

INFILTRATION INVESTIGATION
STORMWATER SWALES
BANNERMAN ROAD AND BULL HEADLEY ROAD
INTERSECTION IMPROVEMENTS
LEON COUNTY, FLORIDA

Prepared For:

PBS&J, Inc.
2639 NORTH MONROE STREET
BUILDING C
TALLAHASSEE, FLORIDA 32303

Prepared By:

ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.
3154 ELIZA ROAD
TALLAHASSEE, FLORIDA 32308
(850) 386-1253

December 2009
22-31-09-04



ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.

December 31, 2009

EGS File Number: 22-31-09-04

PBS&J, Inc.
2639 North Monroe Street
Building C
Tallahassee, FL 32303

ATTN: Dan Bracken
Special Projects Manager

SUBJECT: Results of Infiltration Investigation
Stormwater Swales
Bannerman Road and Bull Headley Road
Intersection Improvements
Leon County, Florida

Dear Dan:

Environmental and Geotechnical Specialists, Inc. (**EGS**) has completed the Infiltration Investigation, as authorized by **PBS&J**, for the design of the two (2) stormwater swale locations to be constructed as part of the Bannerman Road and Bull Headley Road Intersection Improvements.

Project Area and Conditions

The project is located on the northwest and the northeast of the intersection of Bannerman Road and Preservation Road., which is immediately west of the intersection of Bannerman Road and Bull Headley Road. A Site Location Map has been provided as **Figure 1** with the locations of the infiltration tests and soil borings shown in **Figure 2**. Based on visual inspections made at the time of the field investigation, **EGS personnel found** to the site to be dry and clear.

A copy of the United States Geographic Survey's (**USGS**) Topographic Map of the project area has been provided as **Figure 3**. As can be seen in **Figure 3**, groundwater should be anticipated between EL 160 feet and EL 170 feet. The flow of the groundwater is likely to the west southwest.

A Plan view of the stormwater swales with the soil borings and test locations identified has been included as **Figure 4**. As can be seen in **Figure 4**, this study consists of construction of two (2) stormwater swales to store and treat the runoff from the Bannerman and Bull Headley Improvement project. The stormwater swales were labeled as follows in this study:

- **Northwest Swale** – located northwest of the intersection of Bannerman Road and Preservation Road; and,
- **Northeast Swale** – located northeast of the intersection of Bannerman Road and Preservation Road.

Field Investigation

Soil Borings

The subsurface investigation outlined in this Report was conducted in December of 2009 under the supervision of Thomas Hayden, P.E, with Myron Hayden, P.E. serving as Senior Geotechnical Engineer. The soil boring locations were determined from plans provided to **EGS** by **PBS&J**.

EGS installed Soil Borings **BR-1** and **BR-2** using a hand auger coupled with a Cone Penetration Index (**CPI**) tests to evaluate its relative stiffness. **CPI** test results presented in this Report have been converted to equivalent **SPT "N"** values using the correlation of **SPT "N" = CPI "C"/4**.

Global positioning coordinates (**GPS**) and the Roadway Stationing and offset of each soil boring and test location has been provided in **TABLE 1**. **TABLE 1** also includes the measured and estimated "normal" seasonal high groundwater elevations.

Representative soil samples were collected in the field by **EGS** personnel and then sealed and transported to **EGS's** laboratory for additional testing. The laboratory tests performed included water contents, grain-size distributions, and Atterberg Limits. The soil samples were classified in respect to the Unified Soil Classification (**UNIFIED**) system and the American Association of State Highway and Transportation Officials (**AASHTO**) soil classification system. The results of the laboratory tests are summarized on the Soil Survey provided in **APPENDIX A**.

Double Ring Infiltration Testing

Two (2) Double Ring Infiltration (**DRI**) Tests were conducted for this study at the location of each stormwater swale. The **DRI** tests were performed near the location of Soil Borings **BR-1** and **BR-2**; therefore, each **DRI** test was identified according the Soil Boring where the test was conducted (i.e. **DRI** Test **DR-BR-1** was installed adjacent to Soil Boring **BR-1**). The purpose of **DRI** tests was to measure the “in situ” permeability of the soils at the bottom of each proposed swale.

Subsurface Conditions

Soils

The subsurface conditions for each stormwater swale are shown on the “Generalized” Soil Profiles provided as **Figures 5** and **6**. A summary of the material properties of the various **STRATA** encountered has been provided in **APPENDIX A**. Copies of the Soil Boring Logs are provided in **APPENDIX B** with detailed Soil Classification Data Sheets provided in **APPENDIX C**. It should be noted that the Soil Survey for the Stormwater Management Facilities provided in **APPENDIX A** includes **STRATA** encountered at other possible Stormwater Management Facilities associated with this project; therefore, not all the **STRATA** shown in the Soil Survey were encountered at these two (2) stormwater swale locations.

As can be seen in **Figures 5**, the general subsurface soils encountered at the **Northwest Swale** generally consist of:

- EL 164.0 – 163.0 feet – Clayey Fine Sand (**STRATUM B**);
- EL 163.0 – 158.0 feet – Silty Fine Sand (**STRATUM A**);
- EL 158.0 – 155.0 feet – Clayey Fine Sand (**STRATUM B**); and,
- EL 155.0 – 153.5 feet – Silty Fine Sand (**STRATUM A**).

As can be seen in **Figures 6**, the soils at the **Northeast Swale** generally consist of:

- EL 170.4 – 169.4 feet – Silty Fine Sand (**STRATUM A**);
- EL 169.4 – 166.4 feet – Clayey Sand (**STRATUM C**);
- EL 166.4 – 163.4 feet – Silty Fine Sand (**STRATUM A**); and,
- EL 163.4 – 159.9 feet – Clayey Fine Sand (**STRATUM B**).

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Bannerman and Bull Headley Roadway Intersection Improvements

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Groundwater

Groundwater was not encountered at either Soil Boring during this study. Based on a review of applicable literature and the investigation conducted for this study, **EGS believes** that the groundwater conditions at each **SWMF** swale is as follows:

- **Northwest Swale** - Estimated "Normal" Seasonal High Groundwater is at EL 158.0 Feet
- **Northeast Swale** - Estimated "Normal" Seasonal High Groundwater is at EL 160.0 Feet

Detailed Groundwater Data has been provided in **TABLE 1**.

USDA Soil Survey

According to the United States Department of Agriculture's (**USDA**) Soil Survey, the proposed **SWMF** is comprised of **Orangeburg Fine Sandy Loam** and **Plummer Fine Sand**. The subsoils encountered in this study were consistent with the **USDA** Soil Survey. The detailed **USDA** Soil Survey information has been provided in **APPENDIX D**.

Soil Permeability Values

A summary of the permeability rates determined from the field tests for each **STRATA** have been provided in **TABLE 2** with a copy of the test data sheets provided in **APPENDIX E**. The permeability rates shown in **TABLE 2** are based on the mean value of the last hour of field-testing. **These rates have been developed from this study and from a previous study performed for this Project.**

To verify and check the permeability rate determined from the field test, representative samples of the soil were tested in the laboratory for grain-size distribution. Based on the grain-size distribution of representative soil samples, the permeability was estimated from relationships developed at the University of Florida for Florida soils. The estimates of the permeability of the soils based on grain-size distributions are also provided in **APPENDIX E**. It should be noted that the permeability rates shown in **TABLE 2** **do not include a factor of safety or the effects of groundwater mounding.**

Field Infiltration Rates

The field infiltration rate of stormwater into the subsoils can be determined using the following equation:

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Infiltration Investigation for Stormwater Ponds

Bannerman and Bull Headley Roadway Intersection Improvements

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$$I_f = \{(K)(A)(T)(\delta H/L)\} / (F_s)$$

Where:

I_f = design infiltration rate (inches/hour)

K = soil permeability given in **TABLE 2** (inches/hour)

A = cross-sectional area normal to flow (square inches)

T = time for infiltration (hours)

δH = change in hydraulic head (inches)

L = length of shortest seepage path (inches)

F_s = factor of safety (at least 2)

It should be noted that for the design of stormwater swales where the depth to groundwater or a confining layer is greater than three (3) times the depth of the swale (as in this case) the above equation reduces to:

$$I_f = (K) / (F_s)$$

The above equations are not applicable if the bottoms of the swales are clogged with construction fines, significant compaction of the bottom of the swales has occurred during construction or groundwater mounding is occurring.

Overexcavation Considerations

Based on the design parameters provided for the **SWMF, EGS does not believe overexcavation of the soils below the Northwest Swale is necessary; however, EGS recommends the soils beneath the Northeast Stormwater be overexcavated to EL 166.0 feet, which is three (3) feet below the bottom of the swale.**

The overexcavation is recommended to remove the plastic clayey sand (**STRATUM C**) overlying the silty fine sand (**STRATUM A**), thus increasing the infiltration rate from 0.05 in/hr to 1.0 in/hr. The soil used as backfill in the overexcavated area should be clean uniform sand (**SP, SP-SM, A-3**).

EGS recommends that care be taken to ensure that fines are not introduced to the stormwater swale areas during the construction process.

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Design Infiltration Rates

EGS determined the design infiltration rate of the stormwater swales is provided in **TABLE 3**. These infiltration rates parameters are based on the conditions shown below:

- Northwest Swale
 - Bottom of Swale Elevation – EL 162.0 feet;
- Northeast Swale
 - Bottom of the swale overexcavated to EL 166 feet;
 - Backfilled with uniform sand (A-3) to EL 169 feet; and,
- A factor of safety of at least 2.0 was used for the infiltration rate.

Closure

The data and results presented in this Report are intended for the use of **PBS&J** and the **Leon County Department of Public Works** in the design of the stormwater swales identified herein for the Bannerman and Bull Headley Intersection Improvement Project. This Report is not intended for any other use and will likely not be applicable. The data and recommendations presented in this Report are based on the soil borings and field tests made at the specific location and depth noted. Subsurface conditions at other locations may vary significantly from those presented herein. Should data become available which is different from the data presented herein, Environmental and Geotechnical Specialists, Inc. requests the opportunity to review the data and make any modifications to the design recommendations which may be appropriate.

If you have any questions concerning the information contained in this Report, please do not hesitate to contact Myron or myself at (850) 386-1253.

Very truly yours

Environmental and Geotechnical Specialists, Inc.

Florida Certificate of Engineering Authorization Number 6222



12-31-09

Thomas H. Hayden, P.E.
Geotechnical Engineer II
FL P.E. Number 67492

TABLES

TABLE 1
SOIL BORING LOCATION AND GROUNDWATER DATA
STORMWATER SWALES
BANNERMAN AND BULL HEADLEY INTERSECTION IMPROVEMENTS
LEON COUNTY, FLORIDA

BORING NUMBER	BORING DEPTH ¹ (FEET)	ROADWAY STATIONING (FEET)	OFFSET FROM ROADWAY SURVEY CENTERLINE	GROUND ELEVATION ² (FEET)	MEASURED GROUNDWATER ³		ESTIMATED "NORMAL" SEASONAL HIGH GROUNDWATER ⁴		GLOBAL POSITIONING SATELLITE SYSTEM COORDINATES ⁵			
					DEPTH (FEET)	ELEVATION (FEET)	DEPTH (FEET)	ELEVATION (FEET)	LATITUDE		LONGITUDE	
									DEG(°)	MIN (')		DEG(°)
NORTHWEST SWALE SOIL BORING												
BR-1	10.5	85+00	30 FEET LEFT	164.0	> 10.5	< 153.5	6.0	158.0	30	35.245	84	15.375
NORTHEAST SWALE SOIL BORING												
BR-2	10.5	87+50	28 FEET LEFT	170.4	> 10.5	< 159.9	> 10.5	< 159.9	30	35.245	84	15.318
NORTHWEST SWALE FIELD INFILTRATION TEST⁶												
BR-1		85+05	30 FEET LEFT	164.0					30	35.245	84	15.375
NORTHEAST SWALE FIELD INFILTRATION TEST⁶												
BR-2		87+55	20 FEET LEFT	170.4					30	35.245	84	15.318

- NOTES:**
1. DEPTHS ARE BELOW EXISTING GROUND SURFACE
 2. ELEVATIONS DETERMINED FROM PLANS PROVIDED BY PBS&J.
 3. BASED OFF 24 HOUR GROUNDWATER MEASUREMENTS TAKEN IN THE FIELD
 4. ESTIMATED FROM THE INFILTRATION INVESTIGATION PERFORMED FOR THIS STUDY
 5. DETERMINED WITH A MAGELLAN 300 GPS. COORDINATES SHOULD BE ACCURATE TO WITHIN 15 FEET
 6. DETERMINED FROM A DOUBLE RING INFILTRATION (DRI) TEST

TABLE 2
SOIL PERMEABILITY ESTIMATES
STORMWATER SWALES
BANNERMAN AND BULL HEADLEY INTERSECTION IMPROVEMENTS
LEON COUNTY, FLORIDA

STRATUM NUMBER	CLASSIFICATION			SOIL PERMEABILITY VALUES			
	AAASHTO	UNIFIED	USDA TEXTURAL	USDA SOIL SURVEY ESTIMATE ¹ (IN/HR)	LABORATORY GRAIN-SIZE ESTIMATE ² (IN/HR)	FIELD ESTIMATE ³ (IN/HR)	WEIGHTED PERMEABILITY VALUE ⁴ (IN/HR)
A	SM	A-2-4	LOAMY SAND	1.3	0.7 - 3.5	2.0	2.0
B	SC	A-2-6	SANDY LOAM	0.8	0.4 - 0.9	--	0.6
C	SC	A-6	SANDY CLAY LOAM	0.4	< 0.1 - 0.1	0.1	0.1

NOTES: 1. REPORTED IN USDA SOIL SURVEY FOR LEON COUNTY

2. ESTIMATED FROM GRAIN-SIZE DISTRIBUTION CURVES

3. PERMEABILITY VALUES DETERMINED FROM A "CASED HOLE" PIEZOMETER ANALYSIS AND A DOUBLE RING INFILTRATION (DRI) TEST.

4. RECOMMENDED PERMEABILITY VALUES SHOWN DO NOT INCLUDE A FACTOR OF SAFETY.

IT SHOULD BE NOTED THAT THE INFILTRATION RATE OF THE SWALE CAN BE NEGATIVELY EFFECTED BY GROUNDWATER MOUNDING, CLOGGING WITH FINES, OR OVERCOMPACTION OF SWALE.

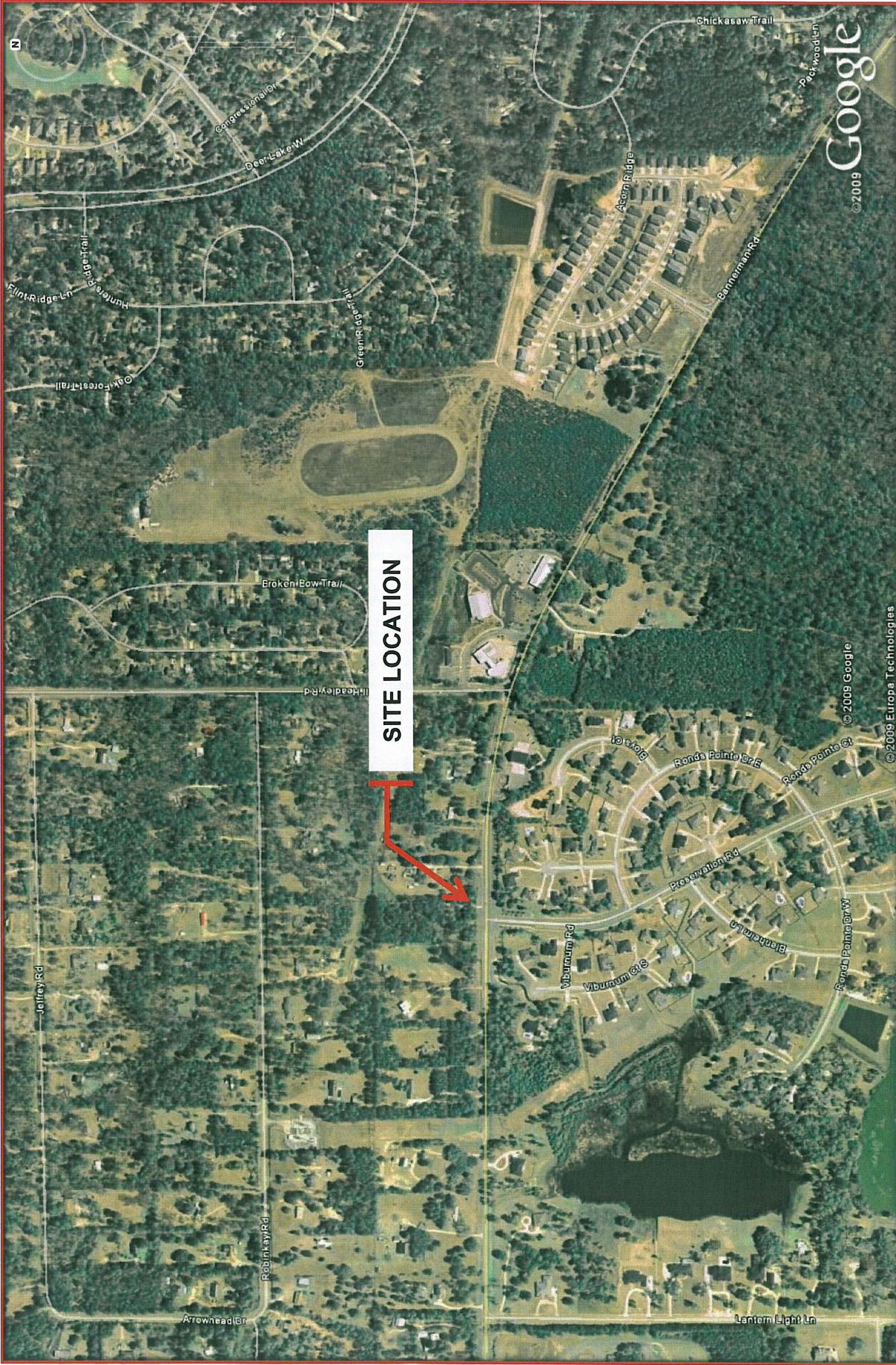
-- MEANS NOT TESTED

**TABLE 3
INFILTRATION PARAMETERS
STORMWATER SWALES
BANNERMAN AND BULL HEADLEY INTERSECTION IMPROVEMENTS
LEON COUNTY, FLORIDA**

PARAMETER	ELEVATION ¹ (FEET)	VALUE	UNITS ²	VALUE	UNITS ²
NORTHWEST SWALE					
UNSATURATED VERTICAL PERMEABILITY	158.0 - 162.0	0.67	INCHES/HOUR	1.3	FEET/DAY
SATURATED VERTICAL PERMEABILITY	153.5 - 162.0	1.00	INCHES/HOUR	2.0	FEET/DAY
BOTTOM OF SWALE ELEVATION	162.0		FEET		
SEASONAL HIGH GROUNDWATER	158.0		FEET		
NORTHEAST SWALE ⁴					
UNSATURATED VERTICAL PERMEABILITY	164.4 - 169.0	0.67	INCHES/HOUR	1.3	FEET/DAY
SATURATED VERTICAL PERMEABILITY	159.9 - 169.0	1.00	INCHES/HOUR	2.0	FEET/DAY
BOTTOM OF SWALE ELEVATION	169.0		FEET		
SEASONAL HIGH GROUNDWATER	160.0		FEET		

- NOTES:**
1. ELEVATIONS WERE DETERMINED BASED OFF PLANS PROVIDED BY PBS&J.
 2. SOIL PERMEABILITIES **INCLUDE A FACTOR OF SAFETY OF 2.**
 3. SOIL PERMEABILITIES DETERMINED FROM A WEIGHTED AVERAGE.
SEE **APPENDIX F** FOR PERMEABILITY CALCULATIONS.
 4. VALUES BASED ON OVEREXCAVATION BEING PERFORMED AS RECOMMENDED IN THIS REPORT.

FIGURES



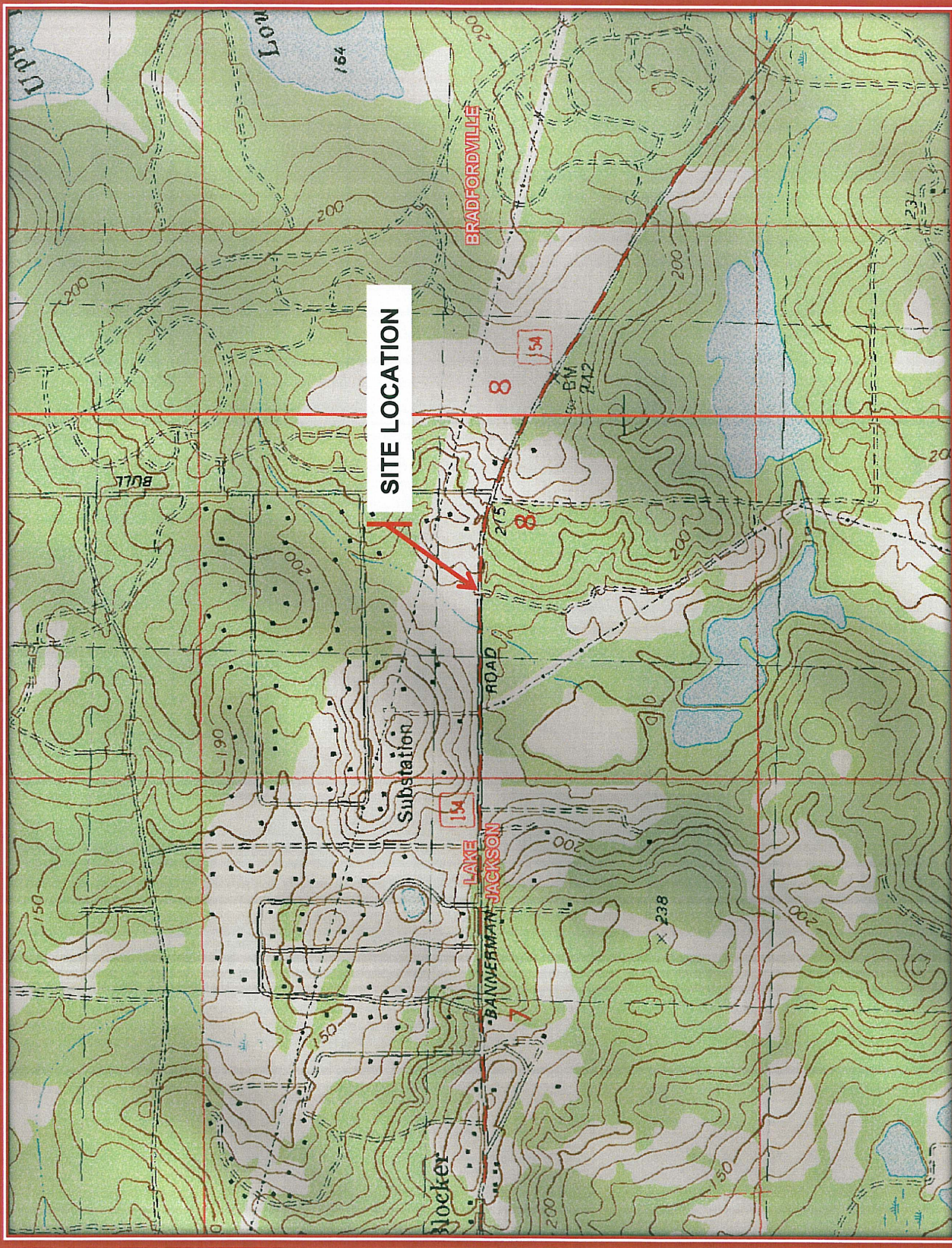
SITE LOCATION

DRAWN S. WALSH	CHECKED: T. HAYDEN, P.E.	SITE LOCATION MAP	
		STORMWATER SWALES	
ENGINEER: T. HAYDEN, P.E.	BANNERMAN AND BULL HEADLEY		
CLIENT: PBS&J	LEON COUNTY, FLORIDA		
PROJ. NO.: 22-31-09-04	DATE: DECEMBER 2009	FIGURE NO.:	1

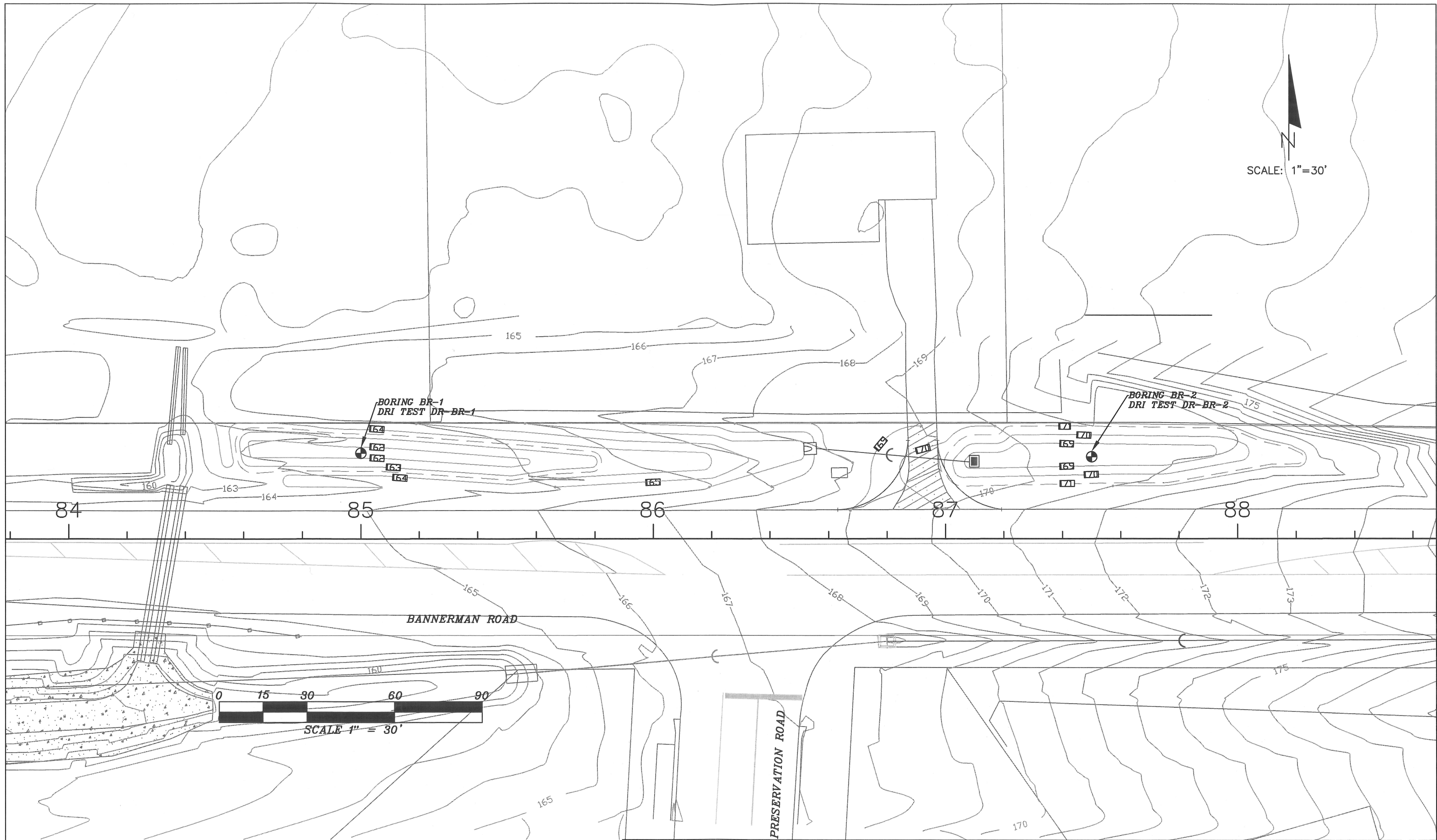
EGS Environmental and Geotechnical Specialists, Inc.
 3154 ELIZA ROAD | TALLAHASSEE, FLORIDA 32308
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DRAWN S. WALSH	CHECKED: T. HAYDEN, P.E.	TITLE: BORING LOCATION MAP	
		STORMWATER SWALES	
ENGINEER: T. HAYDEN, P.E.	BANNERMAN ROAD AND BULL HEADLEY LEON COUNTY, FLORIDA		
CLIENT: PBS&J.	DATE: DECEMBER 2009	FIGURE NO.:	2
PROJ. NO.: 22-31-09-04	EGS Environmental and Geotechnical Specialists, Inc. 3154 ELIZA ROAD TALLAHASSEE, FLORIDA 32308 OFFICE #: (850) 386-1253 FAX #: (850) 385-8050		



DRAWN S. WALSH	CHECKED: T. HAYDEN, P.E.	TITLE: USGS TOPOGRAPHIC MAP
ENGINEER: T. HAYDEN, P.E.	EGS Environmental and Geotechnical Specialists, Inc.	STORMWATER SWALES
CLIENT: PBS&J	3154 ELIZA ROAD TALLAHASSEE, FLORIDA 32308	BANNERMAN ROAD AND BULL HEADLEY
PROJ. NO.: 22-31-09-04	OFFICE #: (850) 386-1253 FAX #: (850) 385-8050	LEON COUNTY, FLORIDA
		DATE: DECEMBER 2009
		FIGURE NO.: 3

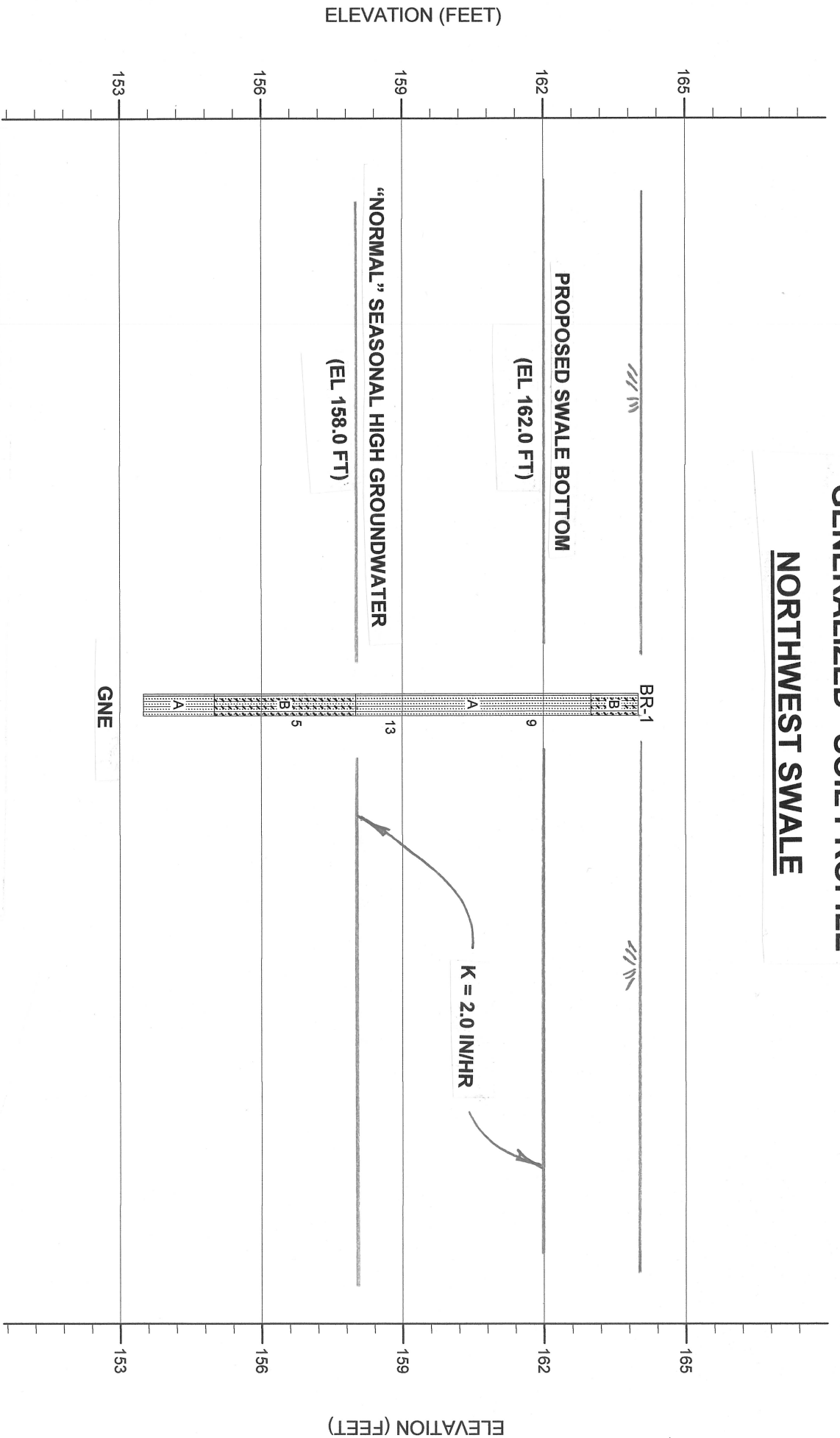


PREPARED BY:	T. HAYDEN, P.E.
REVISED:	T. HAYDEN, P.E.
CHECKED:	M. HAYDEN, P.E.
ENGINEER:	T. HAYDEN, P.E.
SR. ENGINEER:	M. HAYDEN, P.E.

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 Environmental & Geotechnical Specialists, Inc.
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 Tallahassee, Florida 32308
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SOIL BORING LOCATION MAP (PLAN VIEW) ADDITIONAL SWMF INVESTIGATION BANNERMAN AND BULL HEADLEY LEON COUNTY, FLORIDA	
SCALE:	1" = 30'
DATE:	DECEMBER 2009
PROJ. NO.:	22-31-09-04
FIGURE NO.:	4

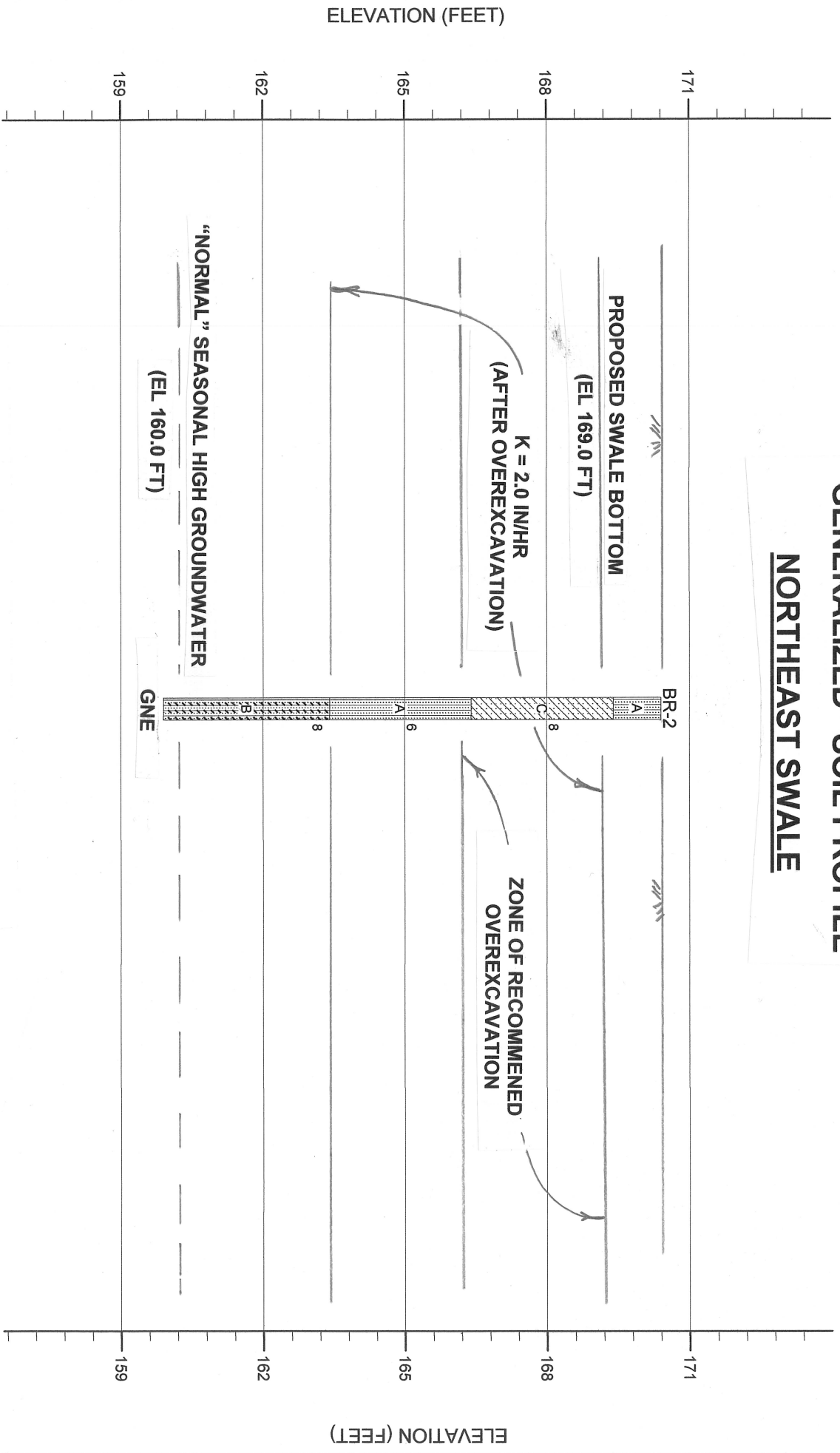
"GENERALIZED" SOIL PROFILE NORTHWEST SWALE



- NOTES:**
1. SEE CLASSIFICATION DATA SHEETS FOR MATERIAL PROPOERTIES.
 2. GNE MEANS GROUNDWATER NOT ENCOUNTERED.
 3. NUMBERS TO THE RIGHT ARE STANDARD PENETRATION TEST (SPT) N VALUES.

DRAWN BY:	A. HAYDEN	EGS	SUBSURFACE PROFILE ADDITIONAL SWMF INVESTIGATION LEON COUNTY, FLORIDA
REVISED:	A. HAYDEN		
CHECKED:	M. HAYDEN, P. E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.	
ENGINEER:	M. HAYDEN, P. E.	3154 ELIZA ROAD	
SR. ENGINEER:	M. HAYDEN, P. E.	TALLAHASSEE, FLORIDA	
PROJ. NO.:	22-31-09-04	OFFICE: (850) 398-1253	FAX: (850) 398-8050
		PROJ. NO.:	22-31-09-04
		FIGURE NO.:	5

"GENERALIZED" SOIL PROFILE NORTHEAST SWALE



- NOTES:**
1. SEE CLASSIFICATION DATA SHEETS FOR MATERIAL PROPERTIES.
 2. GNE MEANS GROUNDWATER NOT ENCOUNTERED.
 3. NUMBERS TO THE RIGHT ARE STANDARD PENETRATION TEST (SPT) N VALUES.

DRAWN BY: A. HAYDEN	EGS	SUBSURFACE PROFILE ADDITIONAL SWMF INVESTIGATION LEON COUNTY, FLORIDA
REVISED: A. HAYDEN		
CHECKED: M. HAYDEN, P.E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.	
ENGINEER: M. HAYDEN, P.E.	3154 ELIZA ROAD	
SR. ENGINEER: M. HAYDEN, P.E.	TALLAHASSEE, FLORIDA	
PROJ. NO.: 22-31-09-04	OFFICE: (980) 386-1253	FAX: (980) 386-8050
	PROJ. NO.: 22-31-09-04	FIGURE NO.: 6

APPENDIX A
SOIL SURVEY

SOIL SURVEY

STORMWATER MANAGEMENT FACILITIES

DATE OF SURVEY : 12/23/2009

SURVEY MADE BY : ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.

SUBMITTED BY : T. HAYDEN, P.E.

STRATUM NO.	ORGANIC CONTENT			SIEVE ANALYSIS RESULTS % PASSING								ATTERBERG LIMITS (%)			UNIFIED GROUP	AASHTO GROUP	COLOR	DESCRIPTION
	NO. OF TESTS	% ORGANIC	MOISTURE CONTENT(%)	NO. OF TESTS	4 MESH	10 MESH	20 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTICITY INDEX				
A	--	--	--	8	100	100	89-100	58-99	22-95	17-66	12-30	2	17-33	5-7	SM	A-2-4	BROWN, GRAY, AND ORANGE	SILTY FINE SAND
B	--	--	--	3	100	100	98-99	89-96	72-94	53-70	21-36	1	26	11	SC	A-2-6	GRAY AND BROWN	CLAYEY FINE SAND
C	--	--	--	3	100	100	97-100	72-95	46-88	44-58	39-42	2	38-39	24	SC	A-6	GRAY	CLAYEY SAND
D	--	--	--	2	100	100	99	96	90-92	64-73	51-54	2	37-38	15-20	CL	A-6	RED, BROWN, AND GRAY	VERY SANDY CLAY
E	--	--	--	5	100	100	96-100	93-100	90-100	87-99	59-86	5	51-67	20-37	CH	A-7-6	BROWN, GRAY, AND ORANGE	HIGHLY PLASTIC CLAY

STRATA NOTES

- STRATUM A is a "SELECT" soil, as defined by the 2008 FDOT Design Standards, and will have a moderate to slow percolation rate.
- STRATA B, C, and D are "PLASTIC" soils, as defined by the 2008 FDOT Design Standards, and will have a slow to very slow percolation rate.
- STRATUM E is a "HIGHLY PLASTIC" soil, as defined by the 2008 FDOT Design Standards, and will act as a confining layer.

GENERAL NOTES

- Numbers left of borings indicate standard penetration test (SPT) N-values for 12 in. penetration (Unless otherwise noted).
- Letters within the boring logs indicate the STRATUM number.
- Soil descriptions, test data, and standard penetration values shown are for the soil boring only and may not apply to any other locations except at the location of the soil boring. Extrapolation of the soil boring data to other locations is the sole responsibility of the person performing the extrapolation.
- Borings plotted by elevation based on drawings provided by PBS&J.

LEGEND

- INDICATES UNMEASURED PARAMETERS
- ▼ 24-HR MEASURED WATER LEVEL

REVISIONS						SEAL:	Environmental & Geotechnical Specialists, Inc. EGS 3154 ELIZA ROAD TALLAHASSEE, FLORIDA 32308 OFFICE: (850) 386-1253 FAX: (850) 385-8050 Cert. of Auth.: 6222	PBS&J BANNERMAN ROAD & BULL HEADLEY ROAD INTERSECTION IMPROVEMENTS	SHEET NO.
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION				
						MYRON L. HAYDEN, P.E. P.E. NO.: 34067			
SOIL SURVEY									

APPENDIX B
SOIL BORING LOGS



PROJECT: ADDITIONAL SWMF INVESTIGATION BANNERMAN & BULL HEADLEY
 CLIENT: PBS&J
 PROJECT NO.: 22-31-09-04
 PROJECT LOCATION: LEON COUNTY, FLORIDA ELEVATION (FEET): 164.0'
 BORING NO.: BR-1 DATE: 12/07/2009
 DRILLER: R. ROGERS FLUID LOSS: N/A
 DEPTH TO - WATER> INITIAL: >10.5' AFTER 24 HOURS: >10.5' CAVING> C NONE

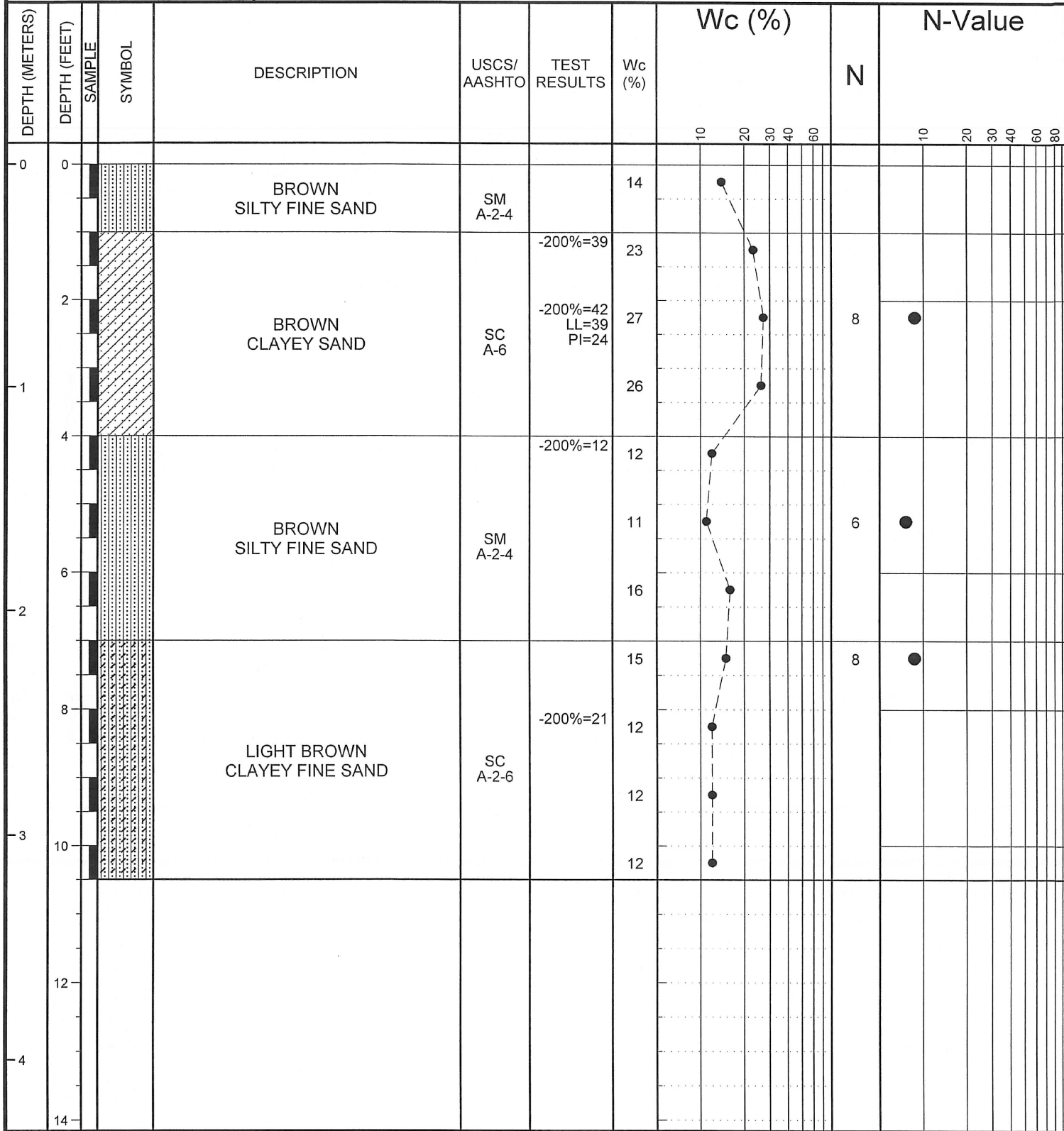
This information pertains only to this boring and should not be interpreted as being indicative of the site.

DEPTH (METERS)	DEPTH (FEET)	SAMPLE	SYMBOL	DESCRIPTION	USCS/AASHTO	TEST RESULTS	Wc (%)	Wc (%)		N	N-Value	
								10	20		10	20
0	0			GRAY CLAYEY FINE SAND	SC A-2-6		17					
	2			GRAY SILTY FINE SAND		-200%=22	15					
	4			BROWN SILTY FINE SAND	SM A-2-4	-200%=15	10		9			
	6			GRAY SILTY FINE SAND			8			13		
	8			BROWN CLAYEY FINE SAND	SC A-2-6		15					
	10			BROWN SILTY FINE SAND	SM A-2-4		16		5			
	12					-200%=28 LL=26 PI=11	12					
	14						14					



PROJECT: ADDITIONAL SWMF INVESTIGATION BANNERMAN & BULL HEADLEY
 CLIENT: PBS&J
 PROJECT NO.: 22-31-09-04
 PROJECT LOCATION: LEON COUNTY, FLORIDA ELEVATION (FEET): 170.4'
 BORING NO.: BR-2 DATE: 12/07/2009
 DRILLER: R. ROGERS FLUID LOSS: N/A
 DEPTH TO - WATER> INITIAL: ∇ >10.5' AFTER 24 HOURS: ∇ >10.5' CAVING> ∇ NONE

This information pertains only to this boring and should not be interpreted as being indicative of the site.



Figure

APPENDIX C
SOIL CLASSIFICATION DATA

SOIL CLASSIFICATION DATA

Project: ADDITIONAL SWMF INVESTIGATION BANNERMAN & BURLINGTON EY22-31-09-04

Client: PBS&J

Location: LEON COUNTY, FLORIDA

Boring	DEPTH (FEET)	Wc (%)	-4 (%)	-10 (%)	-20 (%)	-40 (%)	-60 (%)	-100 (%)	-200 (%)	LL	PI	Org. (%)	N Value	USCS	AASHTO	Mat. No.	Description
BR-1	0.0-0.5	17												SC	A-2-6	B	GRAY CLAYEY FINE SAND
	1.0-1.5	15	100	100	99	94	78	57	22					SM	A-2-4	A	GRAY SILTY FINE SAND
	2.0-2.5	10	100	100	98	88	65	40	15				9	SM	A-2-4	A	BROWN SILTY FINE SAND
	3.0-3.5	9												SM	A-2-4	A	BROWN SILTY FINE SAND
	4.0-4.5	8												SM	A-2-4	A	BROWN SILTY FINE SAND
	5.0-5.5	8											13	SM	A-2-4	A	GRAY SILTY FINE SAND
	6.0-6.5	15												SC	A-2-6	B	BROWN CLAYEY FINE SAND
	7.0-7.5	16											5	SC	A-2-6	B	BROWN CLAYEY FINE SAND
	8.0-8.5	12	100	100	99	91	73	53	28	26	11			SC	A-2-6	B	BROWN CLAYEY FINE SAND
	9.0-9.5	14												SM	A-2-4	A	BROWN SILTY FINE SAND
	10.0-10.5	14												SM	A-2-4	A	BROWN SILTY FINE SAND

SOIL CLASSIFICATION DATA

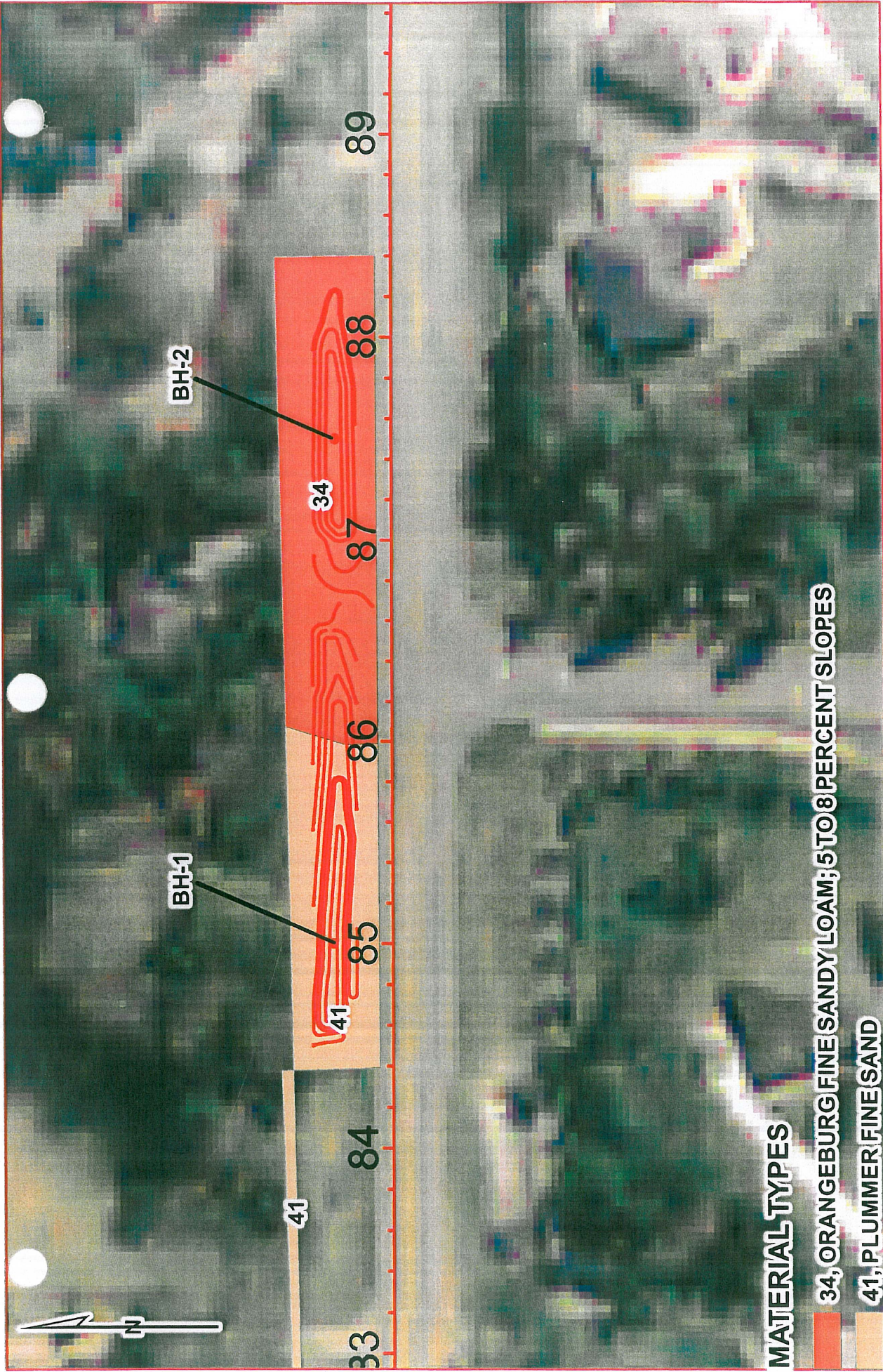
Project: ADDITIONAL SWMF INVESTIGATION BANNERMAN & BURLINGAME AVE EY22-31-09-04

Client: PBS&J

Location: LEON COUNTY, FLORIDA

Boring	DEPTH (FEET)	Wc (%)	-4 (%)	-10 (%)	-20 (%)	-40 (%)	-60 (%)	-100 (%)	-200 (%)	LL	PI	Org. (%)	N Value	USCS	AASHTO	Mat. No.	Description
BR-2	0.0-0.5	14												SM	A-2-4	A	BROWN SILTY FINE SAND
	1.0-1.5	23	100	100	98	83	57	48	39					SC	A-6	C	BROWN CLAYEY SAND
	2.0-2.5	27	100	100	97	72	46	44	42	39	24		8	SC	A-6	C	BROWN CLAYEY SAND
	3.0-3.5	26												SC	A-6	C	BROWN CLAYEY SAND
	4.0-4.5	12	100	100	89	58	22	17	12					SM	A-2-4	A	BROWN SILTY FINE SAND
	5.0-5.5	11											6	SM	A-2-4	A	BROWN SILTY FINE SAND
	6.0-6.5	16												SM	A-2-4	A	BROWN SILTY FINE SAND
	7.0-7.5	15											8	SC	A-2-6	B	LIGHT BROWN CLAYEY FINE SAND
	8.0-8.5	12	100	100	99	96	94	70	21					SC	A-2-6	B	LIGHT BROWN CLAYEY FINE SAND
	9.0-9.5	12												SC	A-2-6	B	LIGHT BROWN CLAYEY FINE SAND
	10.0-10.5	12												SC	A-2-6	B	LIGHT BROWN CLAYEY FINE SAND

APPENDIX D
USDA SOIL SURVEY



MATERIAL TYPES

- 34, ORANGEBURG FINE SANDY LOAM; 5 TO 8 PERCENT SLOPES
- 41, PLUMMER FINE SAND

DRAWN:	M. MONTEITH	CHECKED:	T. HAYDEN, P.E.
ENGINEER:	T. HAYDEN, P.E.		
CLIENT:	PBS&J		
PROJ. NO.:	22-31-09-04	SCALE:	

EGS
Environmental and Geotechnical Specialists, Inc.
 3154 Eliza Road
 Tallahassee, Florida 32308
 Office #: (850) 386-1253
 Fax #: (850) 385-8050

TITLE:	USDA SOIL SURVEY BANNERMAN & BULL HEADLEY SWMF LEON COUNTY, FLORIDA
DATE:	December 2009
FIGURE NO.:	--

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth In	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
32----- Ocilla	0-29	Sand-----	SM, SP-SM	A-2, A-3	0	100	95-100	75-100	8-35	---	NP
	29-80	Sandy loam, sandy clay loam.	SM, CL, SC	A-2, A-4, A-6	0	100	95-100	80-100	30-55	<40	NP-18
33, 34, 35----- Orangeburg	0-10	Fine sandy loam	SM	A-2	0	98-100	95-100	75-95	20-35	---	NP
	10-80	Sandy clay loam	SC, CL	A-6, A-4	0	98-100	95-100	71-91	38-55	22-40	8-19
36:* Orangeburg-----	0-10	Fine sandy loam	SM	A-2	0	98-100	95-100	75-95	20-35	---	NP
	10-80	Sandy clay loam	SC, CL	A-6, A-4	0	98-100	95-100	71-91	38-55	22-40	8-19
Urban land.											
37----- Ortega	0-10	Sand-----	SP, SP-SM	A-3	0	100	100	90-100	3-8	---	NP
	10-99	Fine sand, sand	SP, SP-SM	A-3	0	100	100	90-100	2-7	---	NP
38:* Panlico-----	0-32	Muck-----	Pt	---	0	---	---	---	---	---	---
	32-80	Loamy sand, sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	70-95	5-20	---	NP
Dorovan-----	0-5	Mucky peat-----	Pt	---	0	---	---	---	---	---	---
	5-65	Muck-----	Pt	---	0	---	---	---	---	---	---
	65-80	Sand, loamy sand, loam.	SP-SM, SM-SC, SM	A-1, A-3, A-4, A-2-4	0	100	100	5-70	5-49	<20	NP-7
39----- Pelham	0-26	Fine sand-----	SM	A-2	0	100	95-100	75-90	15-30	---	NP
	26-80	Sandy clay loam, sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	95-100	65-90	30-50	15-30	2-12
40.* Pits											
41----- Plummer	0-61	Fine sand-----	SM, SP-SM	A-2-4, A-3	0	100	100	75-96	5-26	---	NP
	61-80	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, SM-SC	A-2-4, A-2-6	0	100	97-100	76-96	26-35	<31	NP-14
42----- Plummer	0-60	Mucky fine sand	SM, SP-SM	A-2-4, A-3	0	100	100	75-96	5-26	---	NP
	60-80	Sandy loam, sandy clay loam, fine sandy loam.	SM, SC, SM-SC	A-2-4, A-2-6	0	100	97-100	76-96	26-35	<31	NP-14
43, 44*----- Rutlege	0-23	Loamy fine sand	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-80	5-35	<25	NP
	23-82	Sand, loamy sand, loamy fine sand.	SP-SM, SP, SM	A-2, A-3	0	95-100	95-100	50-80	2-25	<20	NP

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth		Clay <2mm	Moist bulk density G/cm ³	Permeability In/hr	Available water capacity In/in	Soil reaction pH	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter Pct
	In	Pct							K	T		
20:* Kershaw----- Urban land.	0-80	1-5	1.35-1.55	>20	0.02-0.05	4.5-6.0	Very low-----	0.15	5	1	<.5	
21----- Lakeland	0-78 78-91	2-8 2-6	1.35-1.55 1.50-1.60	>20 >20	0.05-0.08 0.03-0.08	4.5-6.0 4.5-6.0	Low----- Low-----	0.17	5	2	>1	
22----- Leefield	0-36 36-51 51-80	8-12 15-35 15-35	1.30-1.65 1.40-1.70 1.60-1.70	6.0-20 0.6-2.0 0.2-0.6	0.04-0.07 0.10-0.13 0.08-0.12	4.5-6.0 4.5-5.5 4.5-5.5	Low----- Low----- Low-----	0.10 0.15 0.10	5	2	2-5	
23----- Leon	0-25 25-41 41-80	1-6 2-8 1-6	1.40-1.65 1.50-1.70 1.40-1.65	6.0-20 0.6-6.0 >20	0.02-0.05 0.05-0.10 0.02-0.05	3.6-5.5 3.6-5.5 3.6-5.5	Very low----- Very low----- Very low-----	0.20 0.20 0.17	5	1	.5-1	
24, 25----- Lucy	0-30 30-36 36-80	2-12 20-30 20-35	1.35-1.65 1.60-1.70 1.55-1.70	6.0-20 2.0-6.0 0.6-2.0	0.06-0.10 0.10-0.12 0.12-0.14	5.1-5.5 4.5-5.5 4.5-5.5	Low----- Low----- Low-----	0.20 0.24 0.28	5	1	.5-1	
26----- Lutterloh	0-59 59-71 71-80	<5 15-30 30-55	1.35-1.55 1.60-1.70 1.60-1.70	6.0-20 0.6-2.0 <0.2	0.02-0.05 0.10-0.15 0.10-0.15	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- High-----	0.24 0.32 0.37	5	1	<3	
27----- Lynchburg	0-18 18-65 65-80	5-20 18-35 ---	1.60-1.70 1.55-1.70 ---	2.0-6.0 0.6-2.0 ---	0.09-0.13 0.12-0.16 ---	4.5-5.5 4.5-5.5 ---	Low----- Low----- ---	0.20 0.20 ---	4	3	2-5	
28*----- Meggett	0-12 12-50 50-80	5-20 40-60 25-50	1.25-1.60 1.50-1.70 1.60-1.70	2.0-6.0 0.06-0.2 0.2-2.0	0.10-0.15 0.13-0.18 0.12-0.16	4.5-6.5 4.5-6.5 4.5-6.5	Low----- High----- Moderate-----	0.24 0.32 0.28	4	3	2-8	
29, 30----- Norfolk	0-8 8-58 58-80	2-10 18-35 20-40	1.40-1.70 1.30-1.60 1.20-1.70	6.0-20 0.6-2.0 0.6-2.0	0.06-0.10 0.10-0.15 0.10-0.15	4.5-6.0 4.5-5.5 4.5-5.5	Low----- Low----- Low-----	0.17 0.24 0.24	5	2	.5-2	
31----- Norfolk	0-7 7-14 14-64 64-80	5-12 10-20 22-35 35-80	1.50-1.60 1.50-1.65 1.62-1.80 1.30-1.65	2.0-6.0 2.0-6.0 0.6-2.0 <0.06	0.05-0.10 0.05-0.10 0.10-0.15 0.10-0.15	5.1-6.5 4.5-5.5 4.5-5.5 3.6-5.5	Low----- Low----- Moderate----- Very high-----	0.17 0.20 0.32 0.37	5	2	.5-2	
32----- Ocilla	0-29 29-80	2-7 15-35	1.40-1.50 1.60-1.70	2.0-20 0.6-2.0	0.05-0.08 0.09-0.12	3.6-5.5 4.5-5.5	Low----- Low-----	0.17 0.24	5	1	1-3	
33, 34, 35----- Orangeburg	0-10 10-80	5-20 20-35	1.40-1.70 1.50-1.70	2.0-6.0 0.6-2.0	0.07-0.10 0.10-0.13	4.5-6.0 4.5-5.5	Low----- Low-----	0.24 0.24	5	3	1-3	
36:* Orangeburg----- Urban land.	0-10 10-80	5-20 20-35	1.40-1.70 1.50-1.70	2.0-6.0 0.6-2.0	0.07-0.10 0.10-0.13	4.5-6.0 4.5-5.5	Low----- Low-----	0.24 0.24	5	3	1-3	
37----- Ortega	0-10 10-99	1-3 <3	1.20-1.55 1.35-1.60	6.0-20 6.0-20	0.05-0.08 0.03-0.06	4.5-6.5 4.5-6.5	Low----- Low-----	0.15 0.15	5	2	1-2	
38:* Pamlico----- Dorovan-----	0-32 32-80 0-5 5-65 65-80	--- 5-20 --- --- 5-20	0.25-0.40 1.40-1.65 0.25-0.40 0.35-0.55 1.40-1.65	0.6-2.0 6.0-20 0.6-2.0 0.6-2.0 6.0-20	0.24-0.26 0.03-0.06 0.25-0.50 0.25-0.50 0.05-0.08	3.6-4.4 3.6-5.5 4.5-5.5 4.5-5.5 4.5-5.5	----- Low----- ----- ----- Low-----	----- ----- ----- ----- -----	----- ----- ----- ----- -----	2 ----- 2 ----- -----	----- ----- ----- ----- -----	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Map symbol and soil name	Depth		Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
	In	Pct							K	T		
			G/cm ³	In/hr	In/in	pH					Pct	
39----- Pelham	0-26 26-80	2-7 15-35	1.10-1.60 1.60-1.80	6.0-20 0.6-2.0	0.05-0.08 0.10-0.13	4.5-5.5 4.5-5.5	Very low----- Low-----	0.10 0.24	5	1	1-3	
40.* Pits												
41----- Plummer	0-61 61-80	2-7 15-30	1.30-1.80 1.50-1.90	2.0-6.0 0.6-2.0	0.03-0.08 0.10-0.13	4.5-6.0 4.5-5.5	Very low----- Very low-----	0.10 0.15	5	1	1-3	
42----- Plummer	0-60 60-80	2-7 15-30	1.30-1.80 1.50-1.70	2.0-6.0 0.6-2.0	0.03-0.08 0.10-0.13	4.5-6.0 4.5-5.5	Very low----- Very low-----	0.10 0.15	5	2	3-15	
43, 44*----- Rutlege	0-23 23-82	<10 <10	1.25-1.40 1.45-1.70	6.0-20 6.0-20	0.15-0.20 0.04-0.08	3.6-5.5 3.6-5.0	Low----- Low-----	0.17 0.17	5	2	3-15	
45----- Sapelo	0-14 14-26 26-43 43-80	1-5 4-7 3-6 15-30	1.35-1.50 1.50-1.70 1.45-1.60 1.55-1.90	6.0-20 0.6-2.0 6.0-20 0.6-2.0	0.03-0.07 0.10-0.15 0.03-0.07 0.12-0.17	4.5-5.5 4.5-5.5 4.5-5.5 4.5-5.5	Low----- Low----- Low----- Low-----	0.17 0.15 0.17 0.24	5	1	1-3	
46----- Surrency	0-36 36-65	8-12 20-35	1.35-1.50 1.55-1.70	6.0-20 0.6-2.0	0.15-0.20 0.10-0.15	3.6-5.0 3.6-5.0	Low----- Low-----	0.10 0.15	5	2	3-12	
47----- Talquin	0-25 25-37 37-80	<6 2-8 <6	1.35-1.60 1.50-1.70 1.40-1.65	6.0-20 0.6-6.0 >6.0	0.02-0.05 0.05-0.10 0.02-0.05	3.6-5.5 3.6-5.5 3.6-5.5	Low----- Low----- Low-----	0.15 0.17 0.15	5	1	<2	
48----- Troup	0-44 44-80	2-7 15-30	1.45-1.65 1.50-1.70	6.0-20 0.6-2.0	0.05-0.10 0.10-0.13	4.5-5.5 4.5-5.5	Very low----- Low-----	0.17 0.20	5	1	1-2	
49.* Urban land												
50, 51----- Wagram	0-31 31-62	2-12 15-35	1.40-1.65 1.60-1.70	6.0-20 0.6-2.0	0.05-0.08 0.12-0.16	4.5-5.5 4.5-5.5	Low----- Low-----	0.15 0.20	5	2	1-2	
52----- Yonges	0-9 9-71 71-80	2-20 20-35 15-35	1.35-1.70 1.60-1.70 1.20-1.70	0.6-6.0 0.2-0.6 0.6-2.0	0.09-0.14 0.13-0.18 0.12-0.16	3.6-7.8 5.6-8.4 6.1-8.4	Low----- Low----- Low-----	0.15 0.17 0.20	5	3	1-3	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.---SOIL AND WATER FEATURES---Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
					Ft			In		In	In		
20:* Kershaw Urban land.	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
21 Lakeland	A	None	---	---	>6.0	---	---	>72	---	---	---	Low	Moderate.
22 Leaffield	C	None	---	---	1.5-2.5	Apparent	Dec-Mar	>60	---	---	---	Moderate	High.
23 Leon	A/D	None	---	---	0-1.0	Apparent	Jun-Feb	>60	---	---	---	High	High.
24, 25 Lucy	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
26 Lutterloh	C	None	---	---	1.5-2.5	Apparent	Dec-Mar	>60	---	---	---	High	Moderate.
27 Lynchburg	B/D	None	---	---	0.5-1.5	Apparent	Nov-Apr	>60	---	---	---	High	High.
28* Meggett	D	Frequent	Long	Dec-Apr	0-1.0	Apparent	Nov-Apr	>60	---	---	---	High	Moderate.
29, 30 Norfolk	B	None	---	---	4.0-6.0	Perched	Jan-Mar	>60	---	---	---	Moderate	High.
31 Norfolk	B	None	---	---	5.0-6.0	Perched	Jan-Apr	>60	---	---	---	Moderate	High.
32 Ocilla	C	None	---	---	1.0-2.5	Apparent	Dec-Apr	>60	---	---	---	High	Moderate.
33, 34, 35 Orangeburg	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Moderate.
36:* Orangeburg Urban land.	B	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Initial	Total	Uncoated steel	Concrete
37-Ortega	A	None	---	---	3.5-5.0	Apparent	Jun-Jan	>60	---	In	---	Low	High.
38.* Pamlico**	D	Frequent	Very long	Nov-Jun	+1-1.0	Apparent	Nov-Jul	>60	---	4-12	10-36	High	High.
Dorovan**	D	Frequent	Very long	Jan-Dec	+1-0.5	Apparent	Jan-Dec	>60	---	4-8	75	High	High.
39-Pelham	B/D	None	Brief	Dec-Mar	0.5-1.5	Apparent	Jan-Apr	>60	---	---	---	High	High.
40.* Pits	B/D	None	---	---	---	---	---	>60	---	---	---	Moderate	High.
41-Plummer	B/D	None	---	---	0-1.5	Apparent	Dec-Jul	>60	---	---	---	Moderate	High.
42.* Plummer	B/D	None	---	---	+2-1.5	Apparent	Dec-Jul	>60	---	---	---	Moderate	High.
43, 44.* Rutlege	D	Common	Brief	Dec-May	0-1.0	Apparent	Dec-May	>60	---	---	---	High	High.
45-Sapelo	D	None	---	---	1.5-2.5	Apparent	Nov-Apr	>60	---	---	---	High	High.
46-Surrency	D	Common	Very long	Dec-Mar	0-0.5	Apparent	Dec-Apr	>60	---	---	---	High	High.
47-Talquin	B/D	None	---	---	0-1.0	Apparent	Jun-Feb	>60	---	---	---	High	High.
48-Troup	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	Moderate.
49.* Urban land	A	None	---	---	>6.0	---	---	>60	---	---	---	Low	High.
50, 51-Wagram	D	Frequent	Long	Nov-Mar	0-1.0	Apparent	Nov-Apr	>60	---	---	---	High	Moderate.
52-Yonges	D	Frequent	Long	Nov-Mar	0-1.0	Apparent	Nov-Apr	>60	---	---	---	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

** In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 17.--PHYSICAL PROPERTIES OF SELECTED SOILS--Continued

Soil series and sample number	Depth	Horizon	Particle size distribution										Hydraulic conductivity Cm/hr	Bulk density (field moist)	Water content		
			Sand			Silt			Clay			1/10 bar			1/3 bar	15 bar	
			Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2-0.05 mm)	(0.05-0.002 mm)	(0.002 mm)	(<0.002 mm)						Percent
<u>In</u>																	
Norfolk loamy fine sand:																	
S76FL-073-004-1	0-4	A1	0.1	1.8	14.1	49.7	17.2	82.9	10.7	6.4	33.5	1.38	11.7	7.1	3.1		
S76FL-073-004-2	4-8	A2	0.1	2.1	14.1	50.9	17.8	85.0	7.1	7.9	21.6	1.42	9.6	6.3	3.0		
S76FL-073-004-3	8-15	B22t	0.1	1.8	12.8	48.4	17.7	80.8	7.1	12.1	10.8	1.52	10.8	7.5	4.1		
S76FL-073-004-4	15-31	B22t	0.1	1.6	8.8	35.8	14.6	60.9	5.5	33.6	10.8	1.48	20.9	17.6	11.1		
S76FL-073-004-5	31-44	B23t	0.1	1.4	8.6	35.9	14.4	60.4	5.6	34.0	1.3	1.64	18.2	15.5	9.7		
S76FL-073-004-6	44-58	B24t	0.1	1.8	11.1	38.4	14.1	65.5	3.1	31.4	3.3	1.61	20.7	18.4	11.9		
S76FL-073-004-7	58-68	B3	0.2	1.5	10.0	35.0	13.0	59.7	2.6	37.7	0.1	1.67	20.6	18.4	12.2		
S76FL-073-004-8	68-80	C	0.1	1.1	8.8	33.3	12.5	55.8	2.5	41.7	0.8	1.66	20.4	18.8	14.4		
Norfolk loamy sand clayey substratum																	
S76FL-073-009-1	0-7	Ap	0.3	4.3	27.1	43.0	10.2	84.9	6.3	8.8	3.4	1.59	11.9	8.0	5.2		
S76FL-073-009-2	7-14	B21t	0.1	2.7	23.8	41.5	10.0	78.1	8.2	13.7	3.9	1.65	10.3	10.2	6.1		
S76FL-073-009-3	14-29	B22t	0.1	2.6	20.5	35.9	9.1	68.2	6.8	26.0	1.2	1.58	17.6	14.9	10.9		
S76FL-073-009-4	29-51	B23t	0.2	2.6	20.5	36.2	9.0	68.5	5.1	25.0	0.5	1.73	17.3	15.4	10.2		
S76FL-073-009-5	51-59	B24t	0.2	2.7	20.0	32.5	7.5	62.9	5.3	31.8	0.0	1.75	18.6	17.1	12.3		
S76FL-073-009-6	59-64	B25t	0.2	2.6	20.2	31.2	7.2	61.4	6.7	31.9	0.1	1.76	19.5	18.2	12.5		
S76FL-073-009-7	64-80	IIC	0.0	0.2	0.6	3.4	3.4	7.6	20.0	72.4	5.8	1.32	30.0	27.6	24.3		
Ocilla fine sand:																	
S77FL-073-026-1	0-3	A1	0.1	2.6	13.5	55.2	17.4	88.8	7.5	3.7	---	---	---	---	---		
S77FL-073-026-2	3-6	A21	0.2	2.7	13.9	54.2	16.4	87.4	9.0	3.6	25.4	1.38	11.2	7.7	2.4		
S77FL-073-026-3	6-22	A22	0.1	2.8	14.0	54.3	15.3	86.5	8.8	4.7	18.0	1.52	10.3	7.2	2.5		
S77FL-073-026-4	22-29	B1	0.1	2.4	13.5	51.1	15.2	82.3	9.3	8.4	17.5	1.44	10.6	7.2	2.3		
S77FL-073-026-5	29-39	B21t	0.2	2.8	13.0	45.0	7.4	68.4	17.0	14.6	5.4	1.59	15.5	12.6	4.5		
S77FL-073-026-6	39-56	B22t	0.2	2.4	11.4	42.0	12.6	68.6	11.3	20.1	1.7	1.67	17.3	15.5	8.5		
S77FL-073-026-7	56-80	B23t	0.2	1.8	8.8	33.4	11.0	55.2	14.2	30.6	0.7	1.62	21.5	20.8	12.7		
Orangeburg fine sandy loam:																	
S76FL-073-008-1	0-5	A1	0.3	5.0	21.9	39.3	8.3	75.4	11.0	13.6	27.0	1.42	15.4	12.1	6.6		
S76FL-073-008-2	5-10	B1t	0.4	5.7	22.8	38.1	7.6	74.6	8.4	17.0	7.0	1.58	15.0	11.8	7.3		
S76FL-073-008-3	10-16	B21t	0.4	5.0	21.3	34.3	7.0	68.0	5.5	26.5	5.9	1.50	22.1	13.7	8.1		
S76FL-073-008-4	16-41	B22t	0.3	4.3	17.8	33.3	7.6	63.3	7.6	29.1	3.5	1.53	19.6	15.6	9.2		
S76FL-073-008-5	41-62	B23t	0.5	4.5	18.7	30.7	6.1	60.5	2.9	36.6	7.9	1.71	19.2	16.6	11.3		
S76FL-073-008-6	62-80	B23t	0.6	5.2	20.3	30.9	5.8	62.8	2.3	34.9	1.8	1.71	18.0	15.5	10.5		
Ortega sand:																	
S76FL-073-003-1	0-4	A1	0.1	3.6	28.7	46.5	13.9	92.8	4.9	2.3	41.4	1.39	8.4	5.3	2.2		
S76FL-073-003-2	4-10	C1	0.2	3.9	30.3	47.4	13.4	99.1	0.5	0.4	16.1	1.55	5.8	3.3	1.3		
S76FL-073-003-3	10-28	C2	0.2	3.9	29.0	48.0	14.3	95.4	2.4	2.2	33.5	1.53	5.7	3.0	1.3		
S76FL-073-003-4	28-44	C3	0.2	3.7	27.8	49.5	14.5	95.7	1.9	2.4	34.2	1.58	4.7	2.5	0.9		
S76FL-073-003-5	44-58	C4	0.2	4.2	28.0	49.9	14.2	96.5	1.9	1.6	35.5	1.52	4.0	2.2	0.7		
S76FL-073-003-6	58-72	C5	0.2	4.0	27.8	50.2	14.8	97.0	2.0	1.0	33.5	1.51	5.1	2.7	0.6		
S76FL-073-003-7	72-96	C6	0.1	2.9	23.7	54.5	17.1	98.3	1.1	0.6	30.9	1.51	3.5	1.8	0.4		

TABLE 17.--PHYSICAL PROPERTIES OF SELECTED SOILS--Continued

Soil series and sample number	Depth	Horizon	Particle size distribution										Hydraulic conductivity Cm/hr	Bulk density (field moist) Grams/cm	Water content		
			Sand			Silt			Clay (<0.002 mm)	Total ($2-0.05$ mm)	Very fine ($0.1-0.05$ mm)	Percent			1/10 bar	1/3 bar	15 bar
			Very coarse ($2-1$ mm)	Coarse ($1-0.5$ mm)	Medium ($0.25-0.075$ mm)	Fine ($0.25-0.075$ mm)	Very fine ($0.075-0.025$ mm)	Silt ($0.05-0.002$ mm)									
<u>In</u>																	
Pelham fine sand:																	
S77FL-073-029-1	0-5	A1	0.0	0.9	7.7	57.7	22.4	88.7	5.4	5.9	10.5	1.09	32.0	24.7	8.8		
S77FL-073-029-2	5-12	A21	0.0	1.0	8.0	61.3	19.1	89.4	7.2	3.4	3.3	1.55	14.6	9.4	3.0		
S77FL-073-029-3	12-21	A22	0.1	0.9	8.1	61.1	20.9	91.1	5.9	3.0	12.5	1.59	10.9	6.2	2.0		
S77FL-073-029-4	21-26	A23	0.0	1.0	9.6	57.8	23.0	91.4	6.2	2.4	14.8	1.61	8.7	4.7	1.2		
S77FL-073-029-5	26-32	B21tg	0.0	0.6	5.8	40.8	19.4	66.6	6.7	26.7	0.9	1.75	16.6	16.9	12.3		
S77FL-073-029-6	32-54	B22tg	0.0	0.6	5.2	41.4	20.6	67.8	0.0	32.2	0.4	1.70	14.9	16.0	10.4		
S77FL-073-029-7	54-80	B22tg	0.0	0.4	4.8	41.4	20.8	67.4	4.2	28.4	0.1	1.74	17.9	16.7	11.7		
Plummer fine sand:																	
S76FL-073-010-1	0-6	A11	0.1	2.3	18.3	55.1	14.3	90.1	6.8	3.1	7.0	1.29	32.0	30.4	26.7		
S76FL-073-010-2	6-17	A12	0.0	2.5	19.9	55.2	13.2	90.8	6.1	3.1	9.7	1.60	7.2	4.7	1.5		
S76FL-073-010-3	17-28	A21g	0.0	2.7	21.2	52.0	12.6	88.5	6.3	5.2	8.7	1.78	8.4	5.4	2.0		
S76FL-073-010-4	28-36	A22tg	0.1	2.4	20.3	53.5	13.1	89.4	6.0	4.6	8.4	1.69	10.3	6.3	2.6		
S76FL-073-010-5	36-60	A23tg	0.1	2.7	20.3	55.9	14.3	93.3	4.9	1.8	8.1	1.74	6.4	3.2	0.7		
S76FL-073-010-6	60-61	A23tg	0.1	2.7	20.3	53.2	13.0	89.3	4.8	5.9	---	---	---	---	---		
S76FL-073-010-7	61-80	B2tg	0.0	2.4	17.6	47.8	12.1	79.9	4.5	15.6	0.2	1.86	13.1	9.7	5.9		
Rutlege loamy fine sand:																	
S77FL-073-014-1	0-5	A11	0.7	5.2	18.3	45.9	15.5	85.6	10.3	4.1	---	---	---	---	---		
S77FL-073-014-2	5-23	A12	0.7	5.6	19.2	45.8	16.0	87.3	9.1	3.6	14.7	1.37	14.8	9.9	3.6		
S77FL-073-014-3	23-32	C1	0.7	6.4	20.0	46.9	15.4	89.4	7.0	3.6	11.5	1.46	11.8	8.2	3.0		
S77FL-073-014-4	32-57	C2	1.1	6.0	17.5	48.4	15.7	88.7	5.7	5.6	5.5	1.67	13.3	10.5	2.8		
S77FL-073-014-5	57-62	C3	1.2	6.7	17.6	48.9	15.9	90.3	5.1	4.6	---	---	---	---	---		
S77FL-073-014-6	62-82	C4	0.9	5.2	17.3	53.0	17.2	93.6	4.0	2.4	---	---	---	---	---		
Sapelo fine sand:																	
S77FL-073-018-1	0-6	Ap	0.2	2.6	11.1	53.4	24.0	91.3	7.1	1.6	21.4	1.31	11.2	6.7	2.4		
S77FL-073-018-2	6-14	A2	0.2	3.0	11.3	51.7	26.4	92.6	6.7	0.7	14.4	1.44	7.1	3.2	1.2		
S77FL-073-018-3	14-16	B21h	0.2	2.4	10.8	48.7	24.3	86.4	8.1	5.5	8.8	1.33	15.1	11.5	5.5		
S77FL-073-018-4	16-22	B22h	0.3	2.7	11.3	50.0	23.1	87.4	7.8	4.8	27.8	1.58	10.6	6.4	1.8		
S77FL-073-018-5	22-26	B3	0.2	2.7	10.9	51.4	24.5	89.7	7.2	3.1	6.9	1.62	9.3	5.2	2.4		
S77FL-073-018-6	26-33	A'21	0.5	3.5	11.5	50.3	26.2	92.0	5.4	2.6	6.2	1.59	13.4	8.9	2.9		
S77FL-073-018-7	33-40	A'22	0.4	3.7	12.5	49.8	24.7	91.1	5.6	3.3	8.4	1.51	20.4	14.8	4.3		
S77FL-073-018-8	40-43	A'22	0.3	3.0	11.8	50.6	23.4	89.1	8.5	2.4	4.5	1.65	12.1	7.6	3.3		
S77FL-073-018-9	43-80	B'2tg	0.4	3.7	12.2	44.2	19.3	79.8	6.0	14.2	0.3	1.86	13.1	10.6	6.0		
Talquin fine sand:																	
S77FL-073-021-1	0-10	Ap	0.0	0.2	1.5	69.2	26.2	97.1	2.5	0.4	19.5	1.38	8.5	3.5	1.9		
S77FL-073-021-2	10-25	A2	0.0	0.2	1.5	63.1	31.9	96.7	2.8	0.5	21.2	1.49	7.9	3.5	1.5		
S77FL-073-021-3	25-27	B21h	0.0	0.2	1.3	51.0	39.9	92.4	5.2	2.4	5.1	1.60	15.7	9.3	2.7		
S77FL-073-021-4	27-37	B22h	0.0	0.2	1.3	54.5	40.1	96.1	2.7	1.2	15.4	1.63	13.8	5.6	1.4		
S77FL-073-021-5	37-80	C	0.0	0.3	1.5	61.7	35.2	98.7	0.6	0.7	19.0	1.60	9.9	4.0	0.9		

APPENDIX E
INFILTRATION DATA

**GRAINSIZE ESTIMATION
CURVES
(INSTALLED FOR THIS STUDY)**

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: _____ DATE: 12/15/2009
 BORING NO.: BR-1 DEPTH: 2.0-2.5 (FEET)
 SOIL DESCRIPTION: BROWN SILTY FINE SAND
 SM A-2-4 (STRATUM A)

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	98
40	0.425	88
100	0.150	40
200	0.075	15

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D_{10} = 0.040 mm
 D_{50} = 0.18 mm
 D_{60} = 0.20 mm
 K = 0.0025 (cm/sec)
 3.5 (in/hr)
 C_u = 5.0

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

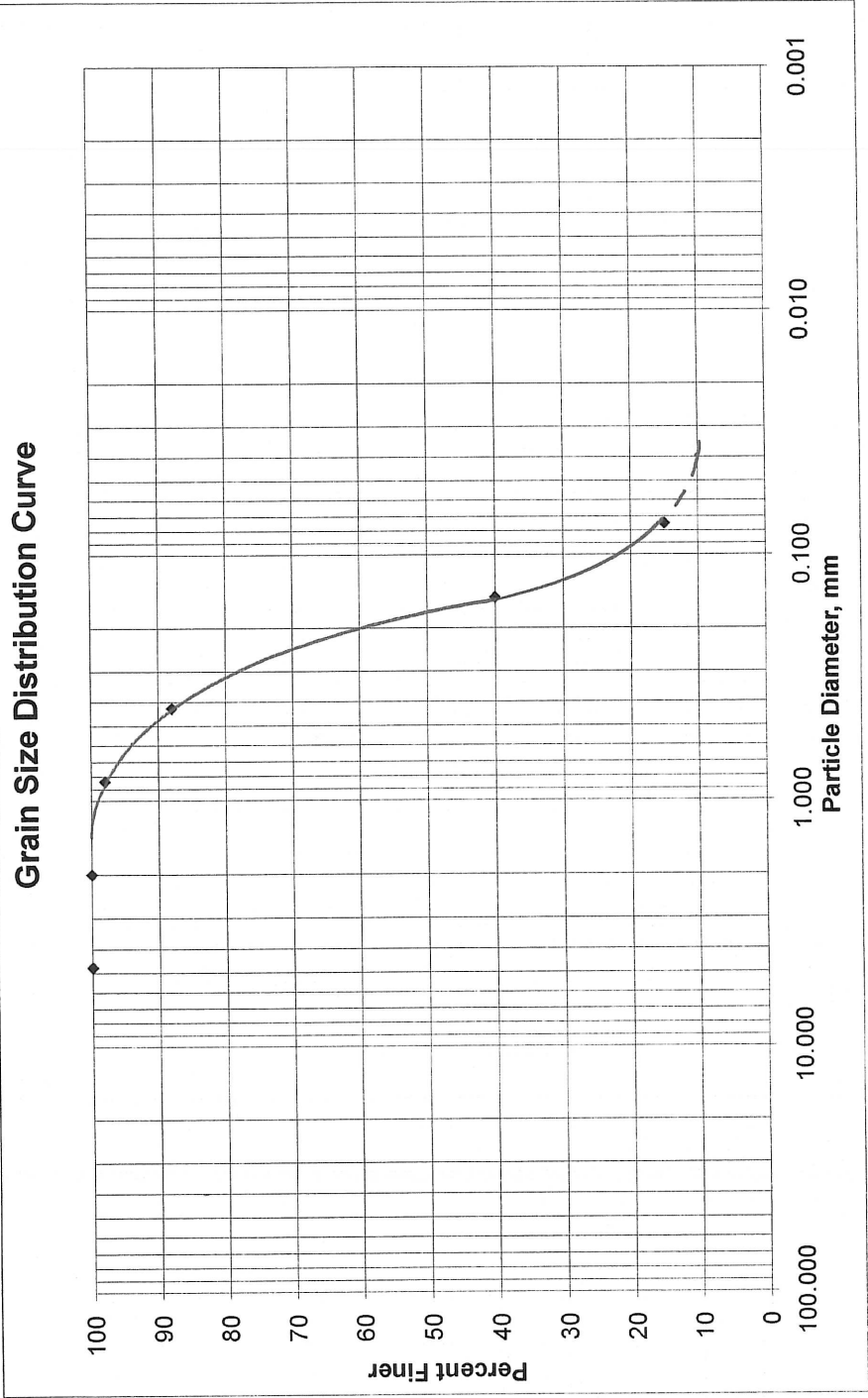
MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009
BORING NO.: BR-1 DEPTH: 2.0-2.5 (FEET)
SOIL DESCRIPTION: BROWN SILTY FINE SAND
SM A-2-4 (STRATUM A)

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009
 BORING NO.: BR-1 DEPTH: 1.0 - 1.5 (FEET)
 SOIL DESCRIPTION: GRAY SILTY FINE SAND
SM A-2-4 (STRATUM A)

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	99
40	0.425	94
100	0.150	57
200	0.075	22

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D₁₀ = 0.030 mm
 D₅₀ = 0.14 mm
 D₆₀ = 0.16 mm
 K = 0.0018 (cm/sec)
2.6 (in/hr)
 C_u = 5.3

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

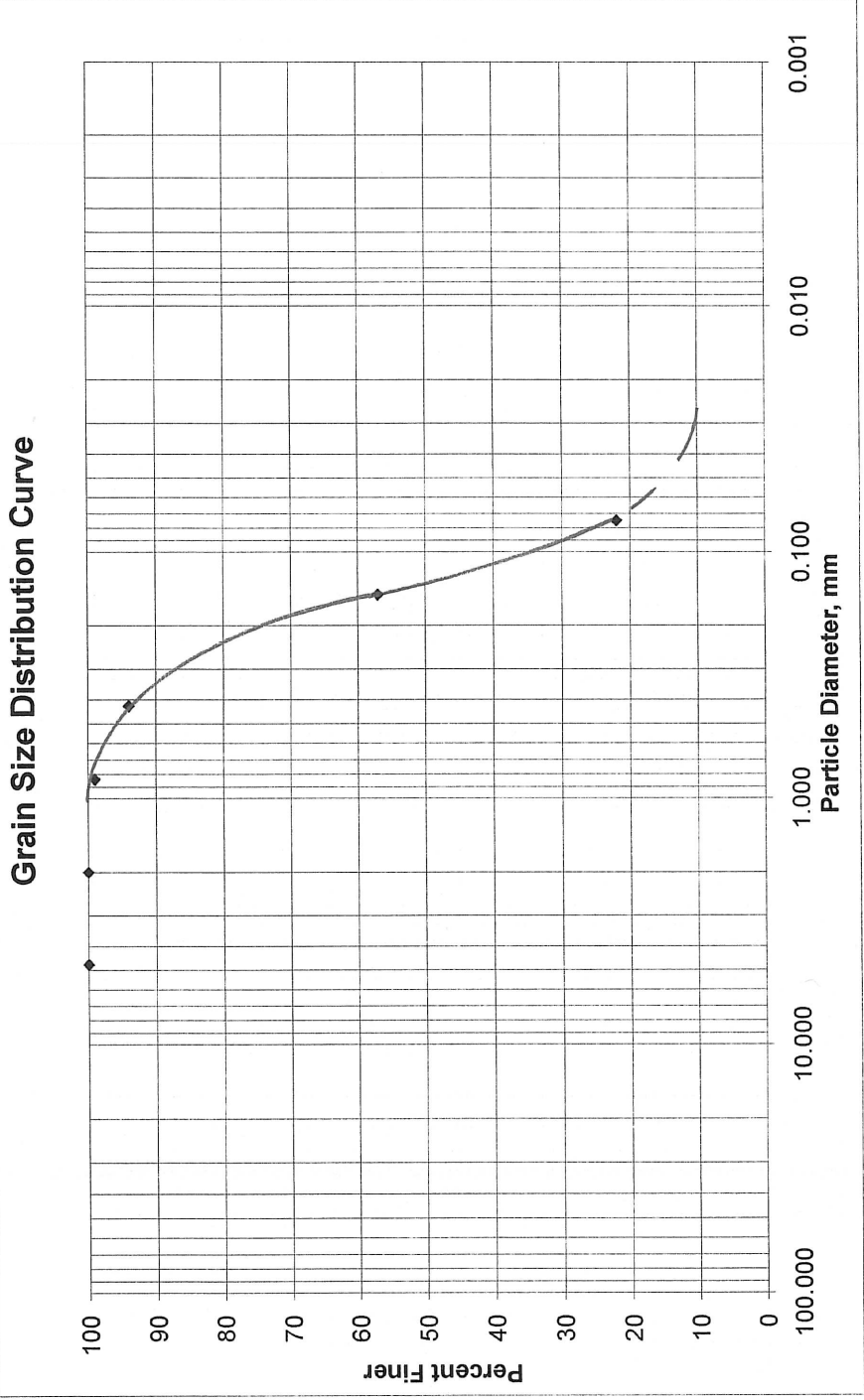
PROJECT NO.: 22-31-09-04 DATE: 12/15/2009

BORING NO.: BR-1 DEPTH: 1.0 - 1.5 (FEET)

SOIL DESCRIPTION: GRAY SILTY FINE SAND
SM/A-2-4 (STRATUM A)

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009
 BORING NO.: BR-1 DEPTH: 8.0-8.5 (FEET)
 SOIL DESCRIPTION: BROWN CLAYEY FINE SAND
 SM A-2-6 (STRATUM B)

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	99
40	0.425	91
100	0.150	53
200	0.075	28

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D_{10} = 0.020 mm
 D_{50} = 0.15 mm
 D_{60} = 0.17 mm
 K = 0.0003 (cm/sec)
 0.4 (in/hr)
 C_u = 8.5

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009

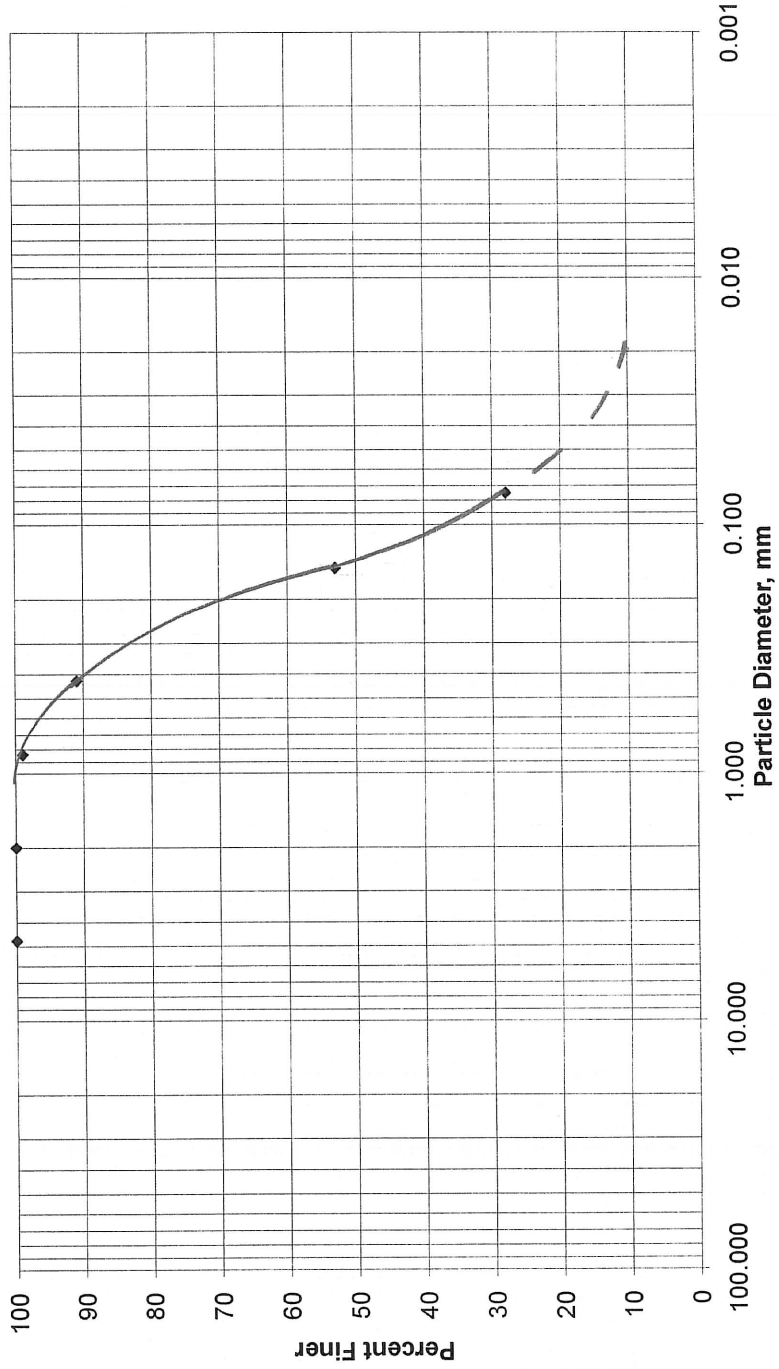
BORING NO.: BR-1 DEPTH: 8.0-8.5 (FEET)

SOIL DESCRIPTION: BROWN CLAYEY FINE SAND
SM A-2-6 (STRATUM B)

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2

Grain Size Distribution Curve



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009
 BORING NO.: BR-2 DEPTH: 8.0-8.5 (FEET)
 SOIL DESCRIPTION: LIGHT BROWN CLAYEY FINE SAND
SM A-2-6 (STRATUM B)

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	99
40	0.425	96
100	0.150	70
200	0.075	21

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D_{10} = 0.025 mm
 D_{50} = 0.11 mm
 D_{60} = 0.13 mm
 K = 0.0006 (cm/sec)
0.9 (in/hr)
 C_u = 5.2

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION

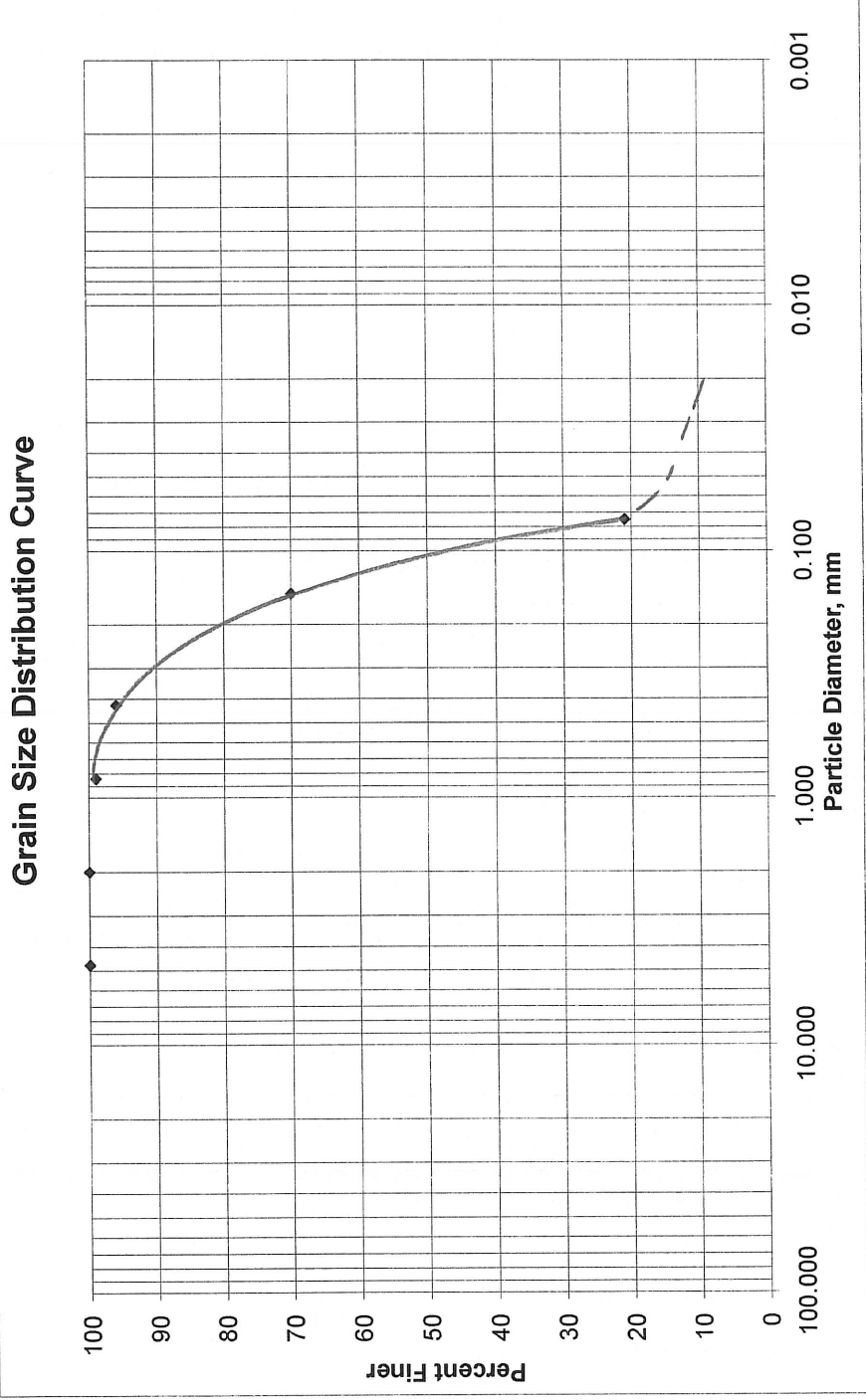
PROJECT NO.: _____ DATE: 12/15/2009

BORING NO.: BR-2 DEPTH: 8.0-8.5 (FEET)

SOIL DESCRIPTION: LIGHT BROWN CLAYEY FINE SAND
SM A-2-6 (STRATUM B)

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: 22-31-09-04 **DATE:** 12/15/2009
BORING NO.: BR-2 **DEPTH:** 1.0-1.5 (FEET)
SOIL DESCRIPTION: BROWN CLAYEY SAND
 SC A-6 (STRATUM C)

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	98
40	0.425	83
100	0.150	48
200	0.075	39

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

$D_{10} =$ < 0.001 mm
 $D_{50} =$ 0.18 mm
 $D_{60} =$ 0.25 mm
 $K =$ < 0.00001 (cm/sec)
 < 0.1 (in/hr)
 $C_u =$ > 10

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

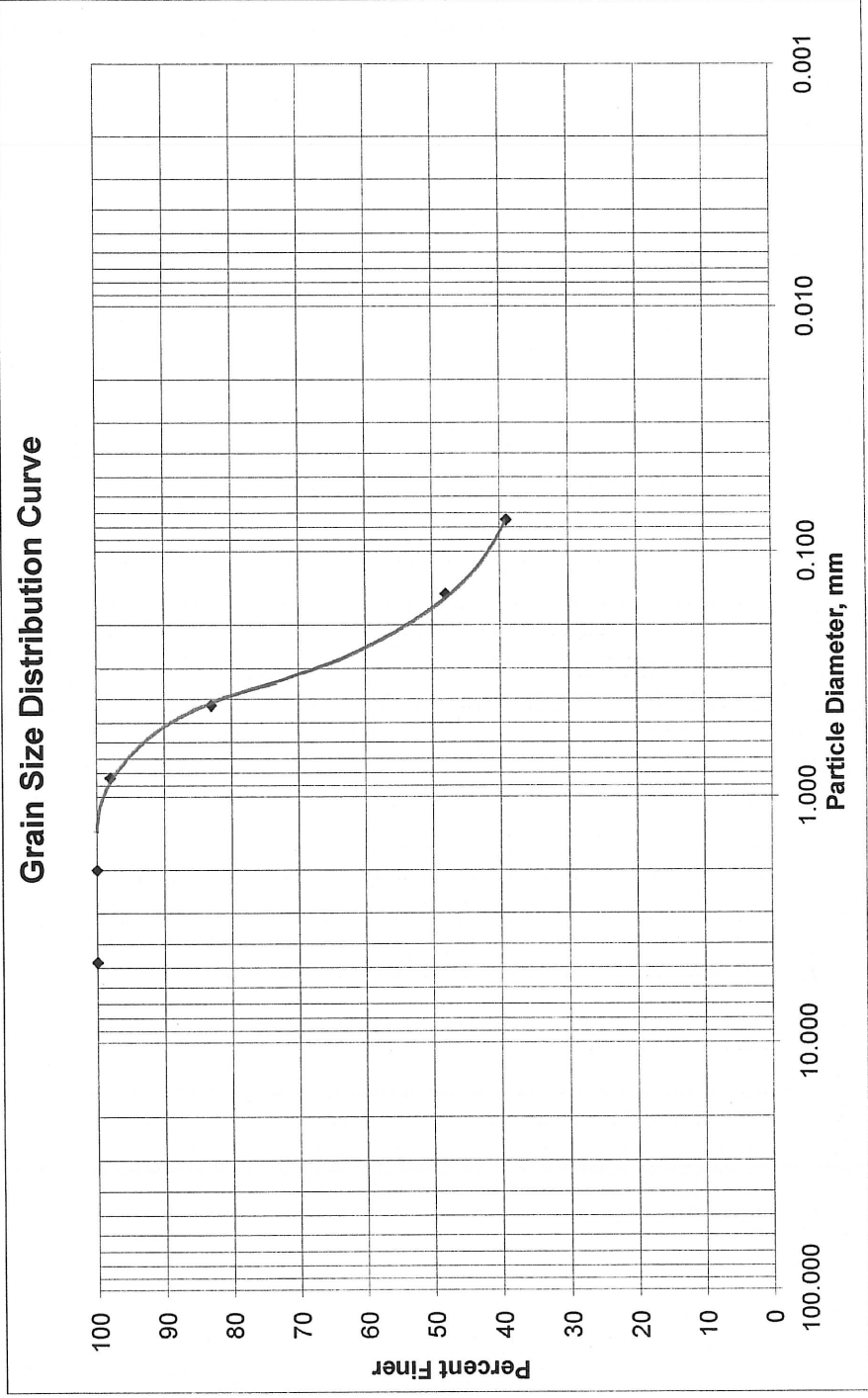
PROJECT NO.: 22-31-09-04 DATE: 12/15/2009

BORING NO.: BR-2 DEPTH: 1.0-1.5 (FEET)

SOIL DESCRIPTION: BROWN CLAYEY SAND
SC A-6 (STRATUM C)

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D11140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009
 BORING NO.: BR-2 DEPTH: 2.0-2.5 (FEET)
 SOIL DESCRIPTION: BROWN SANDY CLAY
SC A-6 (STRATUM C)

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	97
40	0.425	72
100	0.150	44
200	0.075	42

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

$D_{10} =$ < 0.001 mm
 $D_{50} =$ 0.25 mm
 $D_{60} =$ 0.35 mm
 $K =$ < 0.0001 (cm/sec)
< 0.1 (in/hr)
 $C_u =$ > 10

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

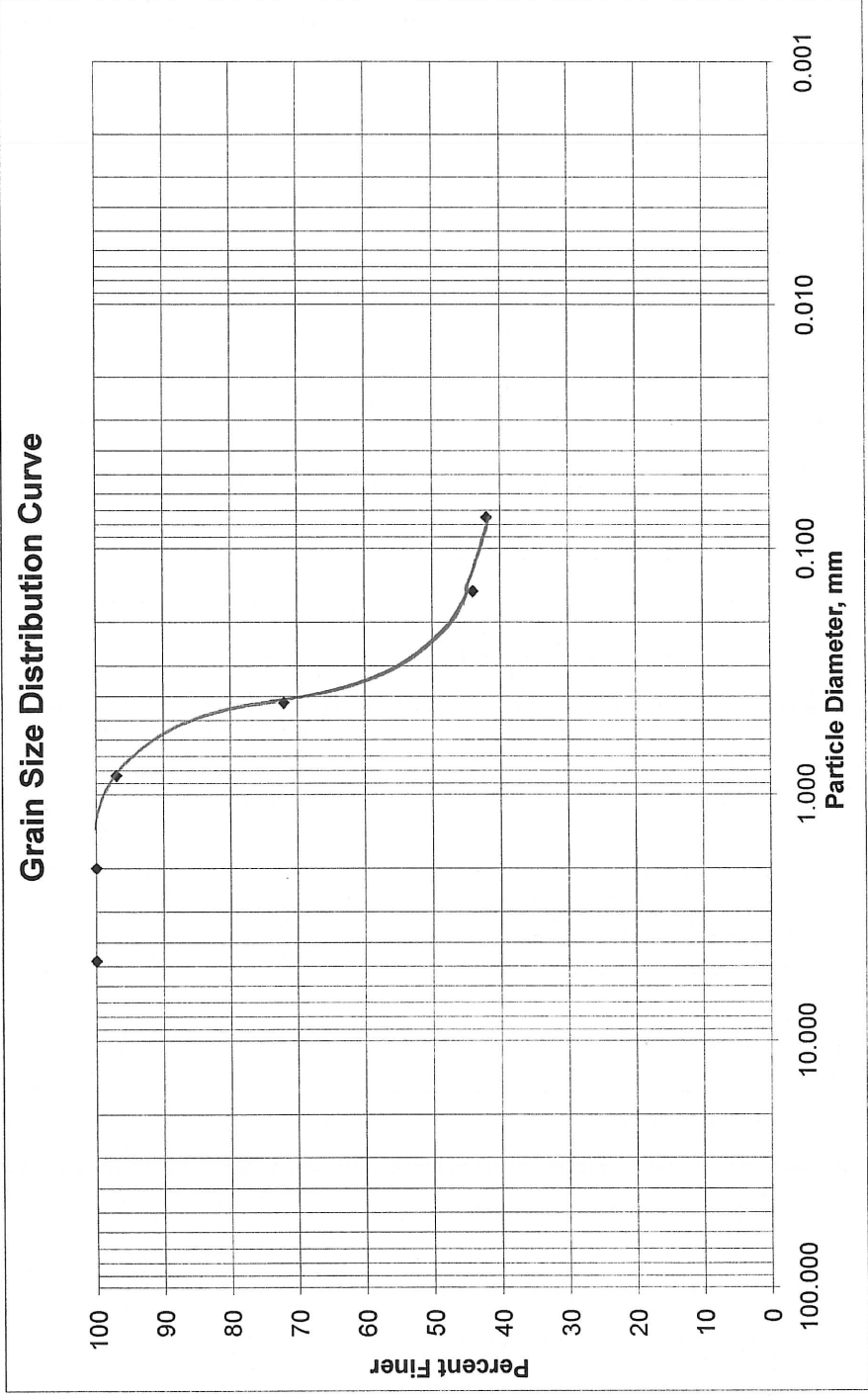
MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

PROJECT NO.: 22-31-09-04 DATE: 12/15/2009
BORING NO.: BR-2 DEPTH: 2.0-2.5 (FEET)
SOIL DESCRIPTION: BROWN SANDY CLAY
SC A-6 (STRATUM C)

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



**GRAINSIZE ESTIMATION
CURVES
(PREVIOUSLY INSTALLED)**

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-1 DEPTH: 7.5 - 9.0 (FEET)
 SOIL DESCRIPTION: BROWN SILTY FINE SAND (SM A-2-4)
STRATUM A

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	91
40	0.425	55
100	0.150	32
200	0.075	22

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

$D_{10} =$ 0.030 mm
 $D_{50} =$ 0.37 mm
 $D_{60} =$ 0.50 mm
 $K =$ 0.0005 (cm/sec)
0.71 (in/hr)
 $C_u =$ 16.7

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

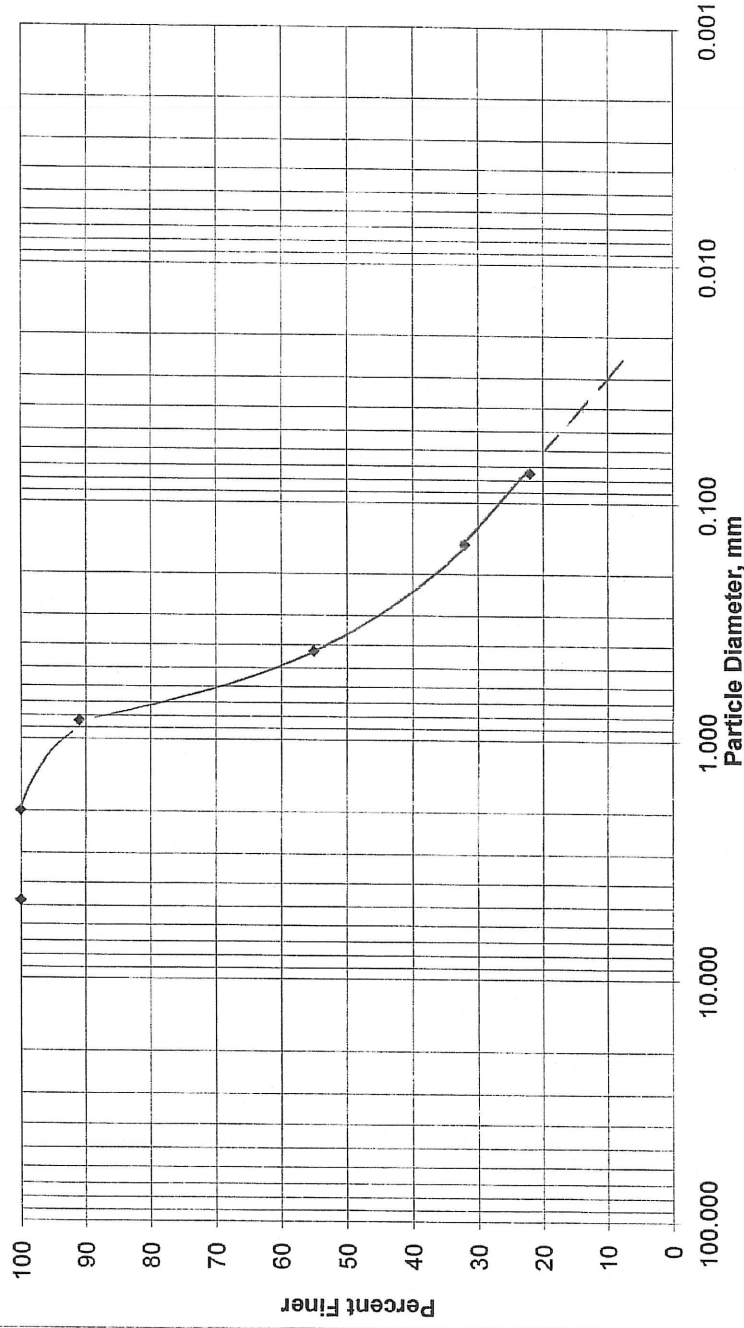
TEST INFORMATION

PROJECT NO.: 22-31-09-03 DATE: 6/29/2009
BORING NO.: BH-2 DEPTH: 7.5 - 9.0 (FEET)
SOIL DESCRIPTION: BROWN SILTY FINE SAND / SM A-2-4
STRATUM A

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2

Grain Size Distribution Curve



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-2 DEPTH: 12.5 - 14.0 (FEET)
 SOIL DESCRIPTION: BROWN SILTY FINE SAND / SM A-2-4
STRATUM A

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	100
40	0.425	80
100	0.150	39
200	0.075	21

NOTE: THE FOLLOWING VALUES
 ARE ESTIMATED FROM THE
 GRAIN-SIZE DATA

D₁₀ = 0.043 mm
 D₅₀ = 0.20 mm
 D₆₀ = 0.27 mm
 K = 0.0012 (cm/sec)
1.7 (in/hr)
 C_u = 6.3

Where:
 K = Coefficient of Permeability
 C_u = Coefficient of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

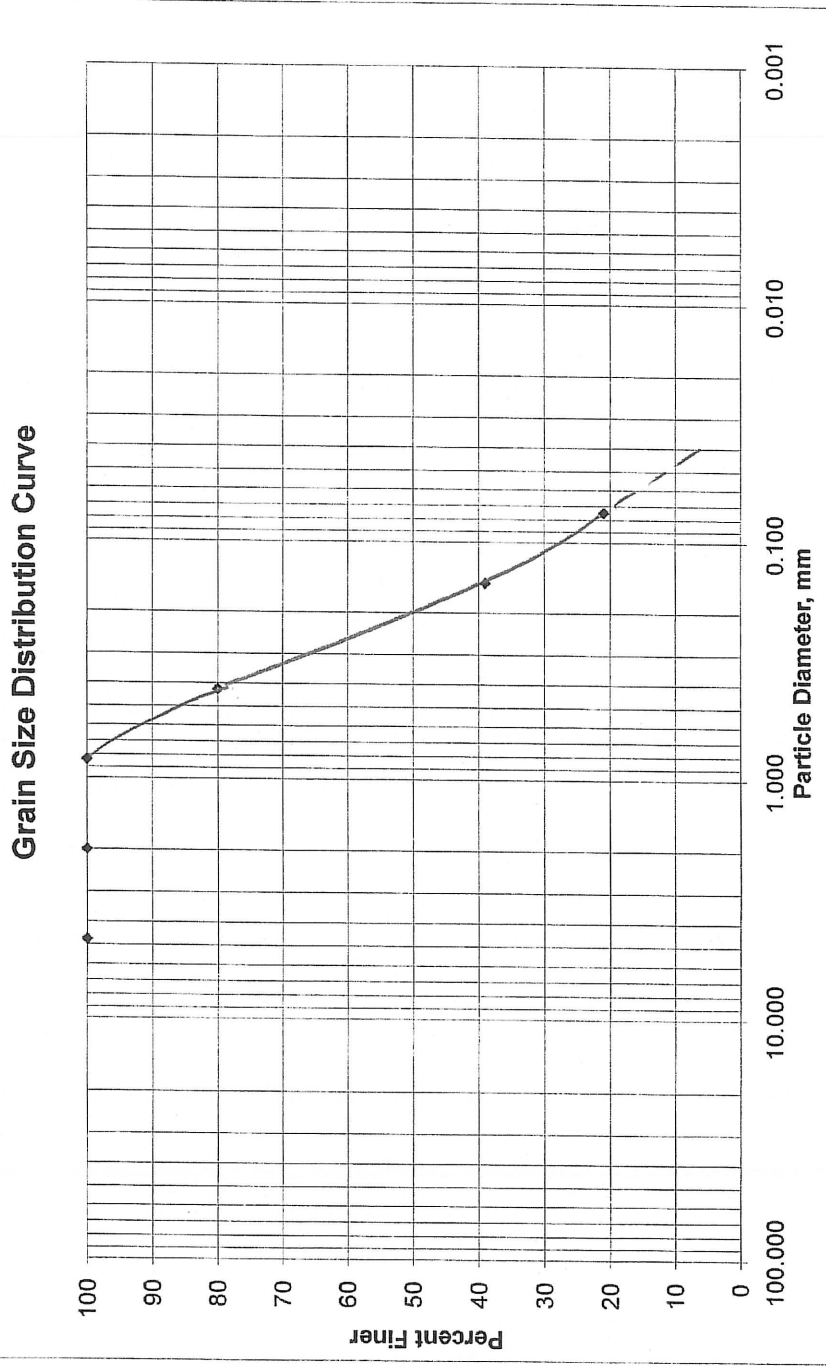
PROJECT NO.: 22-31-09-02 DATE: 7/7/2009

BORING NO.: BHP-2 DEPTH: 12.5 - 14.0 (FEET)

SOIL DESCRIPTION: BROWN SILTY FINE SAND / SM A-2-4
STRATUM A

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
BORING NO.: BHP-2 DEPTH: 37.5 - 39.0 (FEET)
SOIL DESCRIPTION: BROWN SILTY FINE SAND (SM A-2-4)
STRATUM A

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	93
40	0.425	80
100	0.150	43
200	0.075	24

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D₁₀ = 0.040 mm
D₅₀ = 0.20 mm
D₆₀ = 0.25 mm
K = 0.0010 (cm/sec)
1.42 (in/hr)
C_u = 6.3

Where:
K = Coefficient of Permeability
C_u = Coefficient of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

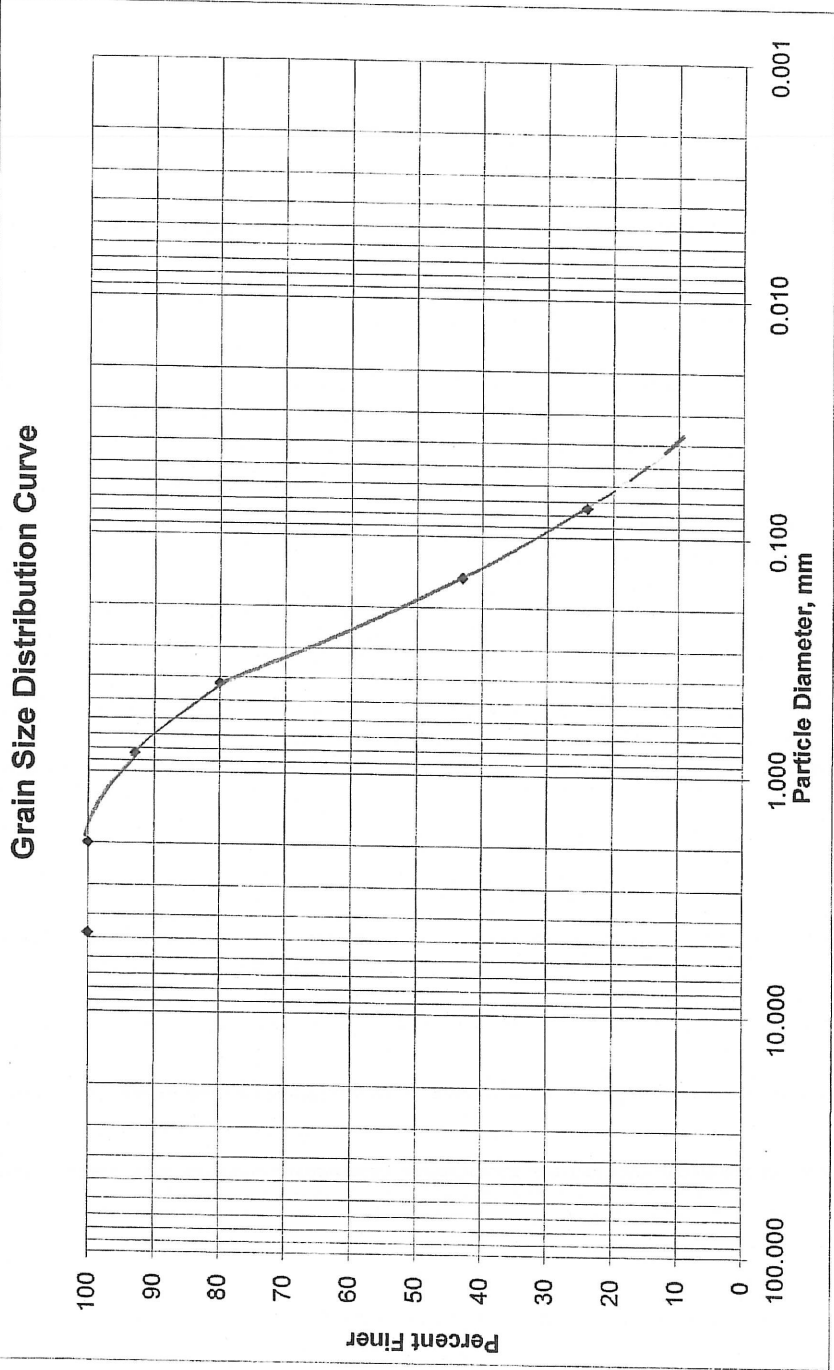
PROJECT NO.: 22-31-09-03 DATE: 6/29/2009

BORING NO: BHP-2 DEPTH: 37.5 - 39.0 (FEET)

SOIL DESCRIPTION: BROWN SILTY FINE SAND / SM A-2-4
STRATUM A

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-1 DEPTH: 30.0 - 31.5 (FEET)
 SOIL DESCRIPTION: BROWN AND GRAY CLAYEY FINE SAND / SM A-2-6
 STRATUM B

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	98
40	0.425	89
100	0.150	57
200	0.075	36

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D₁₀ = 0.025 mm
 D₆₀ = 0.12 mm
 D₈₀ = 0.16 mm
 K = 0.0004 (cm/sec)
 0.6 (in/hr)
 C_u = 6.4

Where:
 K = Coefficient of Permeability
 C_u = Coefficient of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009

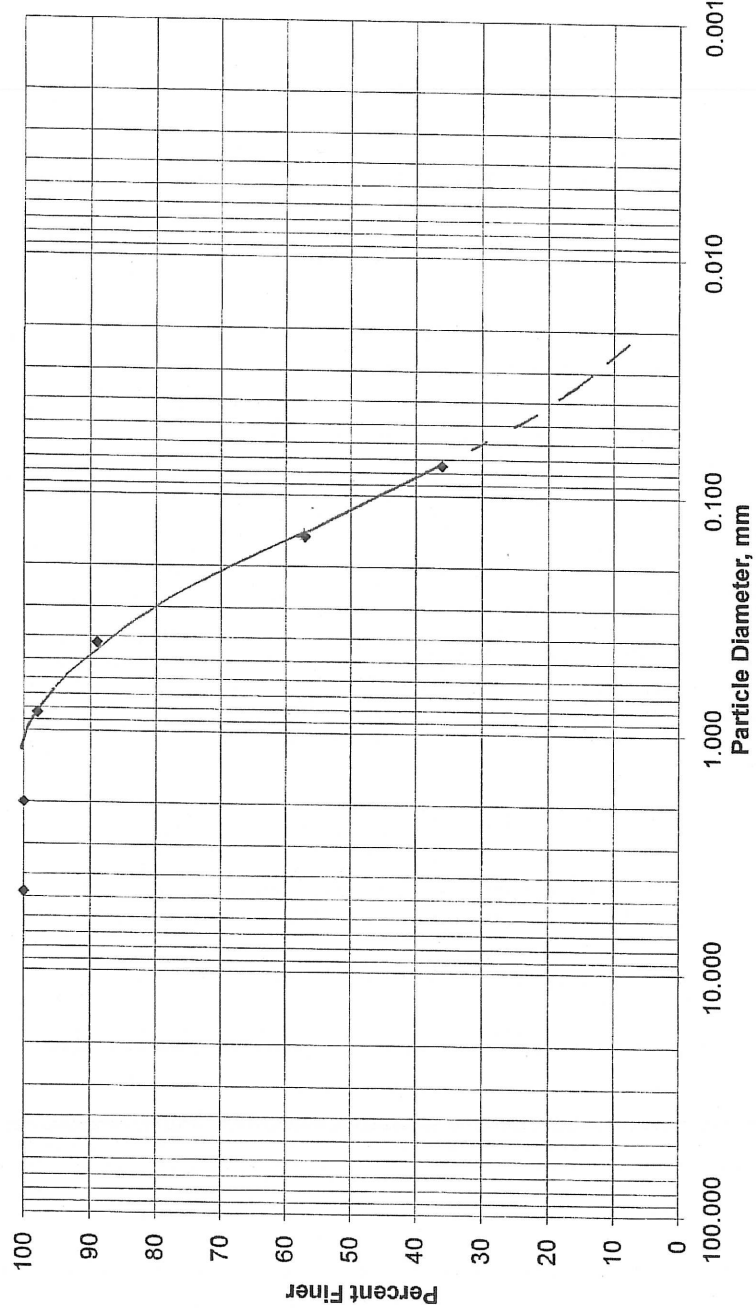
BORING NO.: BHP-1 DEPTH: 30.0 - 31.5 (FEET)

SOIL DESCRIPTION: BROWN AND GRAY CLAYEY FINE SAND / SM A-2-6
STRATUM B

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2

Grain Size Distribution Curve



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: _____ DATE: 7/7/2009
 BORING NO.: BHP-2 DEPTH: 22.5 - 24.0 (FEET)
 SOIL DESCRIPTION: BROWN AND GRAY CLAYEY SAND (SC A-6)
STRATUM C

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	100
40	0.425	95
100	0.150	58
200	0.075	40

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

$D_{10} = 0.015$ mm
 $D_{50} = 0.09$ mm
 $D_{60} = 0.11$ mm
 $K = 0.0001$ (cm/sec)
 0.1 (in/hr)
 $C_u = 7.3$

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION

PROJECT NO.: _____ DATE: 7/7/2009

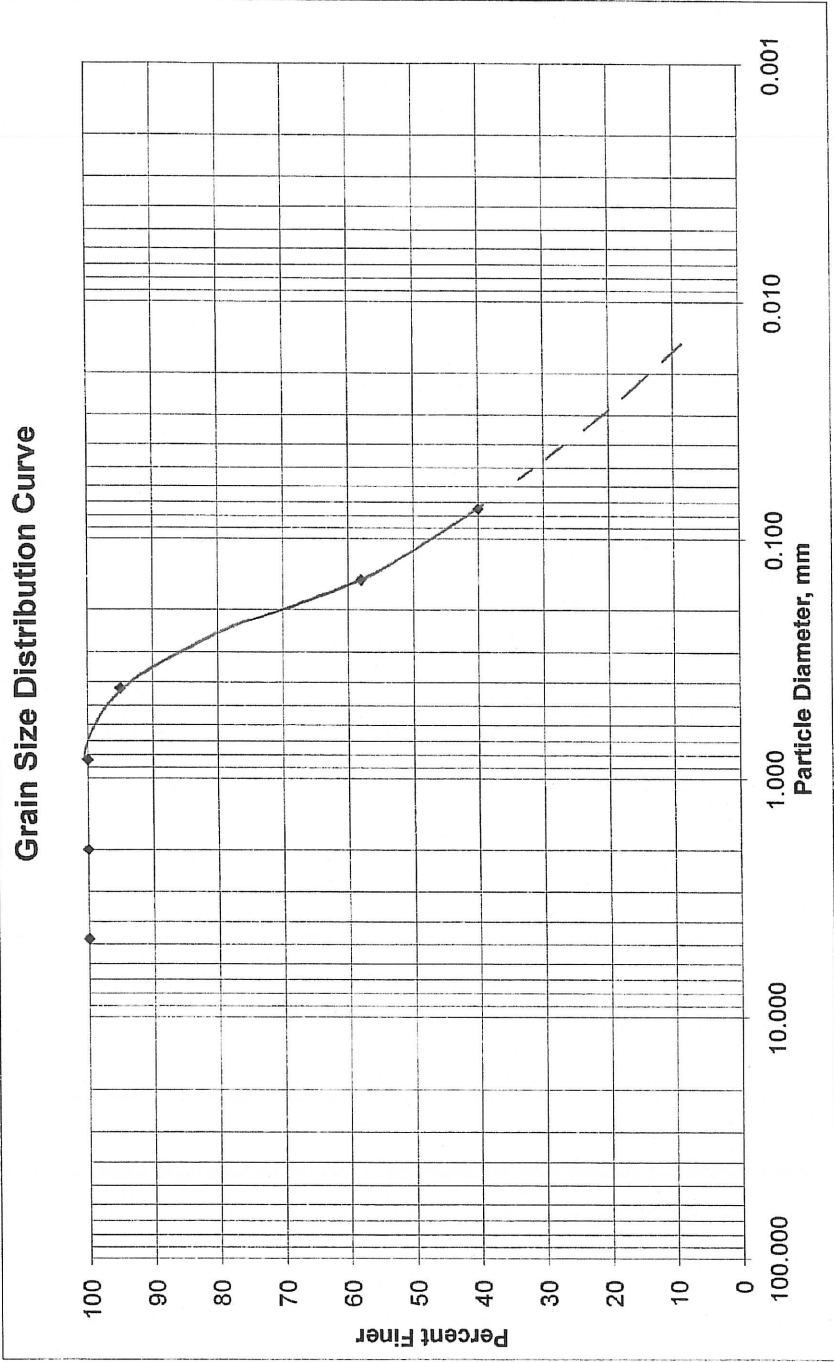
22-31-09-02

BORING NO: BHP-2 DEPTH: 22.5 - 24.0 (FEET)

SOIL DESCRIPTION: BROWN AND GRAY CLAYEY SAND (SC A-6)
STRATUM C

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-1 DEPTH: 40.0 - 41.5 (FEET)
 SOIL DESCRIPTION: BROWN AND GRAY VERY SANDY CLAY (CL A-6)
STRATUM D

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	99
40	0.425	92
100	0.150	64
200	0.075	54

NOTE: THE FOLLOWING VALUES
 ARE ESTIMATED FROM THE
 GRAIN-SIZE DATA

$D_{10} =$ < 0.01 mm
 $D_{50} =$ 0.06 mm
 $D_{60} =$ 0.13 mm
 $K =$ < 0.0001 (cm/sec)
< 0.1 (in/hr)
 $C_u =$ > 13

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION

PROJECT NO.: 22-31-09-02 **DATE:** 7/7/2009

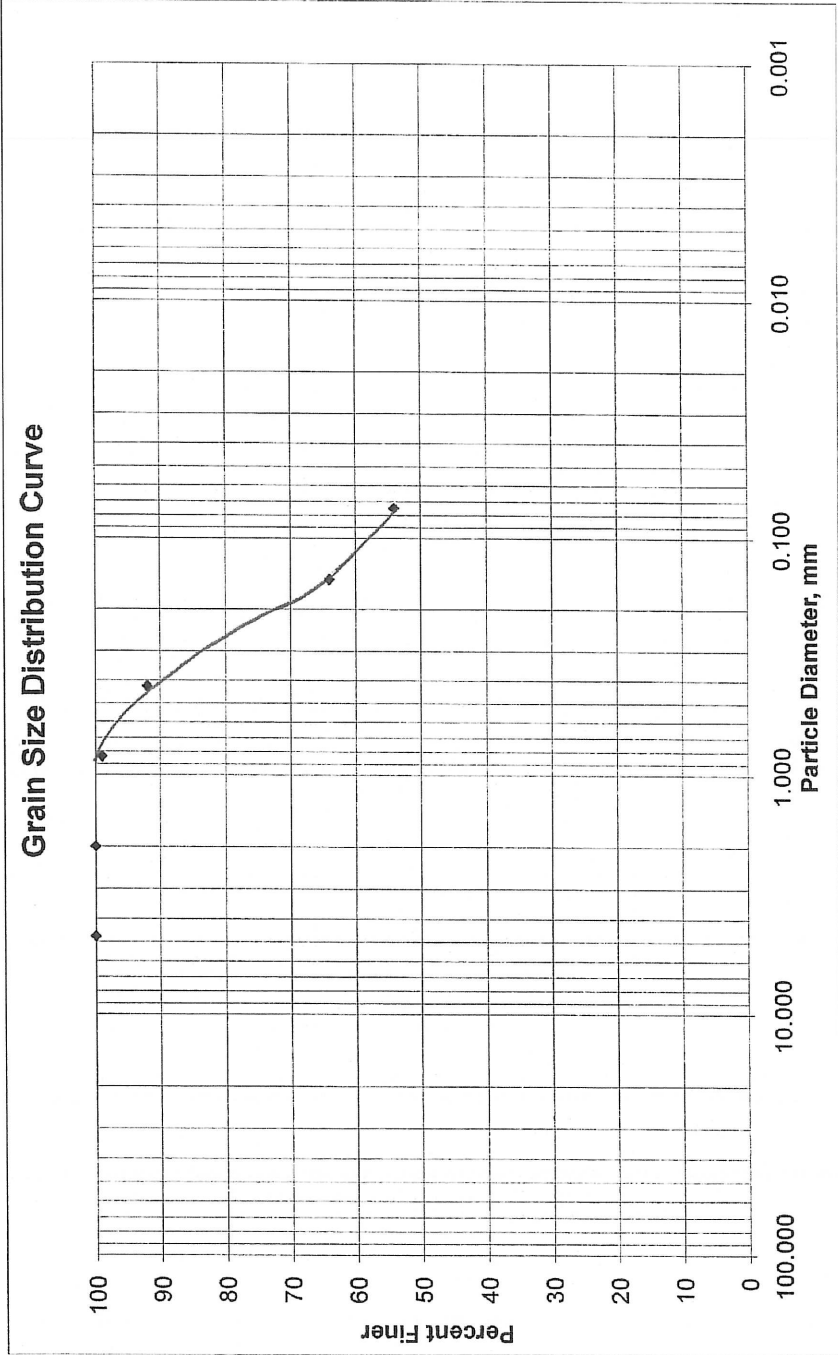
BORING NO.: BHP-1 **DEPTH:** 40.0 - 41.5 (FEET)

SOIL DESCRIPTION: BROWN AND GRAY VERY SANDY CLAY (CL A-6)
STRATUM D

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2

Grain Size Distribution Curve



MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-2 DEPTH: 1.0 - 1.5 (FEET)
 SOIL DESCRIPTION: RED VERY SANDY CLAY (CL A-6)
 STRATUM D

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	99
40	0.425	96
100	0.150	73
200	0.075	51

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

$D_{10} =$ < 0.01 mm
 $D_{50} =$ 0.07 mm
 $D_{60} =$ 0.10 mm
 $K =$ < 0.0001 (cm/sec)
 < 0.1 (in/hr)
 $C_u =$ > 10

Where:
 K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009

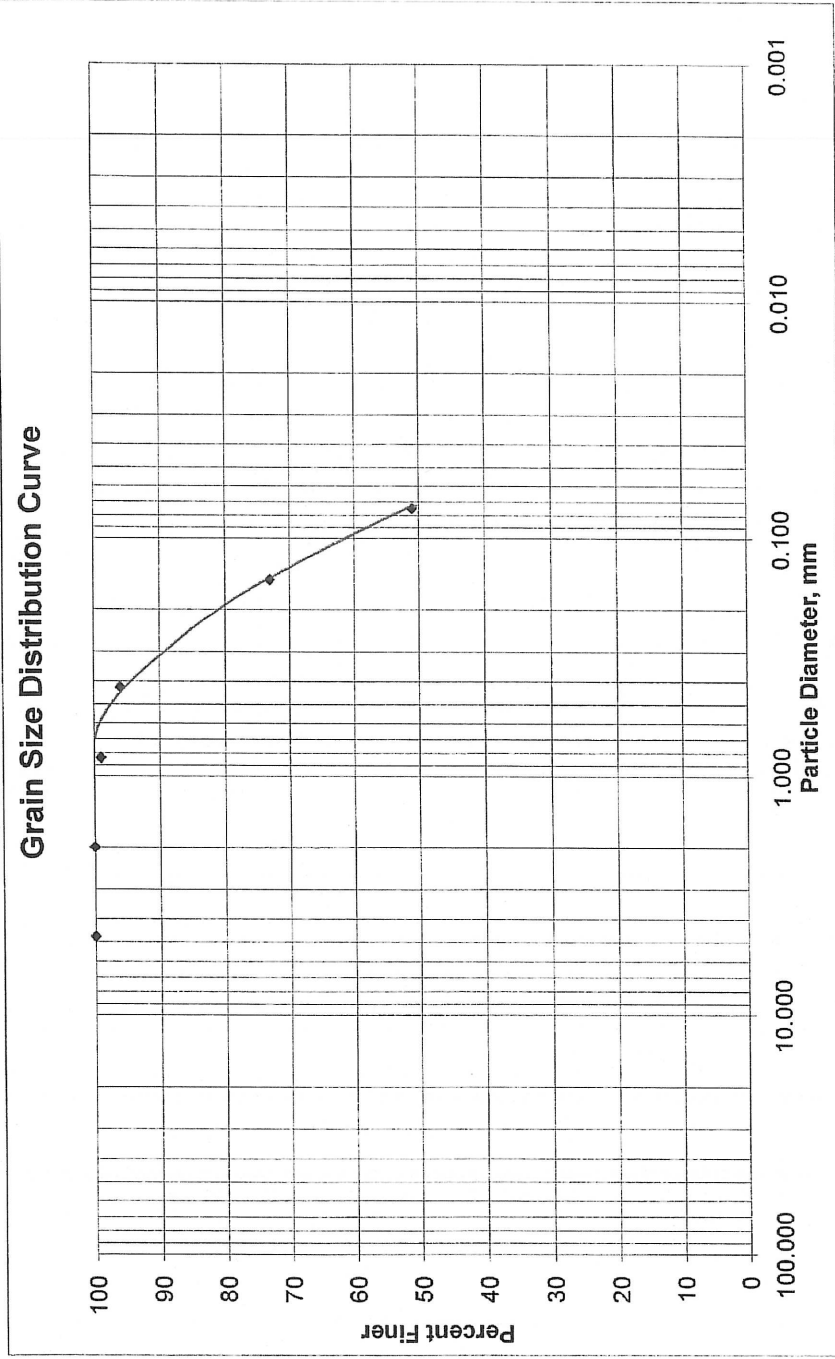
BORING NO.: BHP-2 DEPTH: 1.0 - 1.5 (FEET)

SOIL DESCRIPTION: RED VERY SANDY CLAY (CL A-6)
STRATUM D

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2

Grain Size Distribution Curve



MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-1 DEPTH: 20.0 - 21.5 (FEET)
 SOIL DESCRIPTION: BROWN HIGHLY PLASTIC CLAY (CH A-7-6)
STRATUM E

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	100
40	0.425	100
100	0.150	99
200	0.075	76

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

$D_{10} =$ _____ mm

$D_{50} =$ _____ mm

$D_{60} =$ _____ mm

$K =$ < 0.0001 (cm/sec)

< 0.01 (in/hr)

$C_u =$ _____

Where:

K = Coefficient of Permeability
 C_u = Coefficient Of Uniformity

MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION

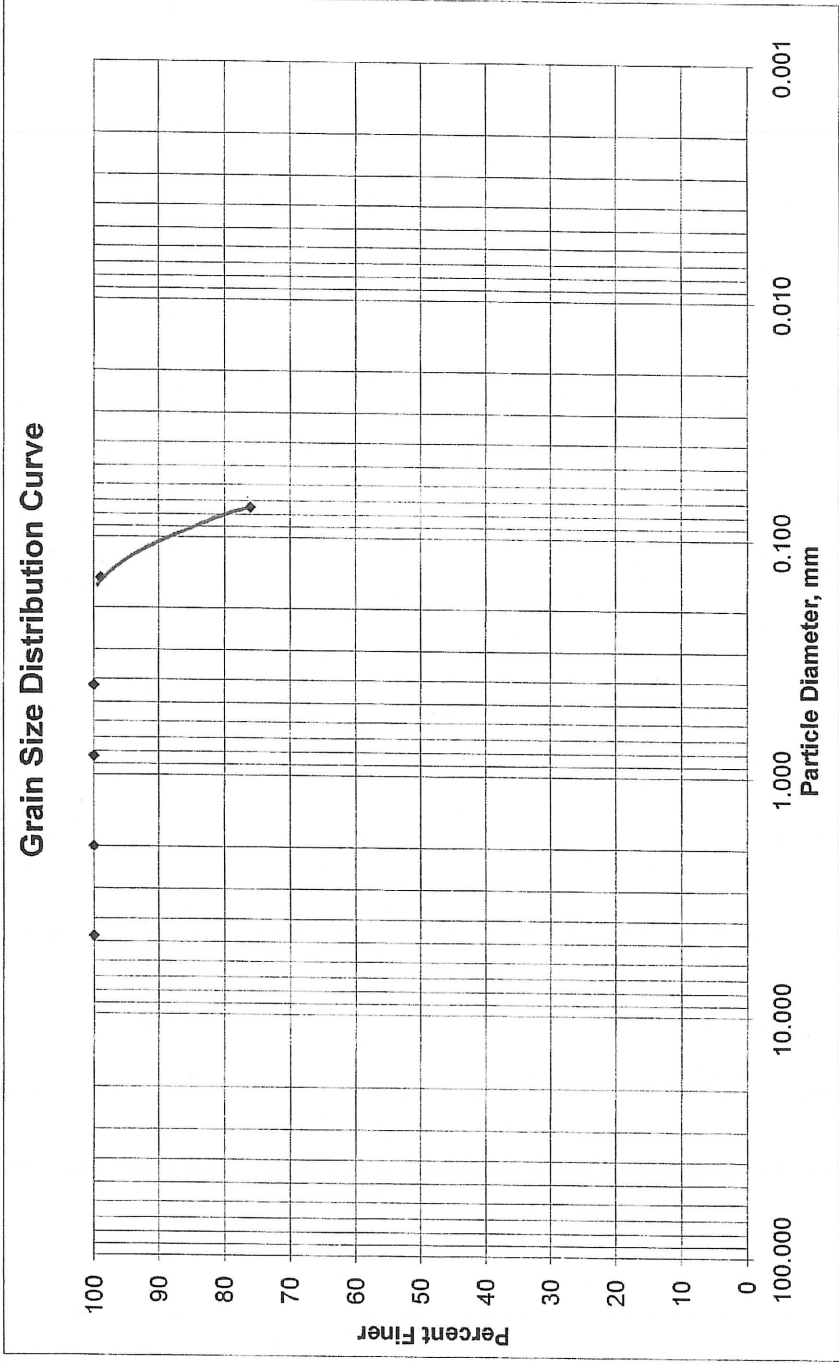
PROJECT NO.: 22-31-09-02 DATE: 7/7/2009

BORING NO.: BHP-1 DEPTH: 20.0 - 21.5 (FEET)

SOIL DESCRIPTION: BROWN HIGHLY PLASTIC CLAY (CH A-7-6)
STRATUM E

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2



MECHANICAL GRAIN-SIZE ANALYSIS (ASTM D1140-54)

TEST INFORMATION:

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009
 BORING NO.: BHP-2 DEPTH: 45.0 - 46.5 (FEET)
 SOIL DESCRIPTION: BROWN AND GRAY HIGHLY PLASTIC CLAY (CH A-7-6)
STRATUM E

PAGE 1 OF 2

TEST RESULTS:

Sieve No.	Diameter (Millimeters)	Percent Passing (%)
4	4.750	100
10	2.000	100
20	0.840	100
40	0.425	99
100	0.150	93
200	0.075	79

NOTE: THE FOLLOWING VALUES ARE ESTIMATED FROM THE GRAIN-SIZE DATA

D_{10} = _____ mm
 D_{50} = _____ mm
 D_{60} = _____ mm
 K = < 0.0001 (cm/sec)
< 0.01 (in/hr)
 C_u = _____

Where:
 K = Coefficient of Permeability
 C_u = Coefficient of Uniformity

**MECHANICAL GRAIN-SIZE ANALYSIS
(ASTM D1140-54)**

TEST INFORMATION

PROJECT NO.: 22-31-09-02 DATE: 7/7/2009

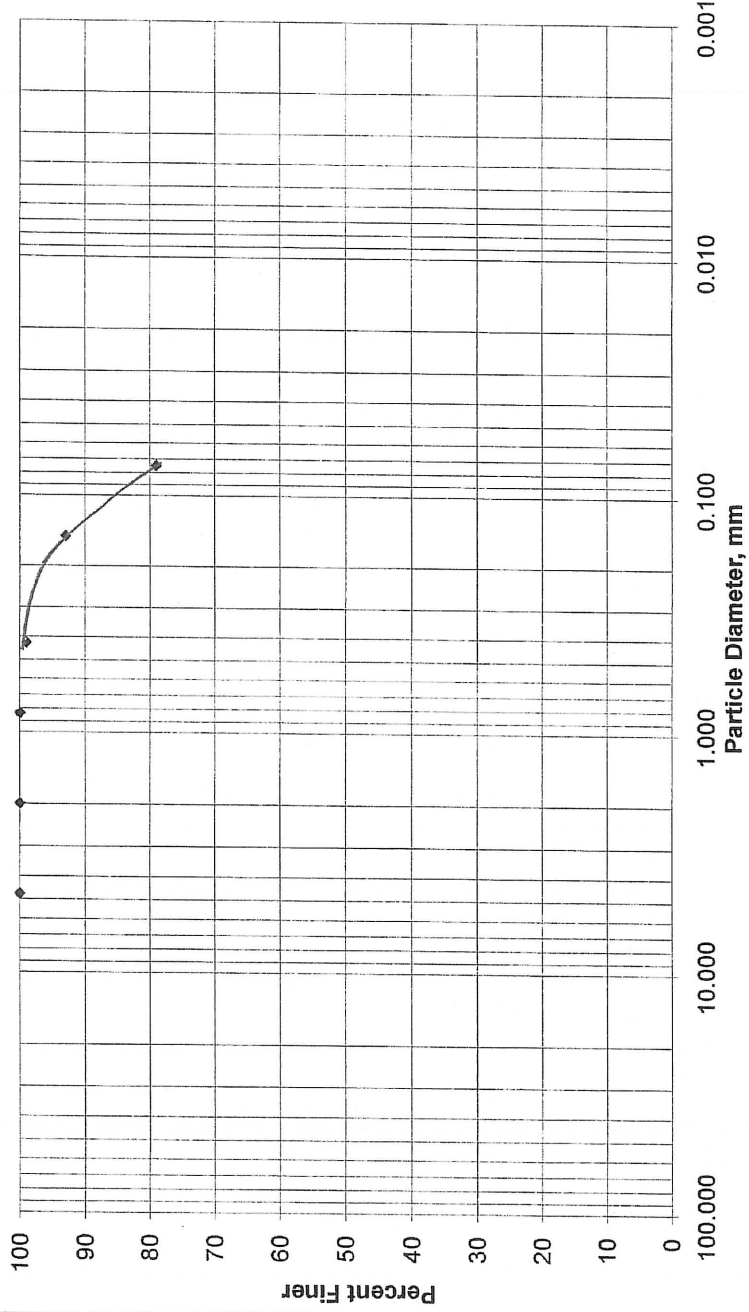
BORING NO.: BHP-2 DEPTH: 45.0 - 46.5 (FEET)

SOIL DESCRIPTION: BROWN AND GRAY HIGHLY PLASTIC CLAY (CH A-7-6)
STRATUM E

GRAPHICAL REPRESENTATION OF TEST RESULTS

PAGE 2 OF 2

Grain Size Distribution Curve



**FIELD INFILTRATION
DATA
(INSTALLED FOR THIS STUDY)**

DATA SHEET
DOUBLE RING INFILTRATION TEST DATA
METHOD ASTM D-3385

TEST IDENTIFICATION:

DATE: 12/7/2009 TIME: 8:15 AM
PROJECT NO: 22-31-09-04 TEST NO: DR-BR-2
DEPTH: 1'6" BELOW SURFACE TESTED BY: R. ROGERS
SOIL DESCRIPTION: BROWN CLAYEY SAND / SC A-6 / STRATUM C
WEATHER CONDITIONS: PARTLY CLOUDY

TEST DATA:

TIME	VOLUME OF WATER ADDED (ML)	HEIGHT OF WATER ADDED (IN)	ELAPSED TIME		INFILTRATION RATE (IN/HR)
			INCREMENT (MIN)	TOTAL (HR)	
8:30 AM	1.02	0.06	15	0.25	0.3
8:45 AM	1.02	0.06	30	0.50	0.3
9:00 AM	1.02	0.06	45	0.75	0.3
9:15 AM	1.02	0.06	60	1.00	0.3
9:30 AM	1.02	0.06	75	1.25	0.3
9:45 AM	1.02	0.06	90	1.50	0.3
10:00 AM	1.02	0.06	105	1.75	0.3
10:15 AM	0.51	0.03	120	2.00	0.1
10:30 AM	0.51	0.03	135	2.25	0.1
10:45 AM	0.51	0.03	150	2.50	0.1
11:00 AM	0.51	0.03	165	2.75	0.1
11:15 AM	0.51	0.03	180	3.00	0.1
11:30 AM	0.51	0.03	195	3.25	0.1
11:45 AM	0.51	0.03	210	3.50	0.1
12:00 PM	0.51	0.03	225	3.75	0.1
12:15 PM	0.51	0.03	240	4.00	0.1

DATA SHEET
DOUBLE RING INFILTRATION TEST DATA
METHOD ASTM D-3385

TEST IDENTIFICATION:

DATE: 12/7/2009 TIME: 8:15 AM
PROJECT NO: 22-31-09-04 TEST NO: DR-BR-1
DEPTH: 1'6" BELOW SURFACE TESTED BY: R. ROGERS
SOIL DESCRIPTION: GRAY SILTY FINE SAND / SM A-2-4 / STRATUM A
WEATHER CONDITIONS: PARTLY CLOUDY

TEST DATA:

TIME	VOLUME OF WATER ADDED (ML)	HEIGHT OF WATER ADDED (IN)	ELAPSED TIME		INFILTRATION RATE (IN/HR)
			INCREMENT (MIN)	TOTAL (HR)	
8:30 AM	16.39	1.00	15	0.25	4.0
8:45 AM	12.29	0.75	30	0.50	3.0
9:00 AM	12.29	0.75	45	0.75	3.0
9:15 AM	12.29	0.75	60	1.00	3.0
9:30 AM	12.29	0.75	75	1.25	3.0
9:45 AM	8.19	0.50	90	1.50	2.0
10:00 AM	8.19	0.50	105	1.75	2.0
10:15 AM	8.19	0.50	120	2.00	2.0
10:30 AM	8.19	0.50	135	2.25	2.0
10:45 AM	8.19	0.50	150	2.50	2.0
11:00 AM	8.19	0.50	165	2.75	2.0
11:15 AM	8.19	0.50	180	3.00	2.0
11:30 AM	8.19	0.50	195	3.25	2.0
11:45 AM	8.19	0.50	210	3.50	2.0
12:00 PM	8.19	0.50	225	3.75	2.0
12:15 PM	8.19	0.50	240	4.00	2.0

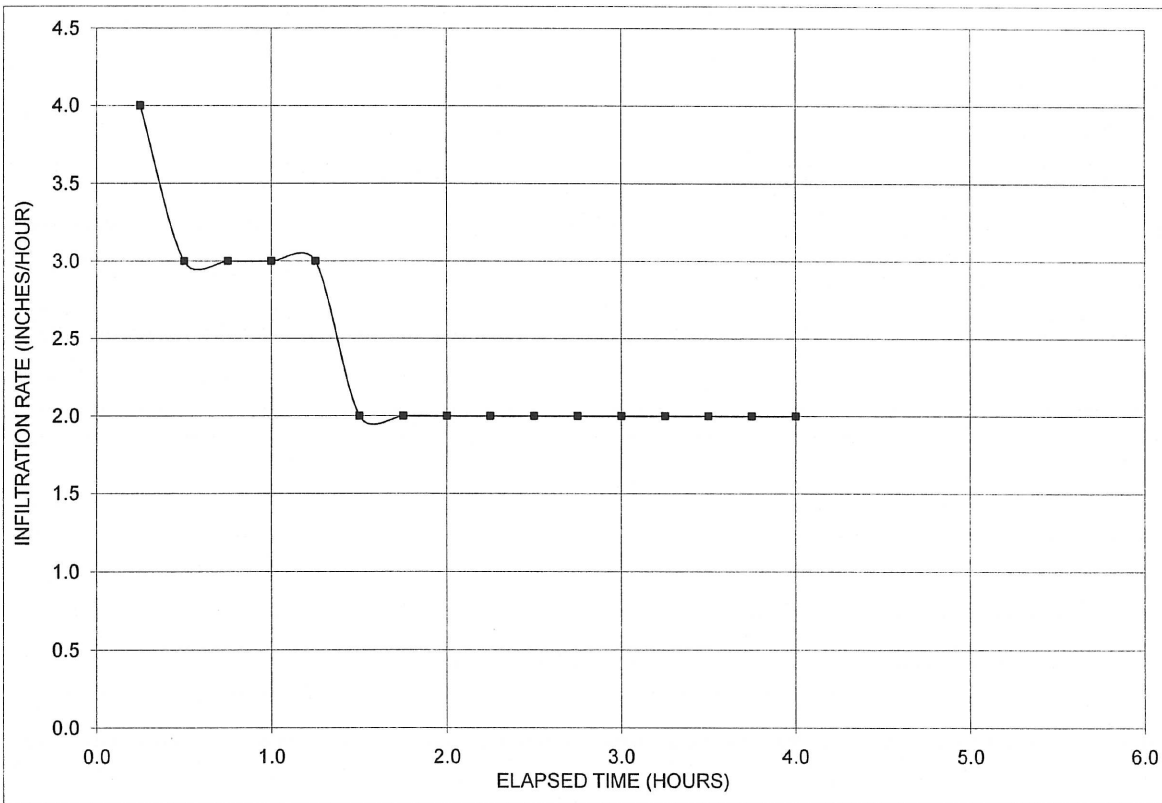
DATA SHEET
DOUBLE RING INFILTRATION TEST DATA
METHOD ASTM D-3385

TEST IDENTIFICATION:

DATE:	<u>12/7/2009</u>	TIME:	<u>8:15 AM</u>
PROJECT NO:	<u>22-31-09-04</u>	TEST NO:	<u>DR-BR-1</u>
DEPTH:	<u>1'6" BELOW SURFACE</u>	TESTED BY:	<u>R. ROGERS</u>
SOIL DESCRIPTION:	<u>GRAY SILTY FINE SAND / SM A-2-4 / STRATUM A</u>		
WEATHER CONDITIONS:	<u>PARTLY CLOUDY</u>		

PAGE 2 of 2

GRAPHICAL PRESENTATION



VERTICAL INFILTRATION RATE FOR LAST HOUR: 2.0 IN/HR

NOTES: RECORDED MEASUREMENTS ARE FOR INNER RING
ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.

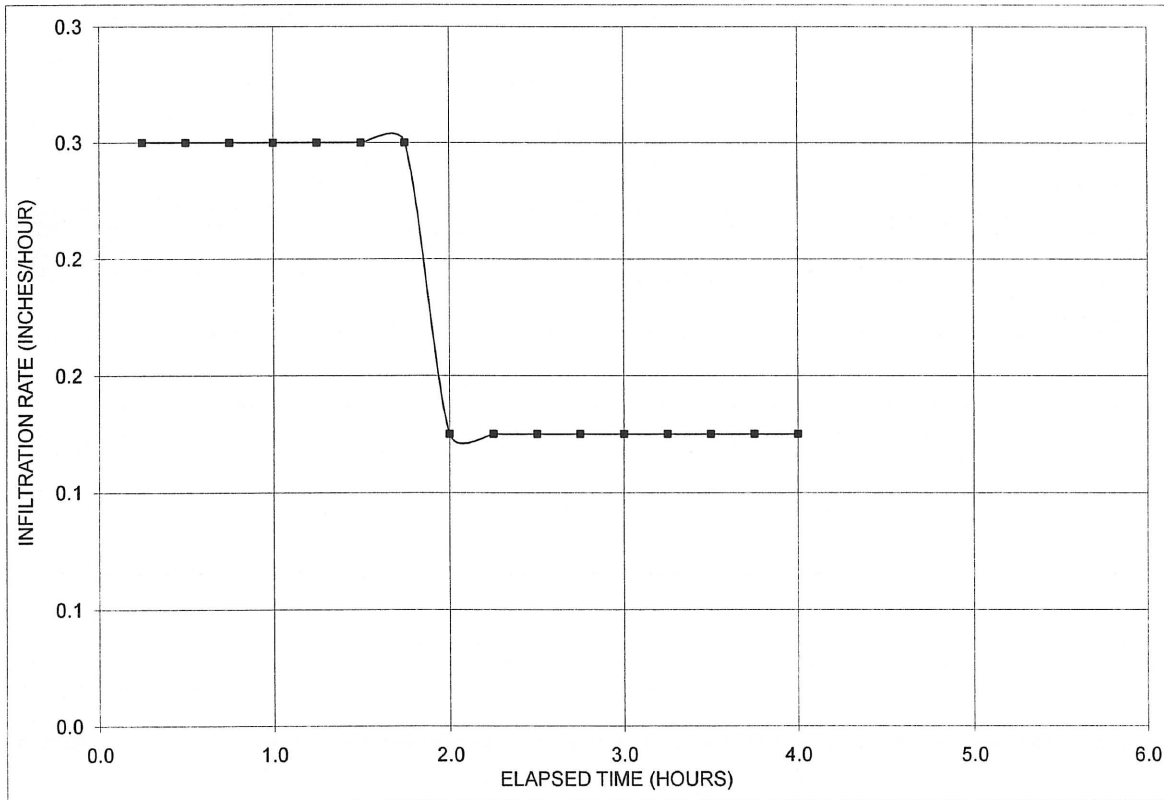
DATA SHEET
DOUBLE RING INFILTRATION TEST DATA
METHOD ASTM D-3385

TEST IDENTIFICATION:

DATE: 12/7/2009 **TIME:** 8:15 AM
PROJECT NO: 22-31-09-04 **TEST NO:** DR-BR-2
DEPTH: 1'6" BELOW SURFACE **TESTED BY:** R. ROGERS
SOIL DESCRIPTION: BROWN CLAYEY SAND / SC A-6 / STRATUM C
WEATHER CONDITIONS: PARTLY CLOUDY

PAGE 2 of 2

GRAPHICAL PRESENTATION



VERTICAL INFILTRATION RATE FOR LAST HOUR: 0.1 IN/HR

NOTES: RECORDED MEASUREMENTS ARE FOR INNER RING
ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.