	5.256	-0.029617	-0.045	0.908	0.24552	3.498	0.57676	0.33124
40	15.38	5.9218	5.256	-0.036005	-0.054	0.9177	0.25191	3.43	0.58481	0.3329

# TRIAxIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-04-07 S5  
Sample No.: S-5  
Test No.: FT04S5T2

Location:  
Tested By: MJS  
Test Date: 4/27/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPO  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: SILTY CLAY TRACE FINE - MEDIUM SAND - GRAY CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.74 in  
Specimen Area: 6.33 in<sup>2</sup>  
Specimen Volume: 36.39 in<sup>3</sup>

Piston Area: 0.00 in<sup>2</sup>  
Piston Friction: 0.00 lb  
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform

Liquid Limit: 46

Plastic Limit: 17

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in <sup>2</sup>	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3337	0	0	5.0401	5.904	5.904
2	2	0.13505	6.3422	17.15	0.1947	5.1568	5.904	6.0987
3	4	0.27814	6.3513	24.225	0.27462	5.2133	5.904	6.1786
4	6	0.42283	6.3605	29.37	0.33246	5.2553	5.904	6.2365
5	8	0.56753	6.3698	33.604	0.37984	5.288	5.904	6.2838
6	10	0.71062	6.379	37.463	0.42285	5.3154	5.904	6.3268
7	12	0.85692	6.3884	40.947	0.46149	5.3387	5.904	6.3655
8	14	1.0016	6.3977	44.27	0.49821	5.3574	5.904	6.4022
9	16	1.1479	6.4072	47.325	0.5318	5.3743	5.904	6.4358
10	18	1.2942	6.4167	50.219	0.56349	5.3895	5.904	6.4675
11	20	1.4389	6.4261	52.791	0.59149	5.4017	5.904	6.4955
12	22	1.581	6.4354	55.258	0.61508	5.4221	5.904	6.5148
13	24	1.7251	6.4448	58.258	0.63082	5.4367	5.904	6.5348
14	26	1.8682	6.4542	61.082	0.64889	5.4489	5.904	6.5548
15	28	2.0113	6.4634	63.882	0.6671	5.4612	5.904	6.5748
16	30	2.1544	6.4726	66.682	0.6853	5.4734	5.904	6.5948
17	32	2.2975	6.4818	69.482	0.7027	5.4856	5.904	6.6148
18	34	2.4406	6.491	72.282	0.7209	5.4978	5.904	6.6348
19	36	2.5837	6.5002	75.082	0.7391	5.5101	5.904	6.6548
20	38	2.7268	6.5094	77.882	0.7573	5.5223	5.904	6.6748
21	40	2.8699	6.5186	80.682	0.7755	5.5345	5.904	6.6948
22	42	3.013	6.5278	83.482	0.7937	5.5468	5.904	6.7148
23	44	3.156	6.537	86.282	0.8119	5.559	5.904	6.7348
24	46	3.2991	6.5462	89.082	0.8301	5.5712	5.904	6.7548
25	48	3.4422	6.5554	91.882	0.8483	5.5834	5.904	6.7748
26	50	3.5853	6.5646	94.682	0.8665	5.5956	5.904	6.7948
27	52	3.7284	6.5738	97.482	0.8847	5.6078	5.904	6.8148
28	54	3.8715	6.583	100.282	0.9029	5.6201	5.904	6.8348
29	56	4.0146	6.5922	103.082	0.9211	5.6323	5.904	6.8548
30	58	4.1577	6.6014	105.882	0.9393	5.6445	5.904	6.8748
31	60	4.3008	6.6106	108.682	0.9575	5.6567	5.904	6.8948
32	62	4.4439	6.6198	111.482	0.9757	5.6689	5.904	6.9148
33	64	4.587	6.629	114.282	0.9939	5.6811	5.904	6.9348
34	66	4.7301	6.6382	117.082	1.0121	5.6933	5.904	6.9548
35	68	4.8732	6.6474	119.882	1.0303	5.7055	5.904	6.9748
36	70	5.0163	6.6566	122.682	1.0485	5.7177	5.904	6.9948
37	72	5.1594	6.6658	125.482	1.0667	5.7299	5.904	7.0148
38	74	5.3025	6.675	128.282	1.0849	5.7421	5.904	7.0348
39	76	5.4456	6.6842	131.082	1.1031	5.7543	5.904	7.0548
40	78	5.5887	6.6934	133.882	1.1213	5.7665	5.904	7.0748



# TRIAxIAL TEST

Project: FRENCHTOWN  
Boring No.: FT-04-07 S5  
Sample No.: S-5  
Test No.: FT04S5T2

Location:  
Tested By: MJS  
Test Date: 4/27/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPO  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: SILTY CLAY TRACE FINE - MEDIUM SAND - GRAY CL  
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767  
Plastic Limit: 46  
Liquid Limit: 46  
Specimen Height: 5.74 in  
Specimen Area: 6.33 in<sup>2</sup>  
Specimen Volume: 36.39 in<sup>3</sup>  
Piston Area: 0.00 in<sup>2</sup>  
Piston Friction: 0.00 lb  
Piston Weight: 0.00 lb  
Filter Strip Correction: 0.00 tsf  
Membrane Correction: 0.00 lb/in  
Correction Type: Uniform  
Estimated Specific Gravity: 2.72

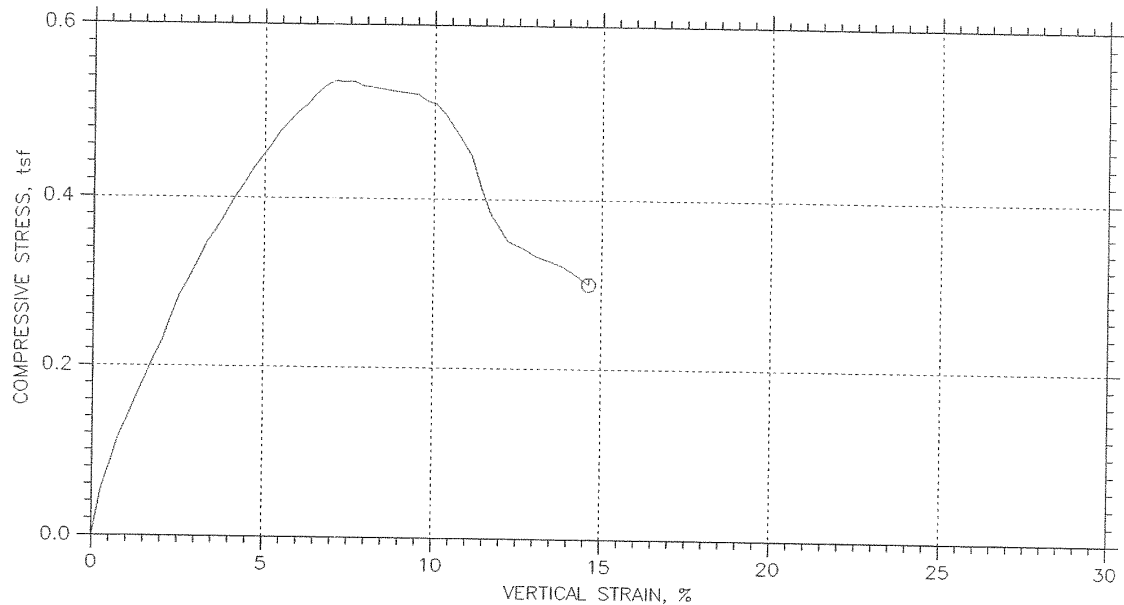
	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.904	5.904	0	0.000	0.86388	0.86388	1.000	0.86388	0
2	0.14	6.0987	5.904	0.11664	0.599	0.94194	0.74724	1.261	0.84459	0.09735
3	0.28	6.1786	5.904	0.17321	0.631	0.96529	0.69067	1.398	0.82798	0.13731
4	0.42	6.2365	5.904	0.21521	0.647	0.98114	0.64858	1.513	0.81491	0.16623
5	0.57	6.2838	5.904	0.24786	0.653	0.98586	0.61602	1.617	0.80594	0.18992
6	0.71	6.3268	5.904	0.27528	0.651	1.0115	0.58661	1.718	0.80003	0.21142
7	0.86	6.3655	5.904	0.2986	0.647	1.0268	0.56528	1.816	0.79602	0.23074
8	1.00	6.4022	5.904	0.31747	0.637	1.0448	0.54662	1.911	0.79572	0.24911
9	1.15	6.4358	5.904	0.33418	0.620	1.0615	0.5297	2.004	0.79561	0.2659
10	1.29	6.4675	5.904	0.34934	0.611	1.078	0.51454	2.095	0.79629	0.28175
11	1.44	6.4955	5.904	0.36159	0.587	1.0938	0.50229	2.178	0.79804	0.29574
12	1.73	6.5548	5.904	0.382	0.564	1.1327	0.48188	2.351	0.8073	0.32542
13	2.01	6.6067	5.904	0.39658	0.546	1.17	0.4673	2.504	0.81865	0.35135
14	2.29	6.6529	5.904	0.40883	0.546	1.2039	0.45205	2.646	0.8295	0.37445
15	2.58	6.697	5.904	0.417	0.526	1.2399	0.44689	2.774	0.84338	0.39649
16	2.87	6.7337	5.904	0.42108	0.508	1.2725	0.44281	2.874	0.85766	0.41485
17	3.16	6.7696	5.904	0.42341	0.489	1.3061	0.44047	2.965	0.87326	0.43279
18	3.45	6.8011	5.904	0.42283	0.471	1.3382	0.44106	3.034	0.88961	0.44856
19	3.73	6.8295	5.904	0.42108	0.455	1.3683	0.44281	3.090	0.90556	0.46276
20	4.02	6.856	5.904	0.41875	0.440	1.3971	0.44514	3.139	0.92114	0.476
21	4.30	6.8759	5.904	0.41466	0.427	1.4217	0.44922	3.164	0.93519	0.48597
22	4.87	6.9195	5.904	0.40592	0.400	1.4735	0.45797	3.217	0.96571	0.50774
23	5.44	6.9537	5.904	0.39483	0.376	1.5187	0.46905	3.241	0.99389	0.52484
24	6.03	6.9826	5.904	0.38259	0.355	1.5599	0.4813	3.238	1.0206	0.53932
25	6.62	7.0078	5.904	0.37092	0.336	1.5967	0.49296	3.239	1.0448	0.55189
26	7.19	7.0332	5.904	0.35868	0.318	1.6344	0.50521	3.235	1.0698	0.56462
27	7.76	7.0544	5.904	0.34701	0.302	1.6673	0.51687	3.226	1.0921	0.5752
28	8.34	7.0746	5.904	0.33535	0.286	1.6991	0.52854	3.215	1.1138	0.58528
29	8.92	7.0977	5.904	0.32427	0.266	1.7333	0.53962	3.212	1.1364	0.59683
30	9.50	7.1154	5.904	0.31377	0.259	1.7615	0.55012	3.202	1.1558	0.60572
31	10.07	7.1264	5.904	0.3021	0.247	1.7842	0.56178	3.176	1.173	0.61122
32	10.64	7.1404	5.904	0.29102	0.235	1.8092	0.57286	3.158	1.191	0.61819
33	11.23	7.154	5.904	0.28111	0.225	1.8327	0.58278	3.145	1.2078	0.62498
34	11.81	7.1678	5.904	0.27003	0.214	1.8577	0.59386	3.128	1.2258	0.63191
35	12.37	7.1799	5.904	0.25895	0.203	1.8809	0.60494	3.109	1.2429	0.63797
36	12.95	7.1944	5.904	0.24786	0.192	1.9064	0.61602	3.095	1.2612	0.6452
37	13.53	7.2053	5.904	0.23795	0.183	1.9272	0.62593	3.079	1.2766	0.65064
38	14.11	7.2159	5.904	0.22804	0.174	1.9478	0.63585	3.063	1.2918	0.65597
39	14.68	7.2254	5.904	0.22695	0.164	1.9684	0.64693	3.043	1.3076	0.66072
40	15.39	7.2392	5.904	0.20471	0.153	1.9943	0.65918	3.025	1.3268	0.66758



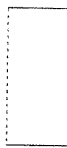
Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



**APPENDIX F**  
**LABORATORY TEST RESULTS**  
**UNCONFINED COMPRESSION**

# UNCONFINED COMPRESSION TEST REPORT



Symbol	①			
Test No.	QUFT0155			
Initial	Diameter, in	2.8283		
	Height, in	5.7551		
	Water Content, %	61.66		
	Dry Density, pcf	63.91		
	Saturation, %	102.86		
	Void Ratio	1.5885		
Unconfined Compressive Strength, tsf		0.53606		
Undrained Shear Strength, tsf		0.26803		
Time to Failure, min		13.504		
Strain Rate, %/min		0.5199		
Estimated Specific Gravity		2.65		
Liquid Limit		44		
Plastic Limit		38		
Plasticity Index		6		
Failure Sketch				

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-01-07 S5
Sample Type: 3 INCH ST
Description: CLAYEY ORGANIC SILT SOME FINE - MEDIUM SAND - DARK BROWN AND BLACK CL-ML
Remarks: TEST PERFORMED AS PER ASTM D 2166

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## UNCONFINED COMPRESSION TEST

Project: FRENCHTOWN  
 Boring No.: FT-01-07 S5  
 Sample No.: S-5  
 Test No.: QUFT01s5

Location:  
 Tested By: MJS  
 Test Date: 4/27/07  
 Sample Type: 3 INCH ST

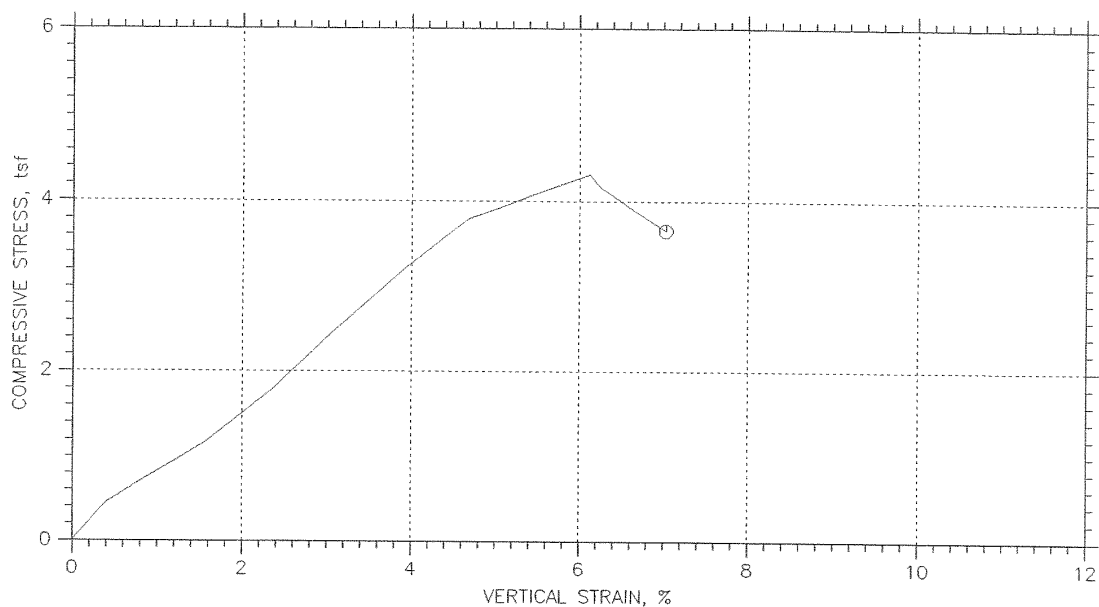
Project No.: 200701266  
 Checked By: WPQ  
 Depth: 10.0'-13.0'  
 Elevation:



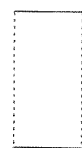

Soil Description: CLAYEY ORGANIC SILT SOME FINE - MEDIUM SAND - DARK BROWN AND BLACK CL-ML  
 Remarks: TEST PERFORMED AS PER ASTM D 2166

Specimen Height: 5.76 in      Liquid Limit: 44      Cap Mass: 0 gm  
 Specimen Area: 6.28 in<sup>2</sup>      Plastic Limit: 38  
 Specimen Volume: 36.16 in<sup>3</sup>      Estimated Specific Gravity: 2.65

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in <sup>2</sup>	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2828	0	0
2	0.504	0.014797	0.25712	4.4725	6.299	0.051123	0.025561
3	1.004	0.02996	0.52058	7.2613	6.3157	0.08278	0.04139
4	1.504	0.042657	0.7412	9.7344	6.3297	0.11073	0.055364
5	2.004	0.057454	0.99832	11.839	6.3462	0.13432	0.06716
6	2.504	0.07216	1.2538	13.996	6.3626	0.15839	0.079193
7	3.004	0.086958	1.511	16.049	6.3792	0.18113	0.090567
8	3.504	0.10212	1.7744	18.101	6.3963	0.20375	0.10187
9	4.004	0.11719	2.0363	20.048	6.4134	0.22506	0.11253
10	4.504	0.13062	2.2696	22.257	6.4287	0.24928	0.12464
11	5.004	0.14469	2.514	24.52	6.4449	0.27393	0.13697
12	5.504	0.15985	2.7775	26.204	6.4623	0.29195	0.14598
13	6.004	0.17519	3.0441	28.046	6.4801	0.31161	0.15581
14	6.504	0.19054	3.3108	30.098	6.498	0.33349	0.16675
15	7.004	0.20607	3.5806	31.413	6.5161	0.3471	0.17355
16	7.504	0.2215	3.8488	32.992	6.5343	0.36353	0.18176
17	8.004	0.23722	4.1218	34.728	6.5529	0.38157	0.19079
18	8.504	0.25284	4.3932	36.096	6.5715	0.39548	0.19774
19	9.004	0.26827	4.6615	37.622	6.59	0.41104	0.20552
20	9.504	0.28362	4.9281	38.832	6.6085	0.42308	0.21154
21	10.004	0.29905	5.1963	40.095	6.6272	0.43561	0.2178
22	10.504	0.3144	5.463	41.516	6.6459	0.44977	0.22489
23	11.004	0.32984	5.7312	42.516	6.6648	0.4593	0.22965
24	11.504	0.34527	5.9994	43.515	6.6838	0.46876	0.23438
25	12.004	0.36089	6.2708	44.357	6.7032	0.47645	0.23822
26	12.504	0.37651	6.5422	45.462	6.7226	0.4869	0.24345
27	13.004	0.39213	6.8136	46.251	6.7422	0.49392	0.24696
28	13.504	0.40775	7.085	46.778	6.7619	0.49808	0.24904
29	14.004	0.42328	7.3548	46.672	6.7816	0.49552	0.24776
30	14.504	0.43872	7.6231	46.725	6.8013	0.49464	0.24732
31	15.004	0.45415	7.8913	46.304	6.8211	0.48876	0.24438
32	15.504	0.46959	8.1595	46.146	6.841	0.48568	0.24284
33	16.004	0.48512	8.4293	45.988	6.8612	0.48259	0.2413
34	16.504	0.50065	8.6992	45.83	6.8815	0.47952	0.23976
35	17.004	0.51627	8.9706	45.673	6.902	0.47645	0.23822
36	17.504	0.53207	9.2451	45.567	6.9229	0.47392	0.23696
37	18.004	0.54751	9.5134	45.462	6.9434	0.47142	0.23571
38	18.504	0.56303	9.7832	44.778	6.9641	0.46295	0.23147
39	19.004	0.57838	10.05	44.515	6.9848	0.45887	0.22943
40	19.504	0.59363	10.315	43.515	7.0054	0.44724	0.22362
41	20.004	0.60907	10.583	42.147	7.0264	0.43188	0.21594
42	20.504	0.62432	10.848	40.779	7.0473	0.41663	0.20831
43	21.004	0.64004	11.121	39.201	7.069	0.39927	0.19964
44	21.504	0.65602	11.399	36.149	7.0911	0.36704	0.18352
45	22.004	0.67146	11.667	33.623	7.1127	0.34036	0.17018
46	22.504	0.68689	11.935	32.097	7.1343	0.32393	0.16196
47	23.004	0.70251	12.207	30.624	7.1564	0.3081	0.15405
48	23.504	0.71813	12.478	30.15	7.1786	0.3024	0.1512
49	24.004	0.73357	12.746	29.677	7.2006	0.29674	0.14837
50	24.504	0.74892	13.013	29.098	7.2227	0.29006	0.14503
51	25.004	0.76444	13.283	28.73	7.2452	0.2855	0.14275
52	25.504	0.77979	13.549	28.414	7.2675	0.2815	0.14075
53	26.004	0.79532	13.819	27.993	7.2903	0.27646	0.13823
54	26.504	0.81103	14.092	27.414	7.3135	0.26989	0.13494
55	27.004	0.82656	14.362	26.783	7.3365	0.26284	0.13142
56	27.487	0.84154	14.622	26.099	7.3589	0.25535	0.12768

# UNCONFINED COMPRESSION TEST REPORT



Symbol	⊙			
Test No.	QUFT01S5			
Initial	Diameter, in	2.8016		
	Height, in	6.3996		
	Water Content, %	18.98		
	Dry Density, pcf	121.1		
	Saturation, %	128.21		
	Void Ratio	0.40261		
	Unconfined Compressive Strength, tsf	4.3087		
	Undrained Shear Strength, tsf	2.1544		
	Time to Failure, min	4.504		
	Strain Rate, %/min	0.5199		
	Estimated Specific Gravity	2.72		
	Liquid Limit	0		
	Plastic Limit	0		
	Plasticity Index	0		
Failure Sketch				

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-02-07S7A
Sample Type: 3 INCH ST
Description: SILTY CLAY TRACE F-C SAND TRACE F GRAVEL TRACE SHALE - BROWN (CL)
Remarks: TEST PERFORMED AS PER ASTM D 2166

Mon, 30-APR-2007 14:32:04

## UNCONFINED COMPRESSION TEST

Project: FRENCHTOWN  
 Boring No.: FT-02-07S7A  
 Sample No.: S-7A  
 Test No.: QUFT01S5

Location:  
 Tested By: MJS  
 Test Date: 4/27/07  
 Sample Type: 3 INCH ST

Project No.: 200701266  
 Checked By: WPQ  
 Depth: 15.0'-16.5'  
 Elevation:

Soil Description: SILTY CLAY TRACE F-C SAND TRACE F GRAVEL TRACE SHALE - BROWN (CL)  
 Remarks: TEST PERFORMED AS PER ASTM D 2166

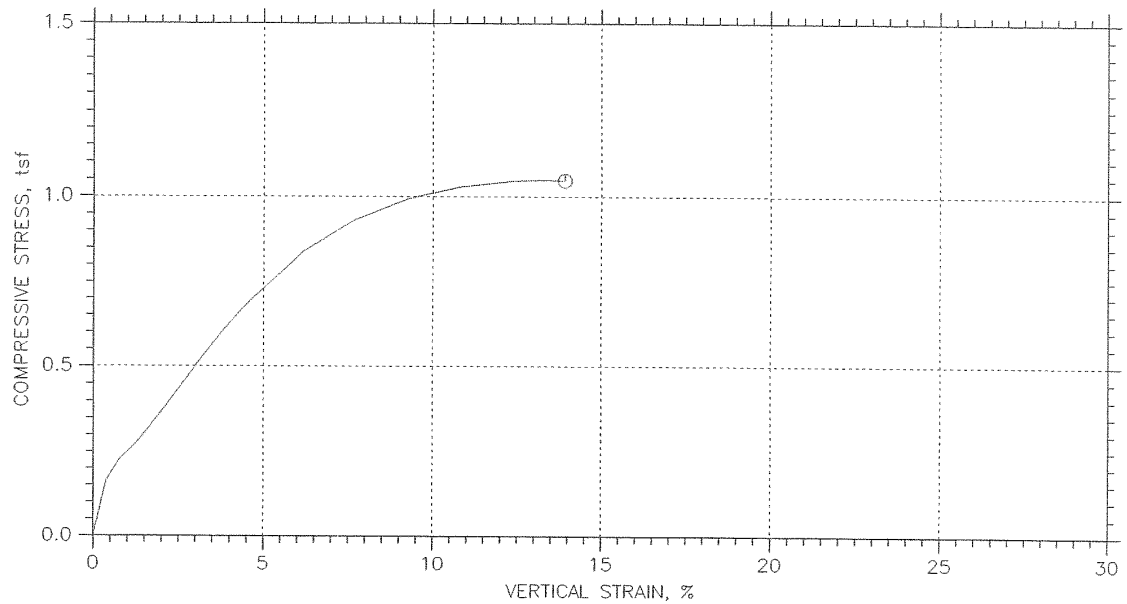
Specimen Height: 6.40 in  
 Specimen Area: 6.16 in<sup>2</sup>  
 Specimen Volume: 39.45 in<sup>3</sup>



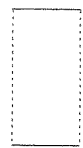
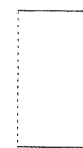
Liquid Limit: 0  
 Plastic Limit: 0  
 Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in <sup>2</sup>	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.1644	0	0
2	0.504	0.025	0.39065	36.6	6.1886	0.42581	0.21291
3	1.004	0.05	0.7813	58.4	6.213	0.67678	0.33839
4	1.504	0.075	1.1719	78.5	6.2376	0.90612	0.45306
5	2.004	0.1	1.5626	99.3	6.2623	1.1417	0.57084
6	2.504	0.15	2.3439	151.5	6.3124	1.728	0.86401
7	3.004	0.2	3.1252	214.6	6.3633	2.4282	1.2141
8	3.504	0.25	3.9065	273.4	6.4151	3.0685	1.5343
9	4.004	0.3	4.6878	324.5	6.4676	3.6124	1.8062
10	4.504	0.392	6.1254	368.9	6.5667	4.0448	2.0224
11	5.004	0.4	6.2504	355.6	6.5754	3.8938	1.9469
12	5.504	0.45	7.0317	312.7	6.6307	3.3955	1.6977

# UNCONFINED COMPRESSION TEST REPORT



Symbol		⊖			
Test No.		QUFT03S5			
Initial	Diameter, in	2.8193			
	Height, in	6.4602			
	Water Content, %	26.48			
	Dry Density, pcf	99.45			
	Saturation, %	101.84			
	Void Ratio	0.70738			
Unconfined Compressive Strength, tsf		1.0472			
Undrained Shear Strength, tsf		0.52362			
Time to Failure, min		6.9998			
Strain Rate, %/min		0.5199			
Estimated Specific Gravity		2.72			
Liquid Limit		0			
Plastic Limit		0			
Plasticity Index		0			
Failure Sketch					

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-03-07 S5
Sample Type: 3 INCH ST
Description: SILTY CLAY TRACE FINE - COARSE SAND - BROWN (CL)
Remarks: TEST PERFORMED AS PER ASTM D 2166

Mon, 30-APR-2007 14:33:18

## UNCONFINED COMPRESSION TEST

Project: FRENCHTOWN  
 Boring No.: FT-03-07 S5  
 Sample No.: S-5  
 Test No.: QUFT03S5

Location:  
 Tested By: MJS  
 Test Date: 4/27/07  
 Sample Type: 3 INCH ST

Project No.: 200701266  
 Checked By: WPQ  
 Depth: 10.0'-13.0'  
 Elevation:

Soil Description: SILTY CLAY TRACE FINE - COARSE SAND - BROWN (CL)  
 Remarks: TEST PERFORMED AS PER ASTM D 2166

Specimen Height: 6.46 in  
 Specimen Area: 6.24 in<sup>2</sup>  
 Specimen Volume: 40.33 in<sup>3</sup>

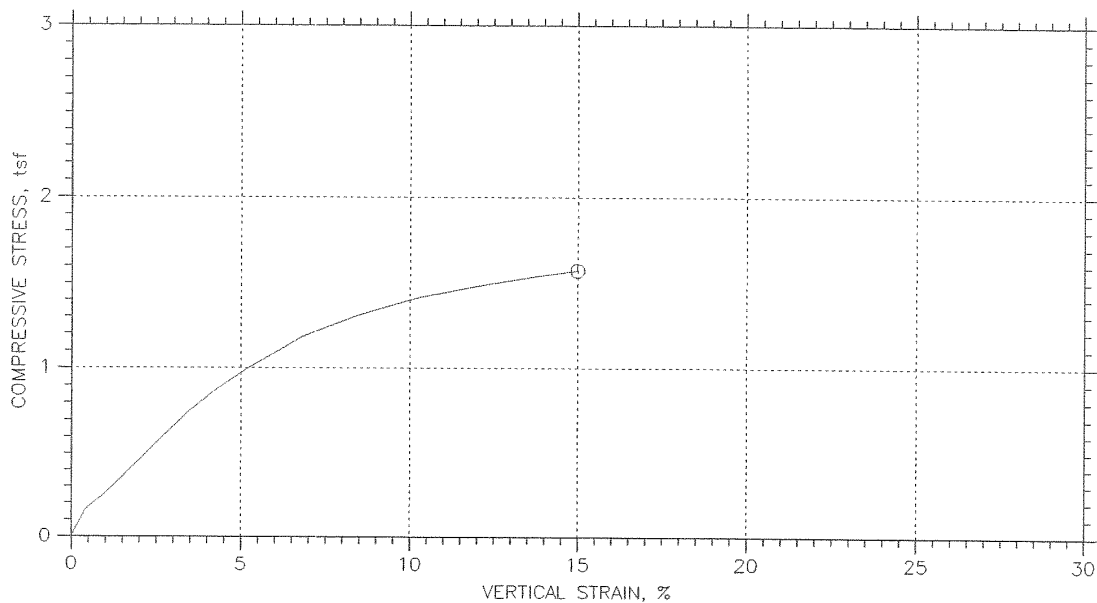
Liquid Limit: 0  
 Plastic Limit: 0  
 Estimated Specific Gravity: 2.72

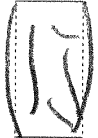

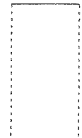
Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in <sup>2</sup>	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2427	0	0
2	0.504	0.025	0.38698	13.9	6.2669	0.1597	0.079848
3	1.004	0.05	0.77397	19.5	6.2914	0.22316	0.11158
4	1.504	0.075	1.1609	22.8	6.316	0.25991	0.12996
5	2.004	0.1	1.5479	26.6	6.3408	0.30204	0.15102
6	2.504	0.15	2.3219	35.4	6.3911	0.39881	0.1994
7	3.004	0.2	3.0959	44.3	6.4421	0.49512	0.24756
8	3.504	0.25	3.8698	52.8	6.494	0.5854	0.2927
9	4.004	0.3	4.6438	60.2	6.5467	0.66208	0.33104
10	4.504	0.4	6.1917	72.7	6.6547	0.78657	0.39329
11	5.004	0.5	7.7397	80.9	6.7664	0.86085	0.43042
12	5.504	0.6	9.2876	86.1	6.8818	0.90081	0.4504
13	5.9998	0.7	10.836	89	7.0013	0.91526	0.45763
14	6.4998	0.8	12.383	90.5	7.125	0.91453	0.45726
15	6.9998	0.861	13.328	90.8	7.2026	0.90767	0.45384
16	7.4998	0.9	13.931	90.6	7.2531	0.89936	0.44968



# UNCONFINED COMPRESSION TEST REPORT



Symbol	⊕			
Test No.	QUFT04S6			
Initial	Diameter, in	2.8217		
	Height, in	5.8622		
	Water Content, %	27.72		
	Dry Density, pcf	98.21		
	Saturation, %	103.42		
	Void Ratio	0.72898		
Unconfined Compressive Strength, tsf		1.5728		
Undrained Shear Strength, tsf		0.78642		
Time to Failure, min		6.9998		
Strain Rate, %/min		0.5199		
Estimated Specific Gravity		2.72		
Liquid Limit		57		
Plastic Limit		22		
Plasticity Index		35		
Failure Sketch				

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-04-07 S6
Sample Type: 3 INCH ST
Description: SILTY CLAY TRACE FINE - COARSE SAND - GRAYISH BROWN CH
Remarks: TEST PERFORMED AS PER ASTM D 2166

Mon, 30-APR-2007 14:35:17

## UNCONFINED COMPRESSION TEST

Project: FRENCHTOWN  
 Boring No.: FT-04-07 S6  
 Sample No.: S-6  
 Test No.: QUFT04S6

Location:  
 Tested By: MJS  
 Test Date: 4/27/07  
 Sample Type: 3 INCH ST

Project No.: 200701266  
 Checked By: WPQ  
 Depth: 13.0'-15.0'  
 Elevation:

Soil Description: SILTY CLAY TRACE FINE - COARSE SAND - GRAYISH BROWN CH  
 Remarks: TEST PERFORMED AS PER ASTM D 2166

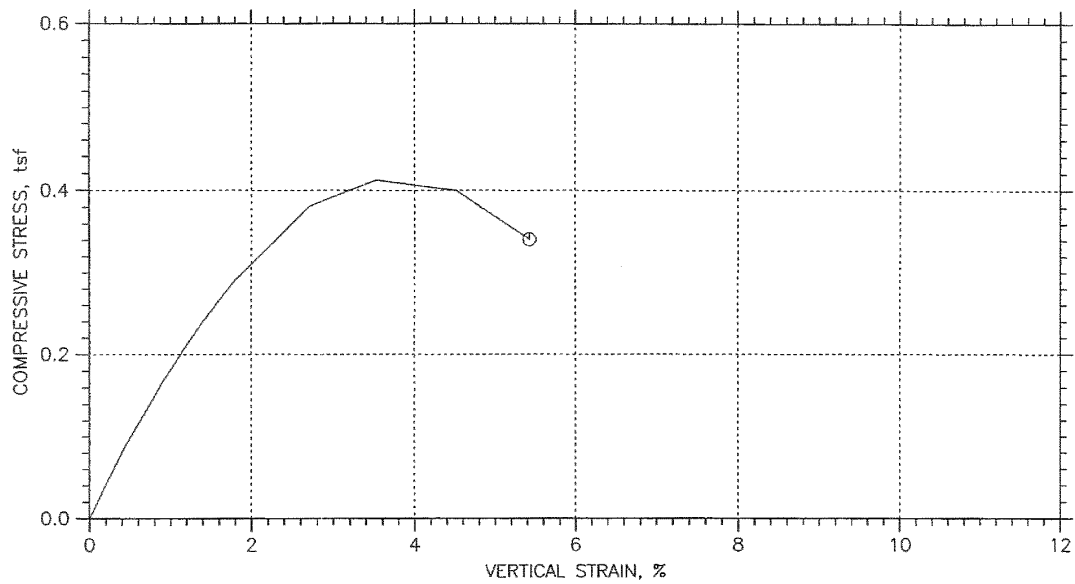
Specimen Height: 5.86 in  
 Specimen Area: 6.25 in<sup>2</sup>  
 Specimen Volume: 36.66 in<sup>3</sup>




Liquid Limit: 57  
 Plastic Limit: 22  
 Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in <sup>2</sup>	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2531	0	0
2	0.504	0.025	0.42646	13.9	6.2799	0.15937	0.079683
3	1.004	0.05	0.85292	19.9	6.3069	0.22718	0.11359
4	1.504	0.075	1.2794	26.5	6.3342	0.30122	0.15061
5	2.004	0.1	1.7058	34.3	6.3616	0.3882	0.1941
6	2.504	0.15	2.5588	49.8	6.4173	0.55874	0.27937
7	3.004	0.2	3.4117	64	6.474	0.71177	0.35589
8	3.504	0.25	4.2646	75.6	6.5317	0.83335	0.41668
9	4.004	0.3	5.1175	85.5	6.5904	0.93409	0.46704
10	4.504	0.4	6.8234	102.3	6.711	1.0975	0.54877
11	5.004	0.5	8.5292	113.6	6.8362	1.1965	0.59823
12	5.504	0.6	10.235	122.4	6.9661	1.2651	0.63255
13	5.9998	0.7	11.941	128.3	7.1011	1.3009	0.65044
14	6.4998	0.8	13.647	133.4	7.2413	1.3264	0.66319
15	6.9998	0.879	14.994	136.6	7.3561	1.337	0.6685

# UNCONFINED COMPRESSION TEST REPORT



Symbol	⊕			
Test No.	QUFT05S5			
Initial	Diameter, in	2.8256		
	Height, in	5.5248		
	Water Content, %	35.92		
	Dry Density, pcf	85.2		
	Saturation, %	99.15		
	Void Ratio	0.9783		
Unconfined Compressive Strength, tsf		0.41221		
Undrained Shear Strength, tsf		0.20611		
Time to Failure, min		3.004		
Strain Rate, %/min		0.5199		
Estimated Specific Gravity		2.70		
Liquid Limit		70		
Plastic Limit		28		
Plasticity Index		42		
Failure Sketch				

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-05-07 S5
Sample Type: 3 INCH ST
Description: SILTY CLAY SOME FINE - COARSE SAND TRACE F GRAVEL - DK GRAY CH
Remarks: TEST PERFORMED AS PER ASTM D 2166

Fri, 04-MAY-2007 15:41:13

# UNCONFINED COMPRESSION TEST

Project: FRENCHTOWN  
Boring No.: FT-05-07 S5  
Sample No.: S-5  
Test No.: QFT05S5

Location:  
Tested By: MJS  
Test Date: 4/27/07  
Sample Type: 3 INCH ST

Project No.: 200701266  
Checked By: WPQ  
Depth: 10.0'-13.0'  
Elevation:

Soil Description: SILTY CLAY SOME FINE - COARSE SAND TRACE F GRAVEL - DK GRAY CH  
Remarks: TEST PERFORMED AS PER ASTM D 2166

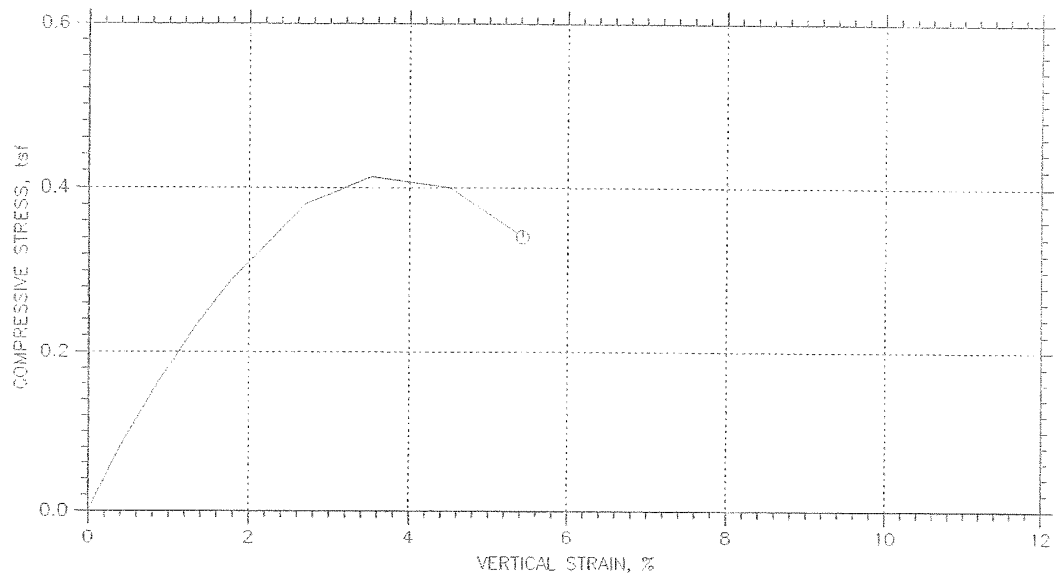
Specimen Height: 5.52 in  
Specimen Area: 6.27 in<sup>2</sup>  
Specimen Volume: 34.64 in<sup>3</sup>



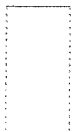
Liquid Limit: 70  
Plastic Limit: 28  
Estimated Specific Gravity: 2.70

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in <sup>2</sup>	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2706	0	0
2	0.504	0.025	0.4525	7.8	6.2991	0.089156	0.044578
3	1.004	0.05	0.90501	14.5	6.3279	0.16498	0.082492
4	1.504	0.075	1.3575	20.3	6.3569	0.22992	0.11496
5	2.004	0.1	1.81	25.4	6.3862	0.28637	0.14318
6	2.504	0.15	2.715	33.2	6.4456	0.37086	0.18543
7	3.004	0.195	3.5295	35.9	6.5	0.39766	0.19883
8	3.504	0.25	4.525	34.8	6.5678	0.3815	0.19075
9	4.004	0.3	5.4301	29.7	6.6306	0.3225	0.16125

# UNCONFINED COMPRESSION TEST REPORT



Symbol	Q			
Test No	QUFT05S5			
Initial	Diameter, in	2.8256		
	Height, in	5.5248		
	Water Content, %	35.92		
	Dry Density, pcf	85.2		
	Saturation, %	99.15		
	Void Ratio	0.9783		
Unconfined Compressive Strength, tsf		0.41221		
Undrained Shear Strength, tsf		0.20611		
Time to Failure, min		3.004		
Strain Rate, %/min		0.5199		
Estimated Specific Gravity		2.70		
Liquid Limit		70		
Plastic Limit		28		
Plasticity Index		42		
Failure Sketch				

Project: FRENCHTOWN
Location:
Project No.: 200701266
Boring No.: FT-05-07 S5
Sample Type: 3 INCH ST
Description: SILTY CLAY SOME FINE - COARSE SAND TRACE F GRAVEL - DK GRAY CH
Remarks: TEST PERFORMED AS PER ASTM D 2166

Fri, 04-MAY-2007 15:41:13

## UNCONFINED COMPRESSION TEST

Project: FRENCHTOWN  
 Boring No.: FT-05-07 S5  
 Sample No.: S-5  
 Test No.: QUFT05S5

Location:  
 Tested By: MJS  
 Test Date: 4/27/07  
 Sample Type: 3 INCH ST

Project No.: 200701266  
 Checked By: WPQ  
 Depth: 10.0'-13.0'  
 Elevation:

Soil Description: SILTY CLAY SOME FINE - COARSE SAND TRACE F GRAVEL - DK GRAY CH  
 Remarks: TEST PERFORMED AS PER ASTM D 2166

Specimen Height: 5.52 in  
 Specimen Area: 6.27 in<sup>2</sup>  
 Specimen Volume: 34.64 in<sup>3</sup>

Liquid Limit: 70  
 Plastic Limit: 28  
 Estimated Specific Gravity: 2.70

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in <sup>2</sup>	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2706	0	0
2	0.504	0.025	0.4525	7.8	6.2991	0.089156	0.044578
3	1.004	0.05	0.90501	14.5	6.3279	0.16498	0.082492
4	1.504	0.075	1.3575	20.3	6.3569	0.22992	0.11496
5	2.004	0.1	1.81	25.4	6.3862	0.28637	0.14318
6	2.504	0.15	2.715	33.2	6.4456	0.37086	0.18543
7	3.004	0.195	3.5295	35.9	6.5	0.39766	0.19883
8	3.504	0.25	4.525	34.8	6.5678	0.3815	0.19075
9	4.004	0.3	5.4301	29.7	6.6306	0.3225	0.16125

Frenchtown (Detroit Beach) Section 205  
Geotechnical Investigation  
US Army Corp of Engineers  
Delivery Order No. DC07  
Contract No. WP12P6-06-D-0001  
June 4, 2007



## **APPENDIX G**

### **TABLE 2 – SUMMARY OF SURVEY RESULTS**

**Table 2 - Boring Elevation and Location Summary**

Project Name: Frenchtown (Detroit Beach) Geotechnical Investigation

COE Contract Number: W912P6-06-D-00011

STS Project No.: 200701266

COE Delivery Order #DC07

Location: Monroe, Michigan

Boring	Northing	Easting	Surface Elevation (ft.)	Total Boring Depth (ft.)	Bottom Boring Elevation (ft.)
FT-01-07	156,394.329	13,406,416.116	<del>-580.9</del> 578.3	30.2	550.7
FT-02-07	157,215.079	13,406,830.364	<del>-582.3</del> 579.7	28.5	553.8
FT-03-07	157,745.385	13,407,048.885	<del>-582.7</del> 580.1	30.0	552.7
FT-04-07	158,094.715	13,407,289.393	<del>-584.0</del> 578.4	29.0	552.0
FT-05-07	159,053.987	13,407,799.345	<del>-582.0</del> 580	30.0	552.6

Notes: Survey Information obtained by STS.

Horizontal Datum: Michigan State Plane Coordinate System, Eastern Zone, North American Datum of 1983 (NAD83)

Vertical Datum: International Great Lakes Datum 1985 (IGLD 85)