

Coble's Sandrock, Inc.  
5833 FOSTER STORE ROAD  
LIBERTY, NORTH CAROLINA 27298

**COBLE'S SANDROCK  
CONSTRUCTION AND DEMOLITION LANDFILL  
PERMIT No. 01-05**

**C&D LANDFILL PHASES 1 AND 2  
PARTIAL CLOSURE**

**CONSTRUCTION QUALITY ASSURANCE**



**AUGUST 2013**

**PREPARED BY:**

**JOYCE**  
ENGINEERING

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JEI PROJECT NO. 419.1201.12/TASK 02  
NORTH CAROLINA CORPORATE LIC: C-0782



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August 16, 2013

Mr. Geoff Little, Environmental Engineer II  
North Carolina Department of Environmental and Natural Resources  
Permitting Branch, Solid Waste Section  
1646 Mail Service Center  
Raleigh, NC 27699

RE: Construction Quality Assurance Certification Report  
Coble's Sandrock C&D Landfill, Phases 1 & 2 Partial Closure  
NC DENR Permit #01-05  
Alamance County, North Carolina  
JEI Project 419.1201.12, Task 01

Dear Geof:

This letter is to certify that to the best of my knowledge and belief, the Phases 1 & 2 Partial Closure of the Coble's C&D Landfill has been constructed in conformance with the permitted plans and specifications.

The enclosed certification report presents an accumulation of field, laboratory, and other quality assurance data for the closure construction. It is our understanding that the enclosed construction quality assurance documentation was compiled in accordance with North Carolina Solid Waste Regulations, 15A NCAC 13B and fulfills the submittal requirements listed in the General Permit Conditions (Permit Module I) of Permit 01-05.

On behalf of Cobles C&D Landfill, we would like to thank you in advance for your assistance in reviewing this construction quality assurance certification report.

Sincerely,  
JOYCE ENGINEERING, INC.

Evan Andrews, P.E.  
Regional Manager



Enclosure

Copy: Mr. Kent Coble, w/ enclosure  
Hannu Kemppinen, P.G., w/ enclosure (Joyce Engineering, Inc.)

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## **1.0 INTRODUCTION**

This report, prepared by Joyce Engineering, Inc. (JOYCE) on behalf of Cobles Sandrock, Inc. (Cobles) addresses the quality assurance procedures and activities conducted during partial closure construction of the Phases 1 and 2 at the Cobles C&D landfill in Alamance County, North Carolina. The documents comprising this report were compiled for the C&D landfill closure construction with North Carolina Solid Waste Management Regulations, 15A NCAC 13B and the Phase 3 Permit to Construct # 01-05.

Cobles acted as the General Contractor and performed all closure construction earth work during 2012 and 2013.

JOYCE provided third party construction quality assurance program. Geotechnics assisted JOYCE in the field soil testing and collected samples for soil materials laboratory testing. The soils laboratory testing was conducted at Geotechnics, Inc. in Raleigh, NC.

Michael Stout Surveying of Ramseur, NC provided survey for the partial closure project.

## **2.0 CONSTRUCTION QUALITY ASSURANCE PROGRAM**

### **2.1 Scope of Work**

The overall goals of the CQA program are to ensure that proper construction techniques and methods are employed, and to verify that the earth materials used meet the requirements of the specifications. Moreover, the CQA program helps to identify and define problems that may occur during construction and allow corrective measures to be implemented. At the completion of the closure construction the certifying engineer prepares a certification report to document that the closure work was conducted in accordance with the design standards and specifications.

### **2.2 Roles and Responsibilities**

Cobles retained Joyce Engineering, Inc. to provide construction quality assurance during the landfill partial closure construction. As an independent consultant from the Owner/Contractor, JOYCE, along with the construction field representative Geotechnics provided observation and documentation of the closure earthwork construction. A representative of Geotechnics visited the site regularly to follow the closure work progression by testing each acre-lift in the field and collecting soil samples for laboratory testing. Per the approved CQA Plan, Cobles retained a surveyor to provide periodic survey of the work to establish and maintain lines and grades.

### **2.3 Earthwork**

Cobles began the construction in mid-April 2012 by first grading the west side of the landfill to prepare the surface for closure. The surveyor verified the existing intermediate cover thickness to be a minimum of 12 inches prior to Cobles commencing the construction of low permeability soil layer. The surveyed locations are shown on Drawing 1 – Intermediate Cover.

Following the grading and survey of the intermediate cover thickness Cobles proceeded with low permeability soil or infiltration layer construction. Soil material was tested to identify site soil

suitability for the layer construction and meet the permitted hydraulic conductivity of 1.0E-05 cm/sec. Starting from the south and progressing north along the west side the infiltration layer was constructed in three lifts approximately one acre at a time. The east side closure followed the same sequence. The work was conducted utilizing the landfill heavy equipment; excavator, track loader, compactor, and truck or a pan to deliver the soil to each acre.

### **2.3.1 Infiltration Layer Testing and Results**

Pre-construction soil samples were collected and submitted to laboratory testing for identifying index properties of the soil proposed for the landfill partial closure work. The laboratory testing results are compiled in Appendix I.

Cobles constructed the first acre as a test pad on the south end of the west side slope. The test pad was constructed in three lifts and each lift was tested in the field and laboratory. The field testing included moisture and density testing with nuclear methods and a drive cylinder test to verify the nuclear gauge readings. Two Shelby tubes were pushed into the soil to collect undisturbed soil samples of the low-permeability material for laboratory testing.

The infiltration layer was constructed in three lifts each six inches in compacted thickness. The first acre was constructed as a test pad and the testing results were used for the first acre to minimize testing fees and redundant testing. The field testing records of the infiltration layer construction including nuclear gauge testing, drive cylinder, undisturbed permeability sample (Shelby tube), and daily field reports are included in Appendix II.

Soil infiltration layer construction CQA testing included in-place wet density, moisture content by nuclear method (ASTM D6938), calculated dry density and percent compaction with a Troxler Model 3440 portable nuclear gauge. A density of soil in place by drive cylinder method (ASTM D 2937) was used to collect a sample of soil to verify the nuclear gauge test results for each acre lift. If the nuclear gauge moisture readings were found to deviate significantly from the moisture percentage by direct heating method, the dry density and in-place compaction percentage were re-calculated to verify compaction of the soil. If the placed soils were found not to meet the specification in a given area, the Contractor was informed of the test results and asked to re-work the soil. Following the soil re-work, the area was subjected to CQA testing verification. With satisfactory nuclear gauge readings at the randomly selected test locations the field personnel pushed a drive cylinder to collect the moisture-density verification sample and a Shelby tube to collect the undisturbed sample for laboratory hydraulic conductivity test (ASTM D5084).

The partial closure construction was divided into 11 areas each approximately one acre in size to track the construction and field testing. The field and laboratory testing included a total of 33 acre lifts. Each lift was tested at a minimum of 5 locations by nuclear method, one drive cylinder and one Shelby tube. A total 165 nuclear tests, 33 drive cylinders and 33 low-permeability tests were required. The infiltration layer was found mostly to meet the moisture-compaction requirement but some areas were reworked and retested. Acre 7 Lift 3 and Acre 11 Lift 2 initially failed the undisturbed hydraulic conductivity testing in the laboratory. The failed acre-lifts were disked, re-compacted, and re-graded; and retested in the field and laboratory. The final hydraulic conductivity tests passed the criteria for infiltration layer and the results are included in Appendix III and in the summary table.

### 2.3.2 Protective Cover – Erosion Layer

An 18-inch thick cover soil layer was placed over the completed infiltration layer. The soil was spread in two lifts and tracked up and down the slope with the earth moving equipment to achieve a nominal compaction of about 90 percent so that vegetation can develop a proper root system deep in the soil. Following placement of the protective erosion layer, the closed side slopes were seeded and the grass well established during 2013 growing season.

### 2.3.3 Passive Gas Vents

Eleven passive landfill gas vents were installed during the partial closure construction of Phases 1 and 2. Cobles excavated pits near the top edge of the infiltration layer to place perforated PVC pipes in the top layer of the waste. The 10 inch vent pipes were installed to a depth 5 to 6 feet below the infiltration cap. The excavated gas vent pit was filled with #57 stone. Low permeability soil was then placed over the stone to close the infiltration layer. Top soil was placed over the worked area to provide a continuous layer of the protective cover.

Due to C&D LF waste content, drilling using traditional bucket auger methods for the construction of passive gas vents was deemed impossible. This change to the landfill gas vent drawing detail was submitted to the SWS for review and approval. The drawing is included in Appendix V.

### 2.3.4 Construction Survey

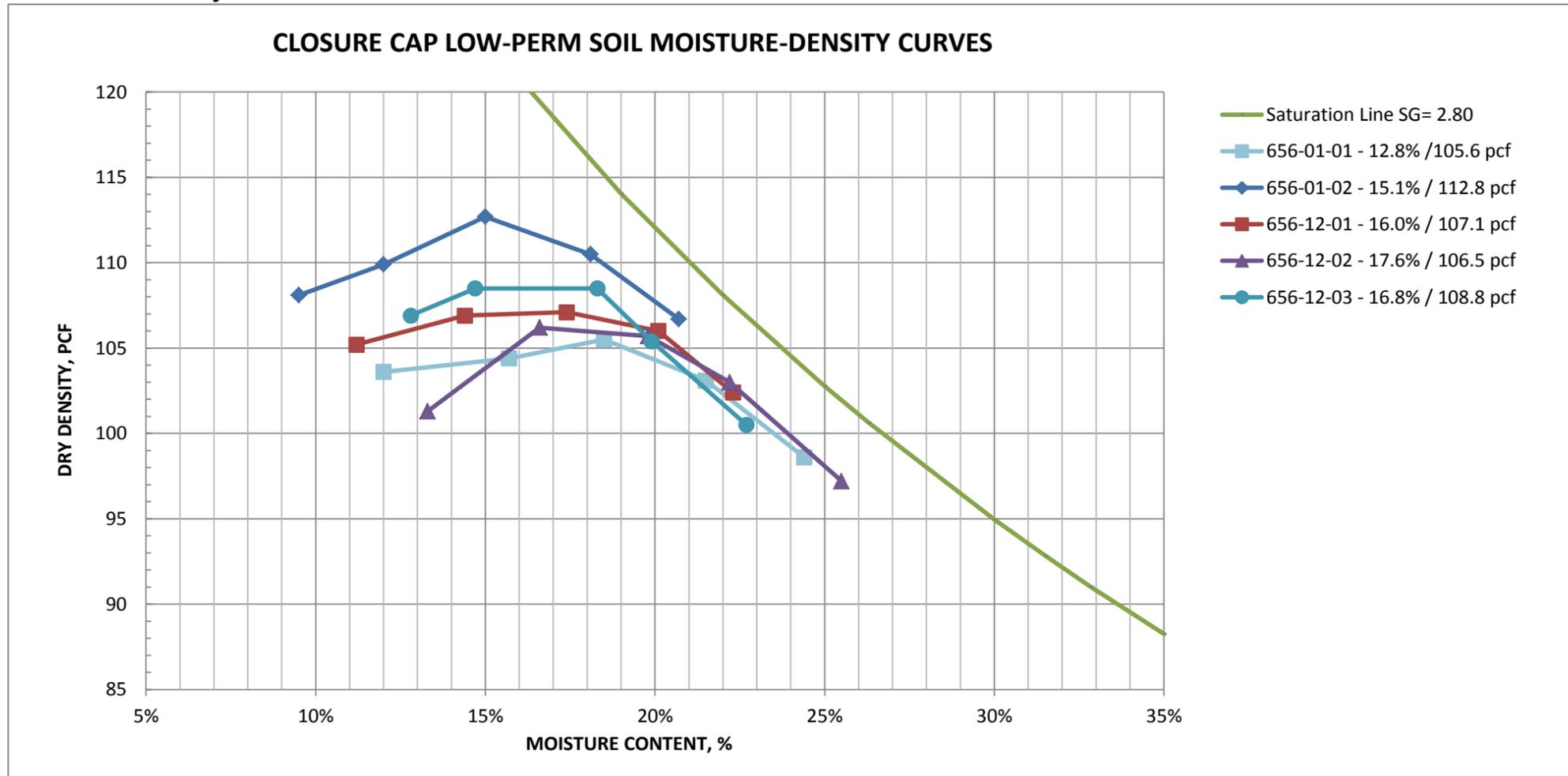
Cobles retained Michael Stout Surveying of Ramseur, NC to provide the survey for the landfill partial closure work. After grading and dressing the intermediate cover the prepared surface was then surveyed using a 50 x 50 foot grid. The top of intermediate cover thus served as base grades for the infiltration layer construction. At the completion of the three lifts of infiltration soil layer construction the surface was then graded and surveyed. Protective cover was placed over the infiltration layer. Once again, Cobles graded the surface to final grades and the surface was surveyed according to the original survey grid locations. The three surveys are included in Appendix V.

The infiltration layer thickness meets and exceeds the minimum required thickness of 1.5 feet. In order to ensure adequate thickness of the infiltration layer, some areas were constructed thicker than required. This was identified following the top of clay survey and adjustments were made to the required thickness of the erosion layer. The total section thickness of the infiltration and vegetative layer section is a minimum of three feet; however the survey for the erosion layer thickness shows some areas less than the permitted 1.5 feet. The same soil material was used for both layers and this report reflects our acceptance of the extra clay layer thickness replacing the shortage of erosion layer in certain areas. In Joyce's professional opinion, this condition will not compromise the performance of the cap in any way nor be detrimental to the establishment of grass or long term maintenance of the cover.

The closure construction was conducted on assumed acre basis on 11 acre lifts. The closure construction survey encompasses total area of 426,983 square feet or 9.8 acres. The area west of the landfill toe of slope as shown on the drawings is permitted area, but was not included in this partial closure work. The area is heavily vegetated and need to be cleared for final closure construction. The Cobles intend to address the area during the next closure construction activities.

END OF REPORT

## APPENDIX 1 – LABORATORY TESTING RESULTS



LAB ID	Partial Closure	MOISTURE-DENSITY RELATIONS					Proctor OMC/MDD	SIEVING ANALYSIS			USCS	ATTERBERG LIMITS			Permeability		
		1	2	3	4	5		#4	#40	#200		LL	PL	PI	K=cm/sec	%M	DD
2012-656-01-01	MC	12.0%	15.7%	18.5%	21.5%	24.4%	<b>18.2%</b>	100.0%	87.8%	66.7%	ML	37	30	7	1.1E-06	20.5%	104.3
	DD	103.6	104.4	105.5	103.1	98.6	<b>105.6</b>										
2012-656-01-02	MC	9.5%	12.0%	15.0%	18.1%	20.7%	<b>15.1%</b>	90.6%	69.9%	54.9%	CL	39	25	14	4.7E-07	17.6%	106.2
	DD	108.1	109.9	112.7	110.5	106.7	<b>112.8</b>										
2012-656-12-01	MC	11.2%	14.4%	17.4%	20.1%	22.3%	<b>16%</b>	96.2%	81.0%	66.9%	ML	39	30	9	4.7E-06	17.9%	102.2
	DD	105.2	106.9	107.1	106.0	102.4	<b>107.1</b>										
2012-656-12-02	MC	13.3%	16.6%	19.8%	22.2%	25.5%	<b>17.6%</b>	94.4%	71.6%	54.5%	ML	41	27	14	1.1E-06	18.7%	102.3
	DD	101.3	106.2	105.7	103.0	97.2	<b>106.5</b>										
2012-656-12-03	MC	12.8%	14.7%	18.3%	19.9%	22.7%	<b>16.8%</b>	96.6%	68.7%	45.8%	SM	38	28	10	4.6E-06	18.9%	103.4
	DD	106.9	108.5	108.5	105.4	100.5	<b>108.8</b>										



April 27, 2012

Project No. 2012-656-01

Mr. Hannu Kemppinen  
Joyce Engineering, Inc.  
Greensboro, NC 27407  
Hannu@joyceengineering.com

**Transmittal**  
**Laboratory Test Results**  
**Coble SR**

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was faxed to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens which were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,  
**Geotechnics, Inc.**

  
Michael P. Smith  
Regional Manager

***We understand that you have a choice in your laboratory services  
and we thank you for choosing Geotechnics.***

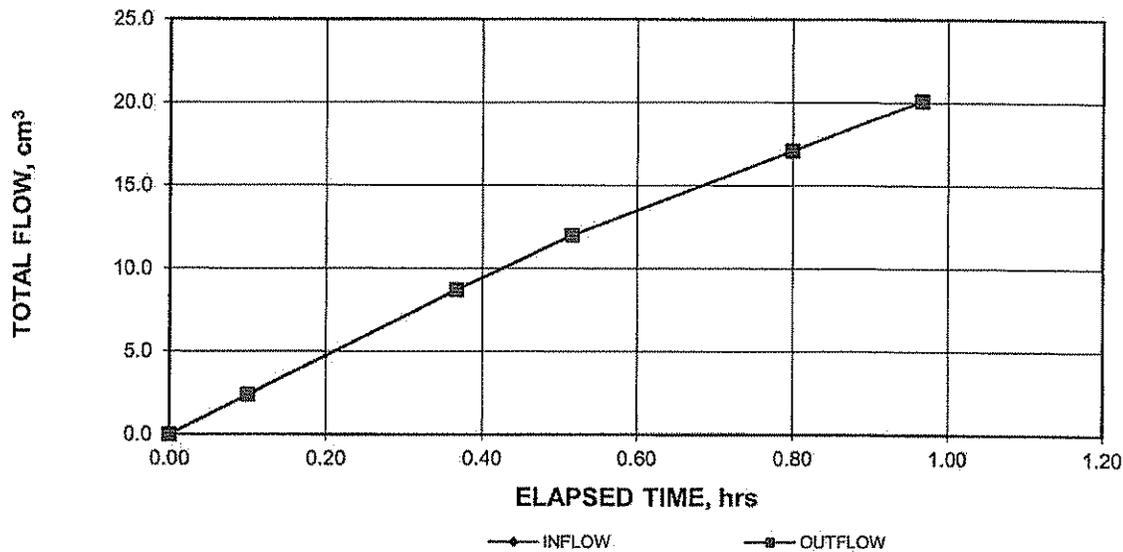
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

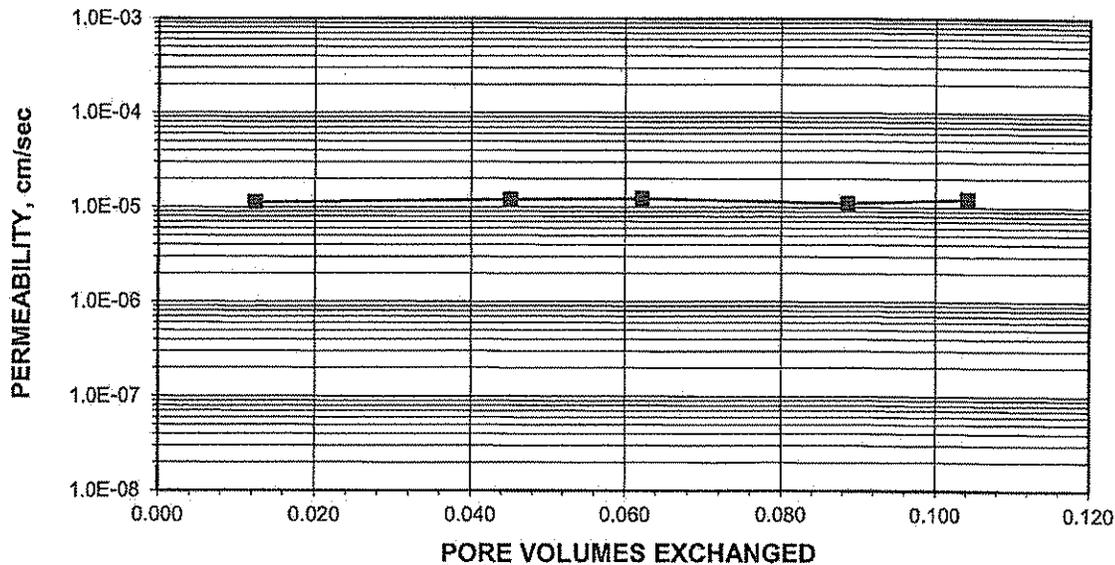
Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	LOW PERM <b>S1</b>
Lab ID No.	2012-656-01-01		

AVERAGE PERMEABILITY = 1.2E-05 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.2E-07 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 4/24/2012 Checked By: *CEM* Date: 4/27

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	LOW PERM S1
Lab ID No.	2012-656-01-01		

Specific Gravity	2.70 Assumed
Sample Condition	Remolded

Visual Description: BROWN SILT

### MOISTURE CONTENT:

	BEFORE TEST	AFTER TEST
Tare Number	273	822
Wt. of Tare & WS (gm.)	123.24	460.52
Wt. of Tare & DS (gm.)	109.21	389.22
Wt. of Tare (gm.)	37.08	136.94
Wt. of Water (gm.)	14.03	71.30
Wt. of DS (gm.)	72.13	252.28
 Moisture Content (%)	 <b>19.5</b>	 <b>28.3</b>

### SPECIMEN:

	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2474.00	NA
Wt. of Tube (gm.)	1635.00	NA
Wt. of WS (calc.)(gm.)	839.00	900.89
Length 1 (in.)	4.003	4.014
Length 2 (in.)	4.003	4.033
Length 3 (in.)	4.003	4.083
Top Diameter (in.)	2.870	2.934
Middle Diameter (in.)	2.870	2.944
Bottom Diameter (in.)	2.870	2.974
 Average Length (in.)	 4.00	 4.04
Average Area (in. <sup>2</sup> )	6.47	6.84
Sample Volume (cm <sup>3</sup> )	424.37	453.08
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.98	1.99
Unit Wet Wt. (pcf)	123.4	124.1
Unit Dry Wt. (pcf)	103.3	96.8
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.66	1.55
Void Ratio, e	0.63	0.74
Porosity, n	0.39	0.43
Pore Volume (cm <sup>3</sup> )	164.2	192.9
Total Wgt. Of Sample After Test		906.30

Tested By: BW      Date: 4/24/2012      Checked By: *GEM*      Date: *4/27*

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	LOW PERM S1
Lab ID No.	2012-656-01-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	10.27
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.49
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	44.12
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.897
Hydraulic Gradient	10.27	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.878
		B Parameter (%)	95

**AVERAGE PERMEABILITY = 1.2E-05 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.2E-07 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
4/26/2012	10	36	0.00	0.0	0.0	127.9	0	23.7	NA
4/26/2012	10	42	0.10	2.4	2.4	122.5	0	23.7	1.1E-05
4/26/2012	10	58	0.37	8.7	8.7	108.4	0	23.8	1.2E-05
4/26/2012	11	7	0.52	12.0	12.0	101.0	0	23.8	1.2E-05
4/26/2012	11	24	0.80	17.1	17.1	89.6	0	23.8	1.1E-05
4/26/2012	11	34	0.97	20.1	20.1	82.9	1	23.8	1.2E-05

Tested By: BW      Date: 4/24/2012      Checked By: *GEM*      Date: 4-27-12

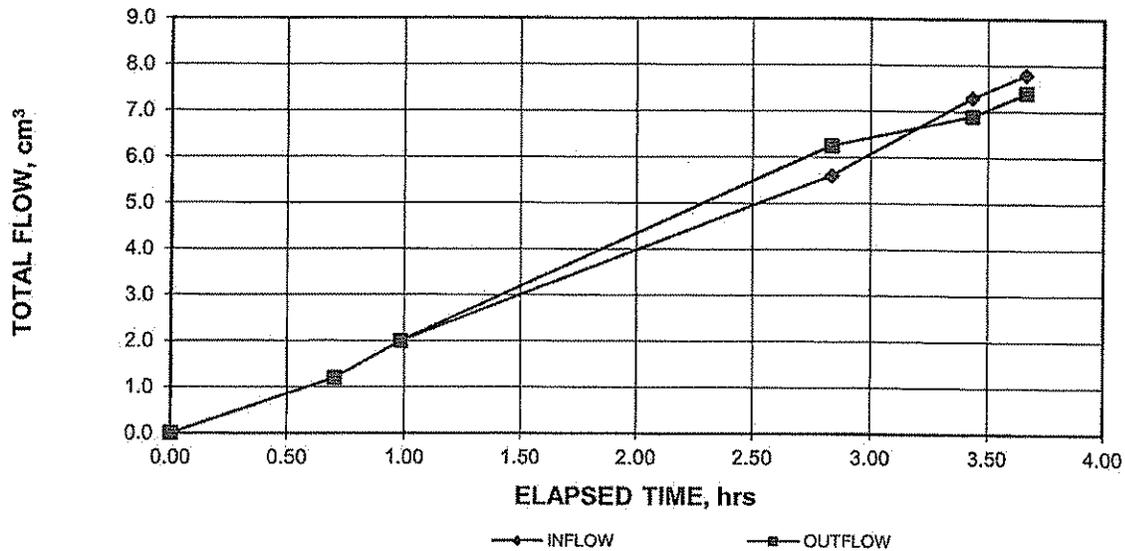
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

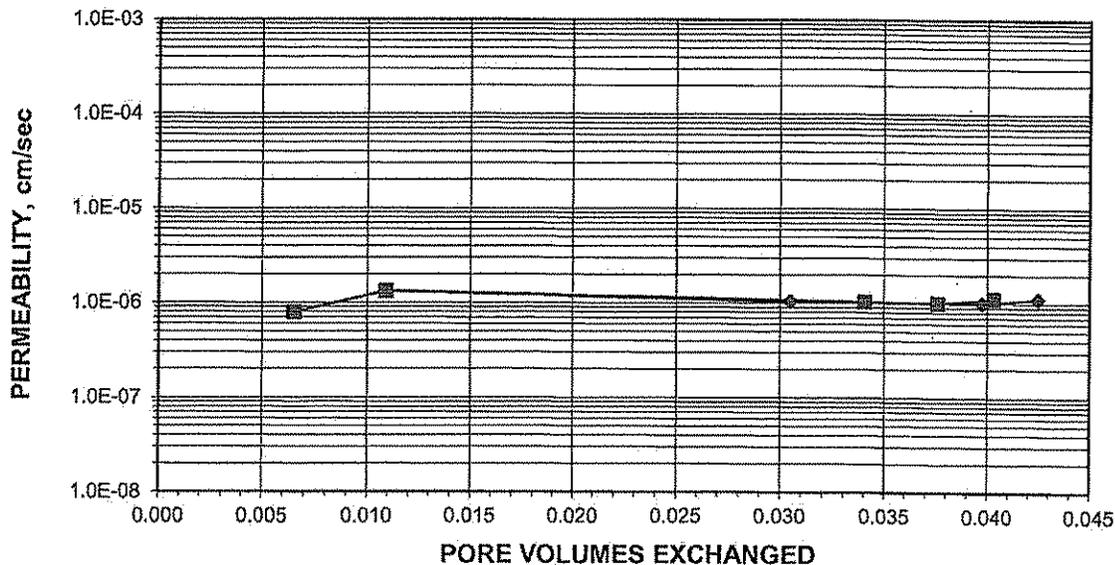
Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	LOW PERM <del>R2</del> S2
Lab ID No.	2012-656-01-01		

AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 4/24/2012 Checked By: *BW* Date: 5/7/12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client JOYCE ENGINEERING  
Client Project COBLE SR  
Project No. 2012-656-01  
Lab ID No. 2012-656-01-01

Boring No. NA  
Depth (ft.) NA  
Sample No. LOW PERM ~~R2~~ S2

Specific Gravity 2.70 Assumed  
Sample Condition Remolded

Visual Description: BROWN SILT

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	828	827
Wt. of Tare & WS (gm.)	282.18	500.82
Wt. of Tare & DS (gm.)	257.27	428.81
Wt. of Tare (gm.)	136.03	136.40
Wt. of Water (gm.)	24.91	72.01
Wt. of DS (gm.)	121.24	292.41
Moisture Content (%)	20.5	24.6

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2489.81	NA
Wt. of Tube (gm.)	1635.26	NA
Wt. of WS (calc.)(gm.)	854.55	883.48
Length 1 (in.)	4.003	4.049
Length 2 (in.)	4.003	4.010
Length 3 (in.)	4.003	4.021
Top Diameter (in.)	2.870	2.976
Middle Diameter (in.)	2.870	2.889
Bottom Diameter (in.)	2.870	2.937
Average Length (in.)	4.00	4.03
Average Area (in. <sup>2</sup> )	6.47	6.76
Sample Volume (cm <sup>3</sup> )	424.37	446.13
Unit Wet Wt. (gm./ cm <sup>3</sup> )	2.01	1.98
Unit Wet Wt. (pcf)	125.7	123.6
Unit Dry Wt. (pcf)	104.3	99.2
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.67	1.59
Void Ratio, e	0.62	0.70
Porosity, n	0.38	0.41
Pore Volume (cm <sup>3</sup> )	161.8	183.6
Total Wgt. Of Sample After Test		881.84

Tested By: BW

Date: 4/24/2012

Checked By: *BW*

Date: 5/7/12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	LOW PERM <del>R2</del> S2
Lab ID No.	2012-656-01-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	43.5	Sample Length (cm), L	10.23
Bottom Cap (psi)	45.0	Sample Diameter (cm)	7.45
Cell (psi)	50.0	Sample Area (cm <sup>2</sup> ), A	43.62
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.897
Hydraulic Gradient	10.31	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.878
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
4/26/2012	11	23	0.00	0.0	0.0	127.9	0	24.2	NA
4/26/2012	12	5	0.70	1.2	1.2	125.2	0	24.2	7.9E-07
4/26/2012	12	22	0.98	2.0	2.0	123.4	0	24.2	1.3E-06
4/26/2012	14	13	2.83	5.6	6.3	114.6	0	24.3	1.0E-06
4/26/2012	14	49	3.43	7.3	6.9	112.0	0	24.3	1.0E-06
4/26/2012	15	3	3.67	7.8	7.4	110.9	1	24.3	1.1E-06

Tested By: BW

Date: 4/24/2012

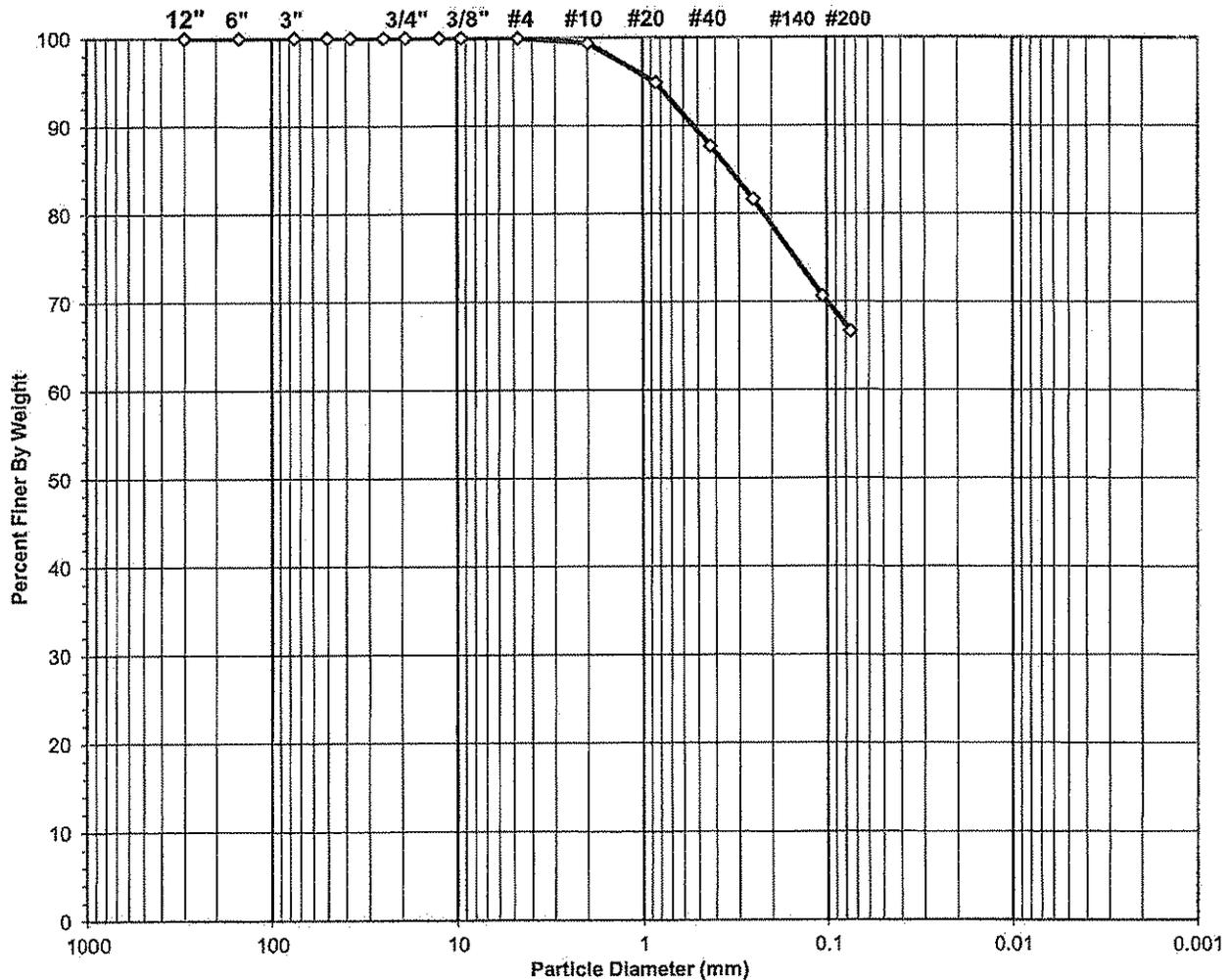
Checked By: *BW*

Date: *5/7/12*

**SIEVE ANALYSIS**  
ASTM D 422-63 (SOP-S3)

Client:	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference:	COBLE SR	Depth (ft)	NA
Project No.:	2012-656-01	Sample No.	LOW PERM
Lab ID:	2012-656-01-01	Soil Color	LIGHT BROWN

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol**      **ML, TESTED**

**USCS Classification** **SANDY SILT**

Tested By **SD**      Date **4/17/2012**      Checked By **am**      Date **4-19-12**

### WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-01	Sample No.	LOW PERM
Lab ID	2012-656-01-01	Soil Color	LIGHT BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	200	Tare No.	NA
Wgt. Tare + Wet Specimen (gm)	712.72	Wgt. Tare + Wet Specimen (gm)	NA
Wgt. Tare + Dry Specimen (gm)	638.62	Wgt. Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	171.61	Weight of Tare (gm)	NA
Weight of Water (gm)	74.10	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	467.01	Weight of Dry Soil (gm)	NA
<b>Moisture Content (%)</b>	<b>15.9</b>	<b>Moisture Content (%)</b>	<b>NA</b>

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	467.01
Dry Weight - 3/4" Sample (gm)	155.4	Weight of minus #200 material (gm)	311.66
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	155.35
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.50	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	0.00	0.0	0.0	100.0	100.0
#4	4.75	0.17	0.0	0.0	100.0	100.0
#10	2.00	2.61	0.6	0.6	99.4	99.4
#20	0.850	21.02	4.5	5.1	94.9	94.9
#40	0.425	33.60	7.2	12.3	87.7	87.7
#60	0.250	28.15	6.0	18.3	81.7	81.7
#140	0.106	51.27	11.0	29.3	70.7	70.7
#200	0.075	18.53	4.0	33.3	66.7	66.7
Pan	-	311.66	66.7	100.0	-	-

Tested By SD Date 4/17/2012 Checked By GEM Date 4-19-12

### ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10 (SOP - S4A)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-01	Sample No.	LOW PERM
Lab ID	2012-656-01-01	Soil Description	<b>LIGHT BROWN SILT</b>

*Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Airdried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

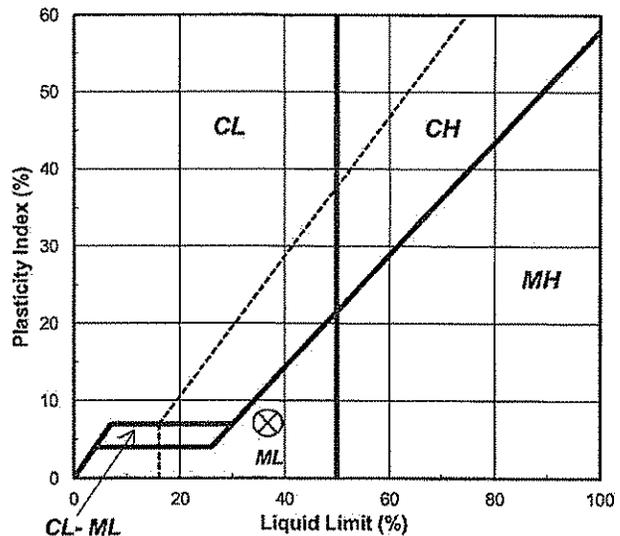
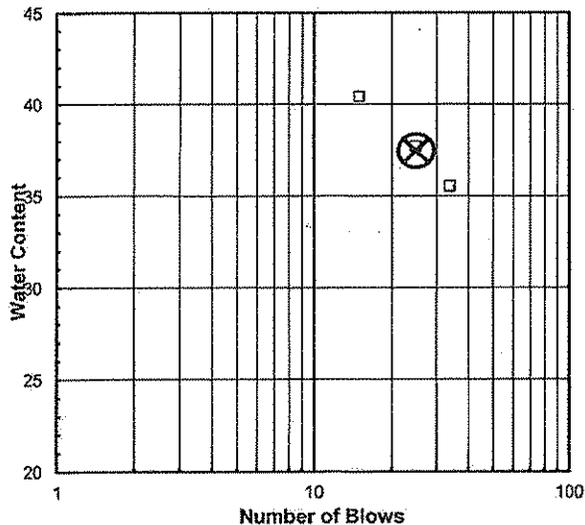
Liquid Limit Test	1	2	3	M U L T I P O I N T
Tare Number	W-5	V-2	3M	
Wt. of Tare & WS (gm)	24.49	24.84	22.78	
Wt. of Tare & DS (gm)	22.15	22.32	20.70	
Wt. of Tare (gm)	15.56	15.63	15.55	
Wt. of Water (gm)	2.3	2.5	2.1	
Wt. of DS (gm)	6.6	6.7	5.2	
<b>Moisture Content (%)</b>	<b>35.5</b>	<b>37.7</b>	<b>40.4</b>	
<b>Number of Blows</b>	<b>34</b>	<b>25</b>	<b>15</b>	

Plastic Limit Test	1	2	Range	Test Results
Tare Number	Z-4	1M		<b>Liquid Limit (%)</b> 37
Wt. of Tare & WS (gm)	23.51	21.96		<b>Plastic Limit (%)</b> 30
Wt. of Tare & DS (gm)	21.70	20.59		<b>Plasticity Index (%)</b> 7
Wt. of Tare (gm)	15.63	15.90		<b>USCS Symbol</b> ML
Wt. of Water (gm)	1.8	1.4		
Wt. of DS (gm)	6.1	4.7		
<b>Moisture Content (%)</b>	<b>29.8</b>	<b>29.2</b>	<b>0.6</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve

Plasticity Chart



Tested By SD      Date 4/17/2012      Checked By GEM      Date 4-19-12

page 1 of 1      DCN:      CT-S4B      DATE:      12/20/2006      REVISION: 3



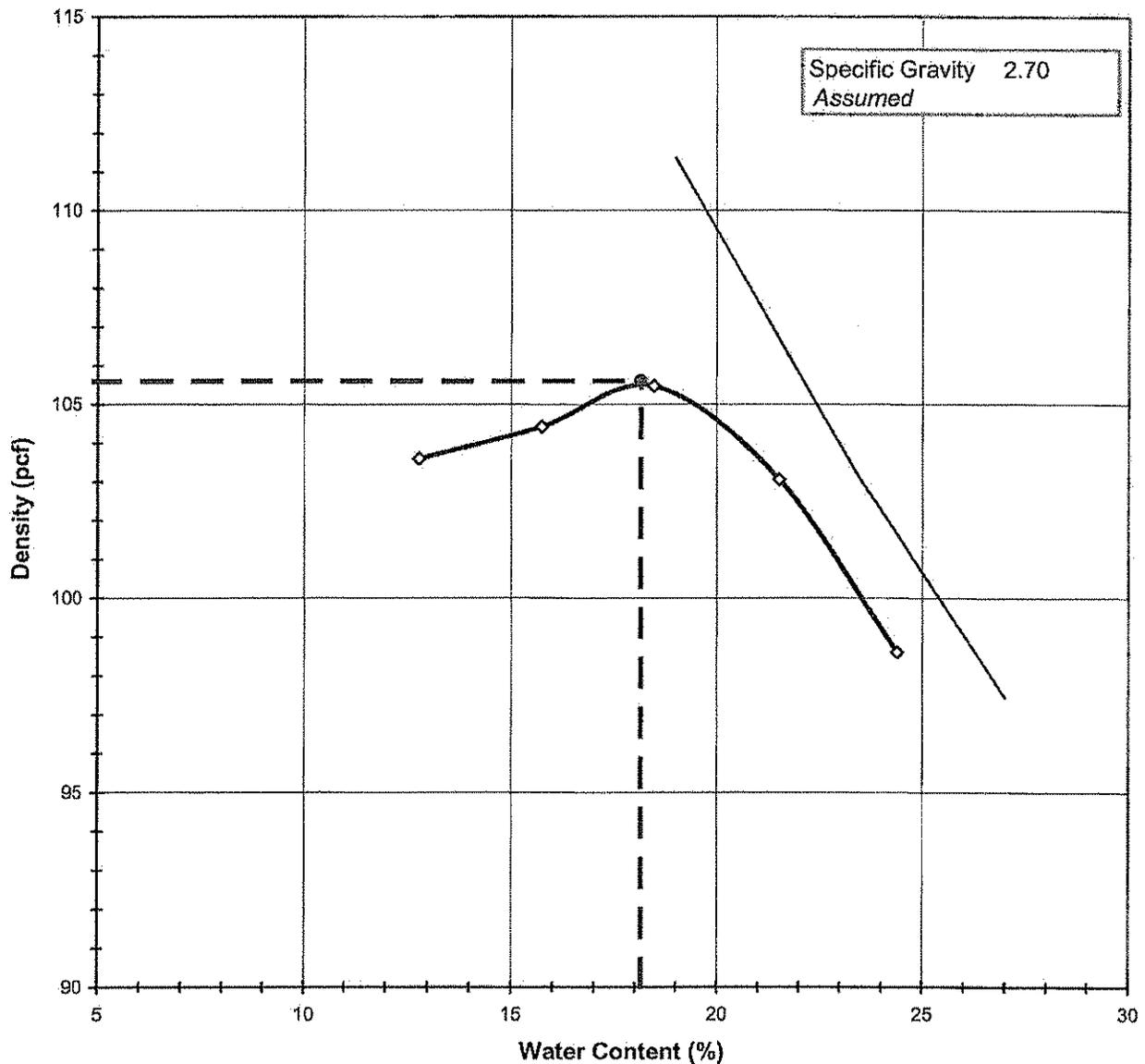
### MOISTURE DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-01	Sample No.	LOW PERM
Lab ID	2012-656-01-01	Test Method	STANDARD

Visual Description      LIGHT BROWN TAN SANDY SILT

**Optimum Water Content                      18.2**  
**Maximum Dry Density                        105.6**



Tested By *SD*      Date *4/16/2012*      Checked By *MDK*      Date *4/17*



## MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-01	Sample No.	LOW PERM
Lab ID	2012-656-01-01		

Visual Description      LIGHT BROWN TAN SANDY SILT

Total Weight of the Sample (gm)	20550
As Received Water Content(%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	NA
Percent Retained on 3/8"	NA
Percent Retained on #4	NA
Oversize Material	Not included
Procedure Used	A

TestType	<b>STANDARD</b>	
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type	MECHANICAL	
Machine ID	R	174
Mold ID	R	172
Mold diameter		4"
Weight of the Mold		4290
Volume of the Mold(cc)		941

### Mold / Specimen

Point No.	1	2	3	4	5
Wt. of Mold & WS (gm)	6052	6112	6174	6179	6140
Wt. of Mold (gm)	4290	4290	4290	4290	4290
Wt. of WS	1762	1823	1885	1889	1850
Mold Volume (cc)	941	941	941	941	941

### Moisture Content / Density

Tare Number	315	300	317	311	318
Wt. of Tare & WS (gm)	465.60	489.30	502.60	491.60	436.90
Wt. of Tare & DS (gm)	425.33	437.80	437.41	419.50	368.32
Wt. of Tare (gm)	110.50	110.60	84.40	84.70	87.10
Wt. of Water (gm)	40.27	51.50	65.19	72.10	68.58
Wt. of DS (gm)	314.83	327.20	353.01	334.80	281.22

Wet Density (gm/cc)	1.87	1.94	2.00	2.01	1.97
Wet Density (pcf)	116.8	120.9	124.9	125.3	122.7
Moisture Content (%)	12.8	15.7	18.5	21.5	24.4
Dry Density (pcf)	103.6	104.4	105.5	103.1	98.6

### Zero Air Voids

Moisture Content (%)	19.0	23.5	27.0
Dry Unit Weight (pcf)	111.4	103.1	97.4

Tested By    SD      Date    4/16/2012    Checked By    *HAAS*      Date    4/17

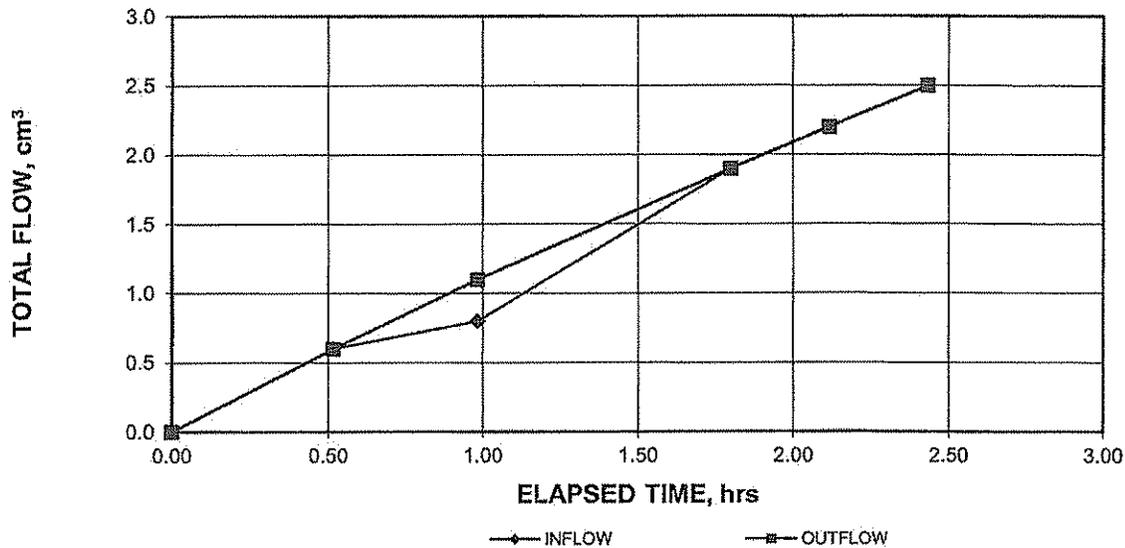
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

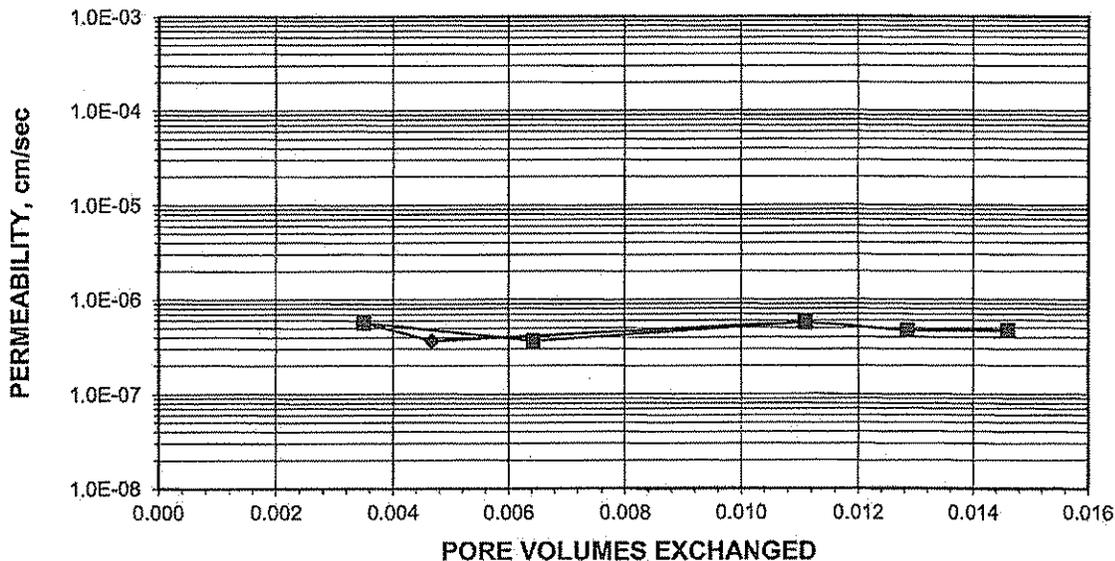
Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	<del>INTERIOR COVER</del>
Lab ID No.	2012-656-01-02		LOW PERM S2

AVERAGE PERMEABILITY = 4.7E-07 cm/sec @ 20°C  
AVERAGE PERMEABILITY = 4.7E-09 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 4/24/2012 Checked By: *GAM* Date: 4-27-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	<del>INTERIOR COVER</del> <b>LOW PERM S2</b>
Lab ID No.	2012-656-01-02	Specific Gravity	2.70 Assumed
		Sample Condition	Remolded

Visual Description: BROWN SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	270	810
Wt. of Tare & WS (gm.)	104.07	467.77
Wt. of Tare & DS (gm.)	94.09	404.99
Wt. of Tare (gm.)	37.48	114.54
Wt. of Water (gm.)	9.98	62.78
Wt. of DS (gm.)	56.61	290.45
Moisture Content (%)	17.6	21.6

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	849.20	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	849.20	877.97
Length 1 (in.)	4.003	4.051
Length 2 (in.)	4.003	4.041
Length 3 (in.)	4.003	4.041
Top Diameter (in.)	2.870	2.899
Middle Diameter (in.)	2.870	2.903
Bottom Diameter (in.)	2.870	2.906
Average Length (in.)	4.00	4.04
Average Area (in. <sup>2</sup> )	6.47	6.62
Sample Volume (cm <sup>3</sup> )	424.37	438.56
Unit Wet Wt. (gm./ cm <sup>3</sup> )	2.00	2.00
Unit Wet Wt. (pcf)	124.9	125.0
Unit Dry Wt. (pcf)	106.2	102.8
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.70	1.65
Void Ratio, e	0.59	0.64
Porosity, n	0.37	0.39
Pore Volume (cm <sup>3</sup> )	157.0	171.2
Total Wgt. Of Sample After Test		925.06

Tested By: BW Date: 4/24/2012 Checked By: *GAM* Date: *4-27-12*

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-01	Sample No.	<del>INTERIOR COVER</del>
Lab ID No.	2012-656-01-02		<i>LOW PERM S2</i>

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	10.27
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.37
Cell (psi)	50.0	Sample Area (cm <sup>2</sup> ), A	42.69
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	10.27	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	99

**AVERAGE PERMEABILITY = 4.7E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 4.7E-09 m/sec @ 20°C**

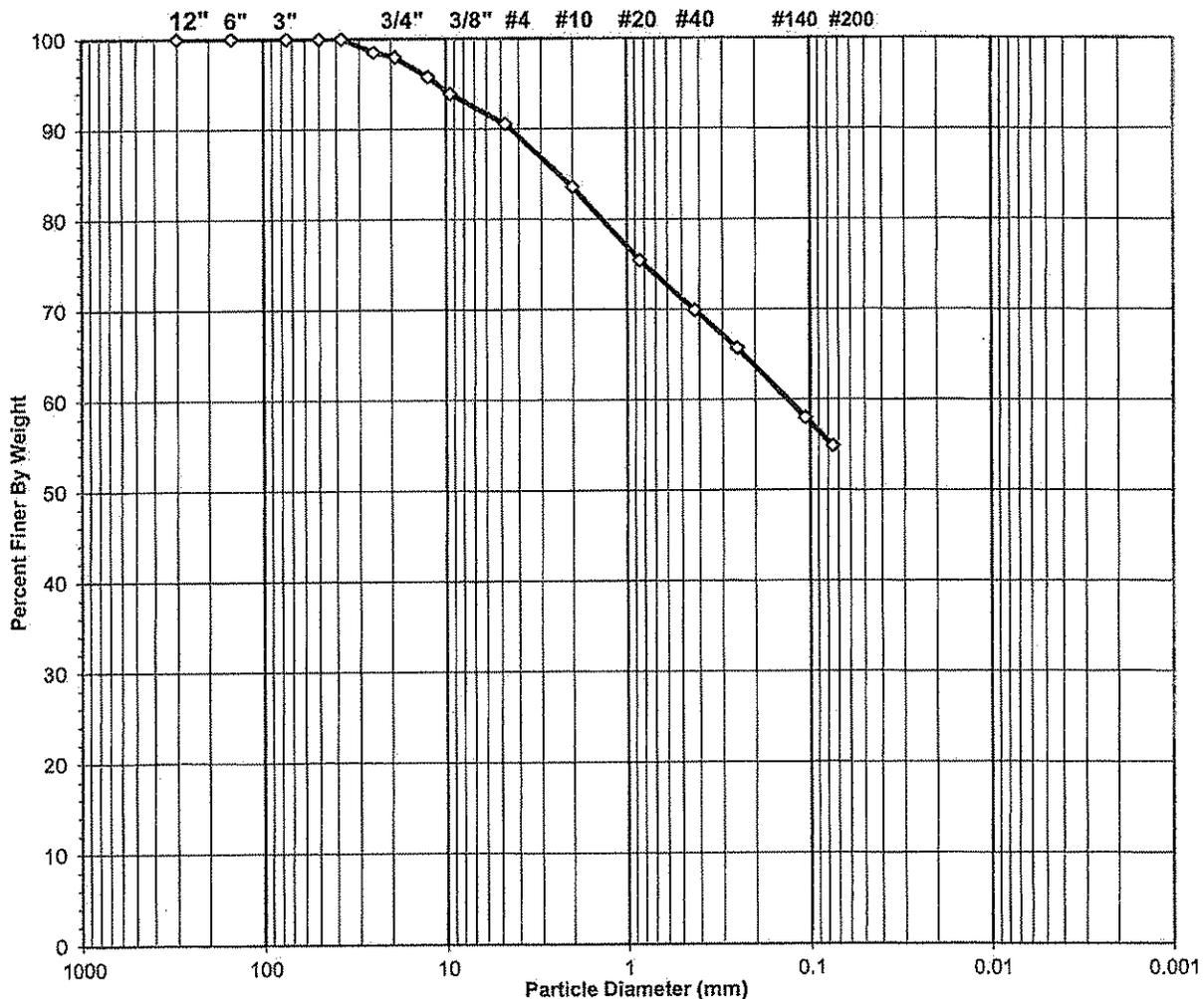
DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. ( °C )	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
4/26/2012	8	26	0.00	0.0	0.0	127.4	0	22.8	NA
4/26/2012	8	57	0.52	0.6	0.6	126.1	0	23.0	5.7E-07
4/26/2012	9	25	0.98	0.8	1.1	125.4	0	23.3	3.7E-07
4/26/2012	10	14	1.80	1.9	1.9	123.4	0	23.6	5.7E-07
4/26/2012	10	33	2.12	2.2	2.2	122.8	0	23.7	4.7E-07
4/26/2012	10	52	2.43	2.5	2.5	122.2	1	23.7	4.7E-07

Tested By: BW      Date: 4/24/2012      Checked By: *GM*      Date: *4-27-12*

**SIEVE ANALYSIS**  
ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-01	Sample No.	<del>INTERIOR COVER</del>
Lab ID	2012-656-01-02	Soil Color	LIGHT BROWN <i>LOW-PERM S2</i>

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol **CL, TESTED**

USCS Classification **SANDY LEAN CLAY**

Tested By **SD** Date **4/17/2012** Checked By **GEM** Date **4-19-12**



### WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA <i>LOW PERM S2</i>
Project No.	2012-656-01	Sample No.	<del>INTERIOR COVER</del>
Lab ID	2012-656-01-02	Soil Color	LIGHT BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	840	Tare No.	314
Wgt. Tare + Wet Specimen (gm)	819.78	Wgt. Tare + Wet Specimen (gm)	651.09
Wgt. Tare + Dry Specimen (gm)	746.03	Wgt. Tare + Dry Specimen (gm)	615.21
Weight of Tare (gm)	262.57	Weight of Tare (gm)	84.88
Weight of Water (gm)	73.75	Weight of Water (gm)	35.88
Weight of Dry Soil (gm)	483.46	Weight of Dry Soil (gm)	530.33
<b>Moisture Content (%)</b>	<b>15.3</b>	<b>Moisture Content (%)</b>	<b>6.8</b>

Wet Weight - 3/4" Sample (gm)	14699	Weight of the Dry Specimen (gm)	483.46
Dry Weight - 3/4" Sample (gm)	12753.5	Weight of minus #200 material (gm)	270.70
Wet Weight + 3/4" Sample (gm)	280.99	Weight of plus #200 material (gm)	212.76
Dry Weight + 3/4" Sample (gm)	263.18		
Total Dry Weight Sample (gm)	13016.7	<b>J - Factor (Percent Finer than 3/4")</b>	<b>0.9798</b>

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00 (*)	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25	206.34	1.5	1.5	98.5	98.5
3/4"	19	74.65	0.5	2.0	98.0	98.0
1/2"	12.5	10.90	2.3	2.3	97.7	95.8
3/8"	9.5	9.21	1.9	4.2	95.8	93.9
#4	4.75	16.51	3.4	7.6	92.4	90.6
#10	2	34.49	7.1	14.7	85.3	83.6
#20	0.85	40.08 (**)	8.3	23.0	77.0	75.4
#40	0.425	27.21	5.6	28.6	71.4	69.9
#60	0.25	20.83	4.3	32.9	67.1	65.7
#140	0.106	38.06	7.9	40.8	59.2	58.0
#200	0.075	15.47	3.2	44.0	56.0	54.9
Pan	-	270.70	56.0	100.0	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
 (\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By SD Date 4/17/2012 Checked By GJM Date 4-19-12



### ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10 (SOP - S4A)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA <i>LOW AREA S2</i>
Project No.	2012-656-01	Sample No.	<del>INTERIOR COVER</del>
Lab ID	2012-656-01-02	Soil Description	<b>LIGHT BROWN LEAN CLAY</b>

*Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Airdried) See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

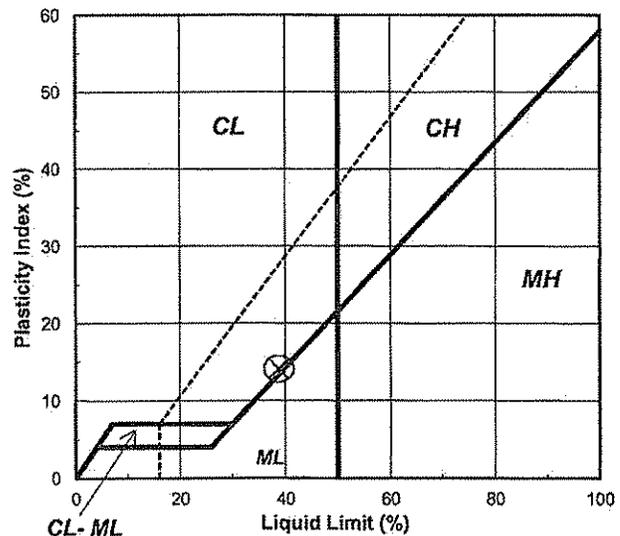
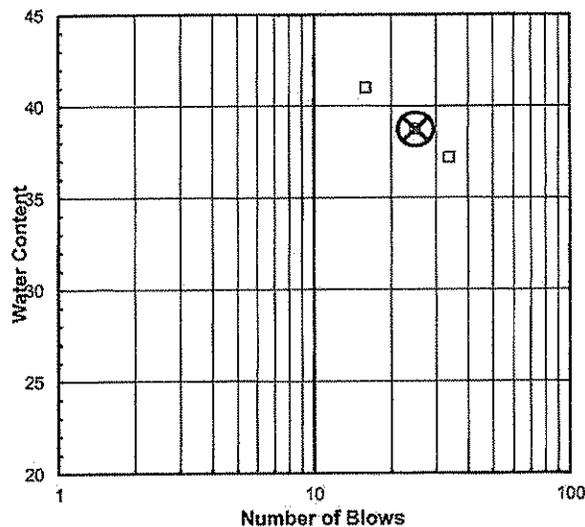
Liquid Limit Test	1	2	3	M U L T I P O I N T
Tare Number	K	A-L	T	
Wt. of Tare & WS (gm)	23.82	23.81	24.78	
Wt. of Tare & DS (gm)	21.49	21.49	21.99	
Wt. of Tare (gm)	15.22	15.50	15.18	
Wt. of Water (gm)	2.3	2.3	2.8	
Wt. of DS (gm)	6.3	6.0	6.8	
<b>Moisture Content (%)</b>	<b>37.2</b>	<b>38.7</b>	<b>41.0</b>	<b>N</b>
<b>Number of Blows</b>	<b>34</b>	<b>25</b>	<b>16</b>	<b>T</b>

Plastic Limit Test	1	2	Range	Test Results
Tare Number	O	A-I		Liquid Limit (%) 39
Wt. of Tare & WS (gm)	21.98	21.70		Plastic Limit (%) 25
Wt. of Tare & DS (gm)	20.63	20.47		Plasticity Index (%) 14
Wt. of Tare (gm)	15.18	15.40		USCS Symbol CL
Wt. of Water (gm)	1.4	1.2		
Wt. of DS (gm)	5.5	5.1		
<b>Moisture Content (%)</b>	<b>24.8</b>	<b>24.3</b>	<b>0.5</b>	

*Note: The acceptable range of the two Moisture contents is ± 2.6*

Flow Curve

Plasticity Chart



Tested By *SD* Date *4/17/2012* Checked By *GEM* Date *4-19-12*



## MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-01	Sample No.	<del>INTERM. COVER</del>
Lab ID	2012-656-01-02		LOW PERM S2

Visual Description      BROWN TAN SILTY SAND

Total Weight of the Sample (gm)	15350
As Received Water Content(%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	NA
Percent Retained on 3/8"	NA
Percent Retained on #4	NA
Oversize Material	INC.
Procedure Used	B

TestType	<b>STANDARD</b>	
Rammer Weight (lbs)	5.5	
Rammer Drop (in)	12	
Rammer Type	MECHANICAL	
Machine ID	R	174
Mold ID	R	172
Mold diameter	4"	
Weight of the Mold	4290	
Volume of the Mold(cc)	941	

### Mold / Specimen

Point No.	1	2	3	4	5
Wt. of Mold & WS (gm)	6074	6146	6244	6258	6233
Wt. of Mold (gm)	4290	4290	4290	4290	4290
Wt. of WS	1784	1856	1954	1968	1943
Mold Volume (cc)	941	941	941	941	941

### Moisture Content / Density

Tare Number	303	807	809	811	804
Wt. of Tare & WS (gm)	478.90	405.90	417.40	475.10	528.50
Wt. of Tare & DS (gm)	447.12	373.73	378.08	418.46	455.79
Wt. of Tare (gm)	111.70	105.00	115.10	106.10	105.10
Wt. of Water (gm)	31.78	32.17	39.32	56.64	72.71
Wt. of DS (gm)	335.42	268.73	262.98	312.36	350.69

Wet Density (gm/cc)	1.90	1.97	2.08	2.09	2.06
Wet Density (pcf)	118.3	123.0	129.5	130.5	128.8
Moisture Content (%)	9.5	12.0	15.0	18.1	20.7
Dry Density (pcf)	108.1	109.9	112.7	110.5	106.7

### Zero Air Voids

Moisture Content (%)	17.0	19.0	23.2
Dry Unit Weight (pcf)	115.5	111.4	103.6

Tested By SD      Date 4/16/2012      Checked By MMH      Date 4/20



October 8, 2012

Project No. 2012-656-12

Mr. Hannu Kempainen  
Joyce Engineering, Inc.  
Greensboro, NC 27407  
Hannu@joyceengineering.com

**Transmittal**  
**Laboratory Test Results**  
**Coble SR**

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens which were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,  
**Geotechnics, Inc.**

Michael P. Smith  
Regional Manager

***We understand that you have a choice in your laboratory services  
and we thank you for choosing Geotechnics.***

## SPECIFIC GRAVITY

ASTM D 854-10

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR LF	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID	2012-656-12-01	Visual Description	<b>TAN SILT</b> ( Minus No.4 sieve material, airdried)

Replicate Number	1	2
Pycnometer ID	R 347	R 345
Weight of Pycnometer + Soil + Water (gm)	700.28	699.26
Temperature, T ( °Celsius )	25.7	25.6
Weight of Pycnometer + Water (gm)	669.00	667.94
Tare Number	206	376
Weight of Tare + Dry Soil (gm)	165.35	156.57
Weight of Tare (gm)	115.35	106.57
Weight of Dry Soil (gm)	50.00	50.00
Specific Gravity of Soil @ T	2.671	2.677
Specific Gravity of Water @ T	0.9969	0.9969
Conversion Factor for Temperature T	0.9987	0.9987
Specific Gravity @ 20° Celsius	2.675	2.681

Average Specific Gravity @ 20° Celsius 2.68

Tested By SFS Date 10/3/2012 Checked By BW Date 10-4-12

## SPECIFIC GRAVITY

ASTM D 854-10

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR LF	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID	2012-656-12-02	Visual Description	<b>BROWN SANDY SILT</b> ( Minus No.4 sieve material, airdried)

<b>Replicate Number</b>	<b>1</b>	<b>2</b>
Pycnometer ID	R 347	R 345
Weight of Pycnometer + Soil + Water (gm)	699.85	698.98
Temperature, T ( °Celsius )	26.3	25.9
Weight of Pycnometer + Water (gm)	668.92	667.90
Tare Number	331	334
Weight of Tare + Dry Soil (gm)	150.99	156.13
Weight of Tare (gm)	100.99	106.13
Weight of Dry Soil (gm)	50.00	50.00
Specific Gravity of Soil @ T	2.622	2.643
Specific Gravity of Water @ T	0.9967	0.9968
Conversion Factor for Temperature T	0.9985	0.9986
Specific Gravity @ 20° Celsius	2.626	2.647

Average Specific Gravity @ 20° Celsius 2.64

Tested By SFS Date 10/2/2012 Checked By BW Date 10-4-12

### SPECIFIC GRAVITY

ASTM D 854-10

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR LF	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-03	Visual Description	<b>REDDISH BROWN SILTY SAND</b> ( Minus No.4 sieve material, airdried)

Replicate Number		1		2
Pycnometer ID	R	344	R	346
Weight of Pycnometer + Soil + Water (gm)		698.95		699.4
Temperature, T ( °Celsius )		25.7		25.7
Weight of Pycnometer + Water (gm)		667.67		668.13
Tare Number		373		372
Weight of Tare + Dry Soil (gm)		155.1		153.83
Weight of Tare (gm)		105.1		103.83
Weight of Dry Soil (gm)		50.00		50.00
Specific Gravity of Soil @ T		2.671		2.670
Specific Gravity of Water @ T		0.9969		0.9969
Conversion Factor for Temperature T		0.9987		0.9987
Specific Gravity @ 20° Celsius		2.675		2.673

Average Specific Gravity @ 20° Celsius 2.67

Tested By SFS Date 10/3/2012 Checked By BW Date 10-4-12

### ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10 (SOP - S4A)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID	2012-656-12-01	Soil Description	<b>TAN SILT</b>

*Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Airdried) See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

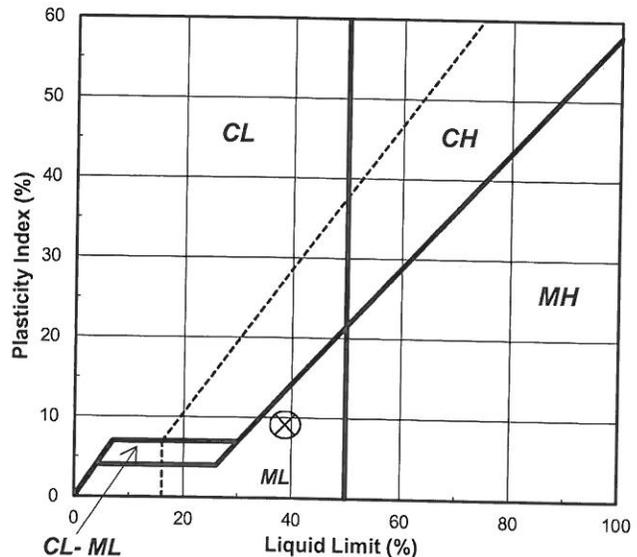
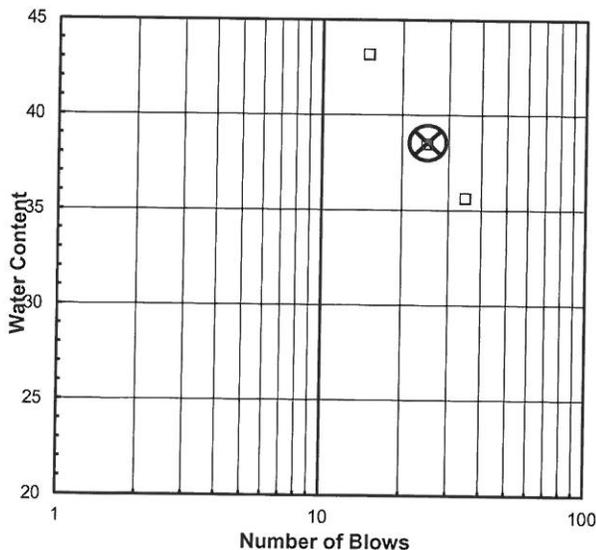
Liquid Limit Test	1	2	3	
Tare Number	B	U	G	<b>M U L T I P O I N T</b>
Wt. of Tare & WS (gm)	26.82	26.33	25.10	
Wt. of Tare & DS (gm)	23.77	23.25	22.08	
Wt. of Tare (gm)	15.20	15.24	15.08	
Wt. of Water (gm)	3.1	3.1	3.0	
Wt. of DS (gm)	8.6	8.0	7.0	
Moisture Content (%)	35.6	38.5	43.1	
Number of Blows	35	25	15	

Plastic Limit Test	1	2	Range	Test Results	
Tare Number	A-M	K		Liquid Limit (%)	39
Wt. of Tare & WS (gm)	23.05	23.40		Plastic Limit (%)	30
Wt. of Tare & DS (gm)	21.27	21.48		Plasticity Index (%)	9
Wt. of Tare (gm)	15.37	15.22		USCS Symbol	ML
Wt. of Water (gm)	1.8	1.9			
Wt. of DS (gm)	5.9	6.3			
Moisture Content (%)	30.2	30.7	-0.5		

*Note: The acceptable range of the two Moisture contents is ± 2.6*

Flow Curve

Plasticity Chart



Tested By BW Date 10/2/2012 Checked By BW Date 10/3/12

### ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10 (SOP - S4A)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID	2012-656-12-02	Soil Description	<b>REDDISH BROWN SILT</b>

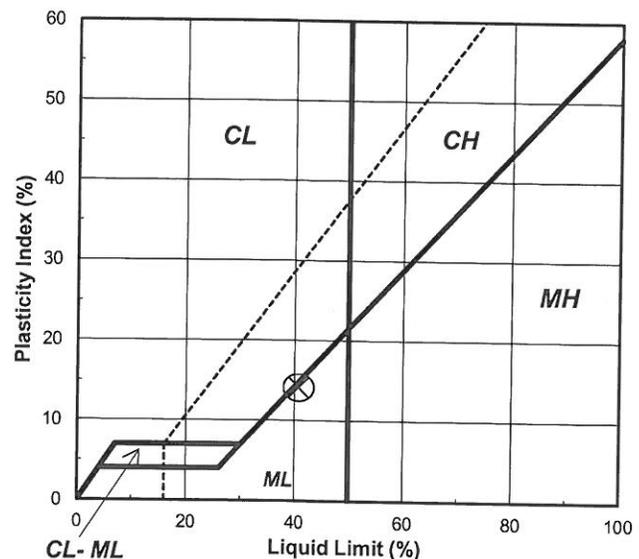
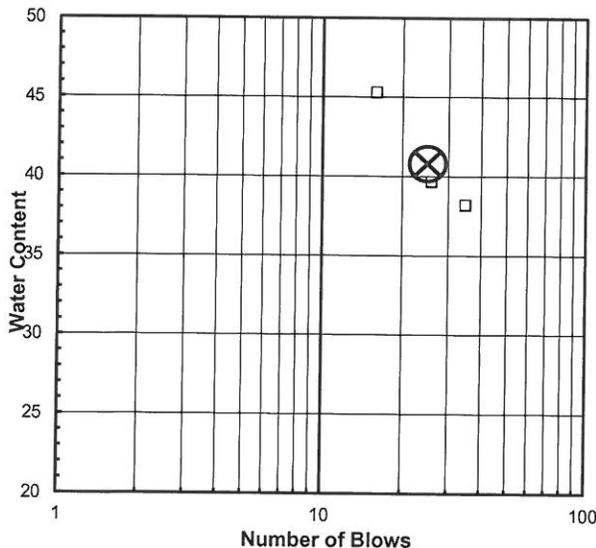
*Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

Liquid Limit Test	1	2	3	
Tare Number	BB	AB	H	<b>M U L T I P O I N T</b>
Wt. of Tare & WS (gm)	26.59	26.45	26.58	
Wt. of Tare & DS (gm)	23.54	23.37	23.00	
Wt. of Tare (gm)	15.55	15.60	15.09	
Wt. of Water (gm)	3.1	3.1	3.6	
Wt. of DS (gm)	8.0	7.8	7.9	
<b>Moisture Content (%)</b>	<b>38.2</b>	<b>39.6</b>	<b>45.3</b>	
<b>Number of Blows</b>	<b>35</b>	<b>26</b>	<b>16</b>	

Plastic Limit Test	1	2	Range	Test Results
Tare Number	L	A-C		
Wt. of Tare & WS (gm)	22.42	21.87		
Wt. of Tare & DS (gm)	20.92	20.55		
Wt. of Tare (gm)	15.23	15.60		
Wt. of Water (gm)	1.5	1.3		
Wt. of DS (gm)	5.7	5.0		
<b>Moisture Content (%)</b>	<b>26.4</b>	<b>26.7</b>	<b>-0.3</b>	<b>Liquid Limit (%)</b> <b>41</b>
<i>Note: The acceptable range of the two Moisture contents is <math>\pm 2.6</math></i>				<b>Plastic Limit (%)</b> <b>27</b>
				<b>Plasticity Index (%)</b> <b>14</b>
				<b>USCS Symbol</b> <b>ML</b>

Flow Curve

Plasticity Chart



Tested By *BW* Date *10/2/2012* Checked By *BW* Date *10-3-12*

page 1 of 1 DCN: CT-S4B DATE: 12/20/2006 REVISION: 3

### ATTERBERG LIMITS

ASTM D 4318-10 / AASHTO T89-10 (SOP - S4A)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-03	Soil Description	<b>REDDISH BROWN SILT</b>

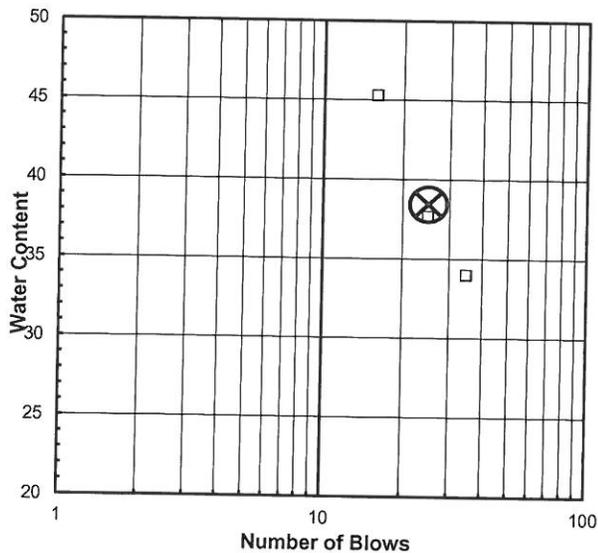
*Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.* (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	1	2	3	M U L T I P L I C I T Y P O I N T
Tare Number	A1	C	H	
Wt. of Tare & WS (gm)	24.73	29.25	26.58	
Wt. of Tare & DS (gm)	22.38	25.41	23.00	
Wt. of Tare (gm)	15.46	15.21	15.09	
Wt. of Water (gm)	2.4	3.8	3.6	
Wt. of DS (gm)	6.9	10.2	7.9	
<b>Moisture Content (%)</b>	<b>34.0</b>	<b>37.6</b>	<b>45.3</b>	
<b>Number of Blows</b>	<b>35</b>	<b>25</b>	<b>16</b>	

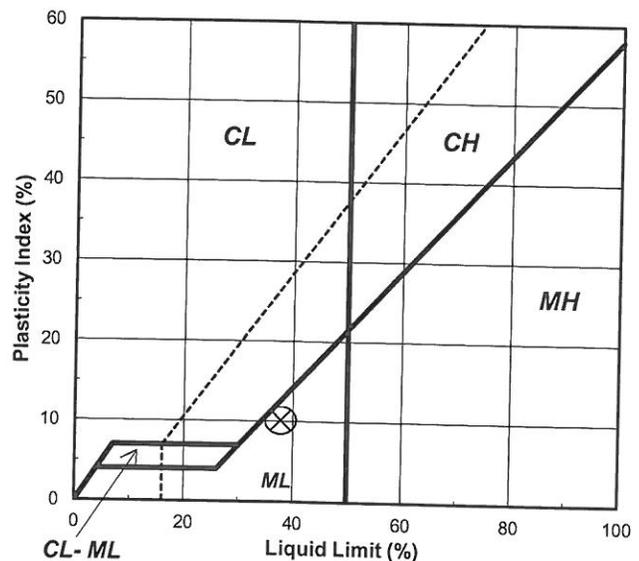
Plastic Limit Test	1	2	Range	Test Results	
Tare Number	AK	AD		Liquid Limit (%)	38
Wt. of Tare & WS (gm)	23.63	22.50		Plastic Limit (%)	28
Wt. of Tare & DS (gm)	21.87	20.92		Plasticity Index (%)	10
Wt. of Tare (gm)	15.53	15.37		USCS Symbol	ML
Wt. of Water (gm)	1.8	1.6			
Wt. of DS (gm)	6.3	5.6			
<b>Moisture Content (%)</b>	<b>27.8</b>	<b>28.5</b>	<b>-0.7</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



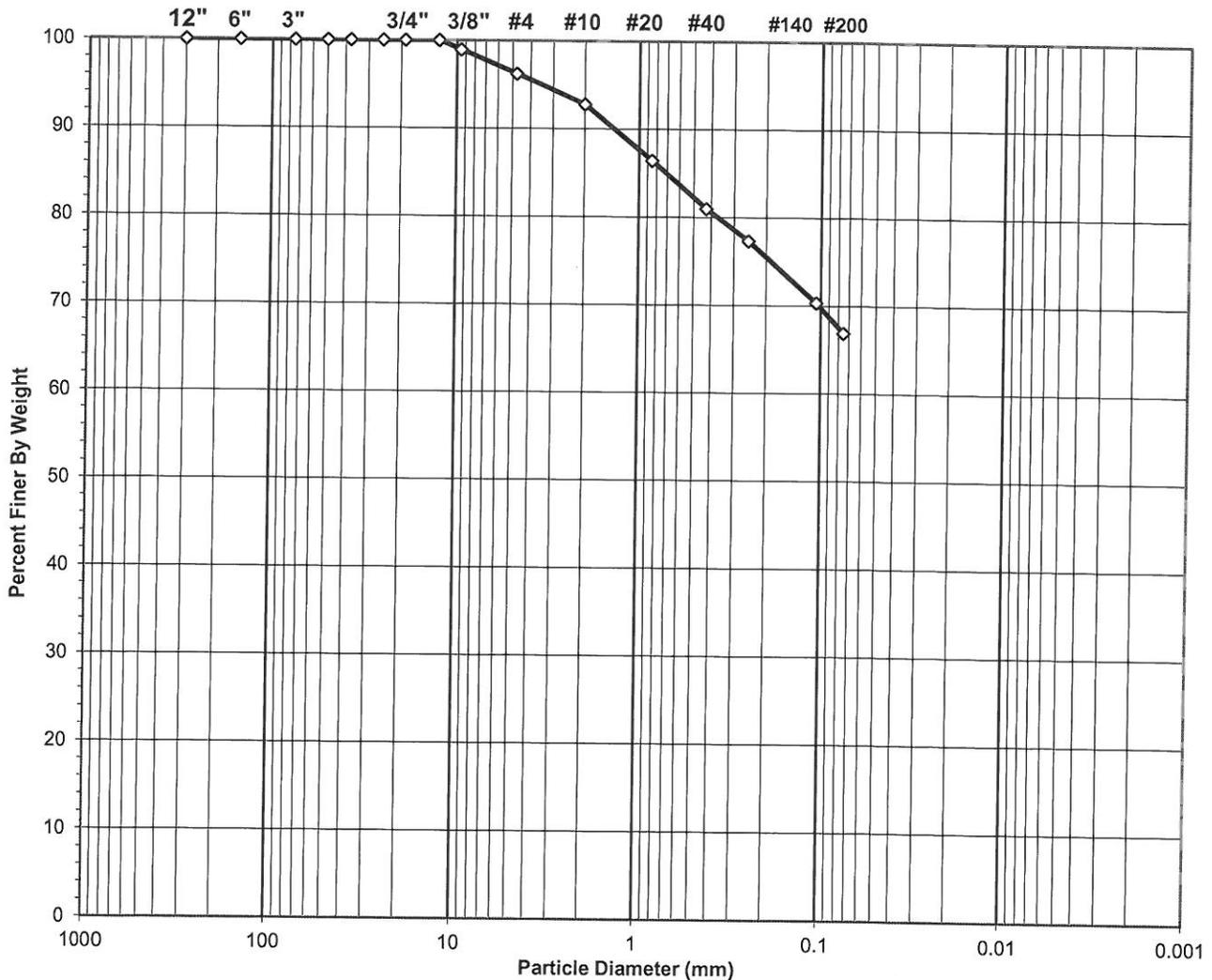
Tested By BW Date 10/2/2012 Checked By BW Date 10/3/12

page 1 of 1      DCN: CT-S4B      DATE: 12/20/2006      REVISION: 3

**SIEVE ANALYSIS**  
ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID	2012-656-12-01	Soil Color	TAN

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol**      *ML, TESTED*

**USCS Classification** *SANDY SILT*

Tested By SFS      Date 9/28/2012      Checked By BW      Date 10-2-12

page 1 of 2      DCN: CT-S3C DATE 6-25-98 REVISION: 2      Z:\2012 PROJECTS\2012-656 JOYCE - Cobles\2012-656-12-01 SIEVON REV 4 wHeader.xls\Sheet1

### WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID	2012-656-12-01	Soil Color	TAN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	838	Tare No.	NA
Wgt. Tare + Wet Specimen (gm)	1182.03	Wgt. Tare + Wet Specimen (gm)	NA
Wgt. Tare + Dry Specimen (gm)	1097.38	Wgt. Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	261.60	Weight of Tare (gm)	NA
Weight of Water (gm)	84.65	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	835.78	Weight of Dry Soil (gm)	NA
<b>Moisture Content (%)</b>	<b>10.1</b>	<b>Moisture Content (%)</b>	<b>NA</b>

Wet Weight -3/4" Sample (gm)	22500	Weight of the Dry Specimen (gm)	835.78
Dry Weight - 3/4" Sample (gm)	276.5	Weight of minus #200 material (gm)	559.25
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	276.53
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

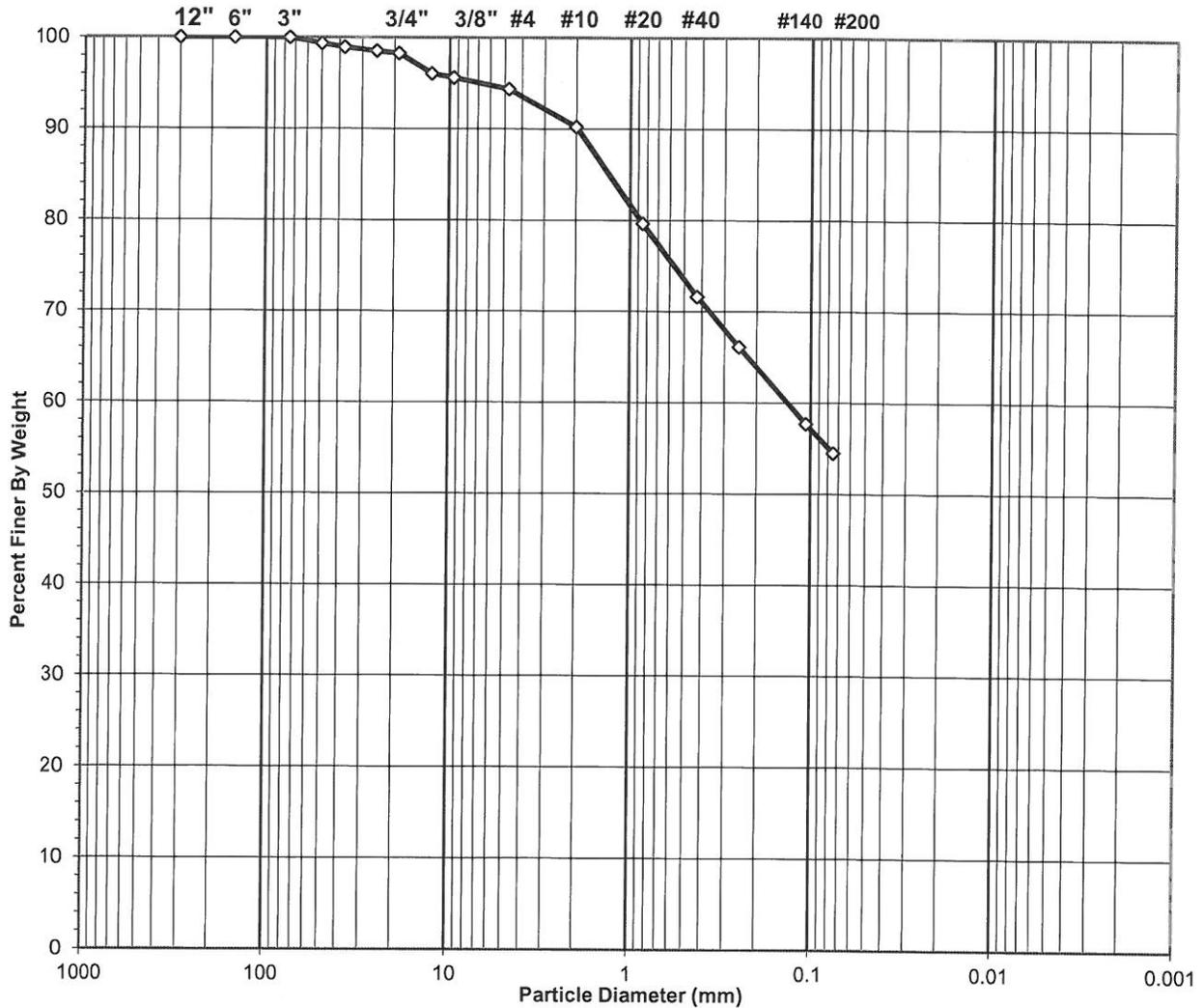
Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	0.00	0.0	0.0	100.0	100.0
1 1/2"	37.5	0.00	0.0	0.0	100.0	100.0
1"	25.0	0.00	0.0	0.0	100.0	100.0
3/4"	19.0	0.00	0.0	0.0	100.0	100.0
1/2"	12.50	0.00	0.0	0.0	100.0	100.0
3/8"	9.50	8.66	1.0	1.0	99.0	99.0
#4	4.75	22.78	2.7	3.8	96.2	96.2
#10	2.00	28.70	3.4	7.2	92.8	92.8
#20	0.850	53.02	6.3	13.5	86.5	86.5
#40	0.425	45.73	5.5	19.0	81.0	81.0
#60	0.250	30.25	3.6	22.6	77.4	77.4
#140	0.106	58.57	7.0	29.6	70.4	70.4
#200	0.075	28.82	3.4	33.1	66.9	66.9
Pan	-	559.25	66.9	100.0	-	-

Tested By SFS Date 9/28/2012 Checked By BW Date 10-2-12

**SIEVE ANALYSIS**  
ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-02	Soil Color	<b>BROWN</b>

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol**      **ML, TESTED**

**USCS Classification** **SANDY SILT**

Tested By SFS      Date 10/1/2012      Checked By BW      Date 10-3-12

### WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-02	Soil Color	<b>BROWN</b>

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	201	Tare No.	SS-1
Wgt. Tare + Wet Specimen (gm)	1020.98	Wgt. Tare + Wet Specimen (gm)	477.94
Wgt. Tare + Dry Specimen (gm)	876.43	Wgt. Tare + Dry Specimen (gm)	459.62
Weight of Tare (gm)	170.59	Weight of Tare (gm)	94.46
Weight of Water (gm)	144.55	Weight of Water (gm)	18.32
Weight of Dry Soil (gm)	705.84	Weight of Dry Soil (gm)	365.16
<b>Moisture Content (%)</b>	<b>20.5</b>	<b>Moisture Content (%)</b>	<b>5.0</b>

Wet Weight -3/4" Sample (gm)	24050	Weight of the Dry Specimen (gm)	705.84
Dry Weight - 3/4" Sample (gm)	19962.0	Weight of minus #200 material (gm)	391.36
Wet Weight +3/4" Sample (gm)	365.16	Weight of plus #200 material (gm)	314.48
Dry Weight + 3/4" Sample (gm)	347.72		
Total Dry Weight Sample (gm)	20309.7	<b>J - Factor (Percent Finer than 3/4")</b>	<b>0.9829</b>

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	136.94	(*) 0.6	0.6	99.4	99.4
1 1/2"	37.5	85.83	0.4	1.0	99.0	99.0
1"	25	91.29	0.4	1.5	98.5	98.5
3/4"	19	51.10	0.2	1.7	98.3	98.3
1/2"	12.5	16.04	2.3	2.3	97.7	96.1
3/8"	9.5	3.16	0.4	2.7	97.3	95.6
#4	4.75	8.93	1.3	4.0	96.0	94.4
#10	2	29.76	4.2	8.2	91.8	90.2
#20	0.85	76.07	(**) 10.8	19.0	81.0	79.6
#40	0.425	57.54	8.2	27.1	72.9	71.6
#60	0.25	39.45	5.6	32.7	67.3	66.1
#140	0.106	60.60	8.6	41.3	58.7	57.7
#200	0.075	22.93	3.2	44.6	55.4	54.5
Pan	-	391.36	55.4	100.0	-	-

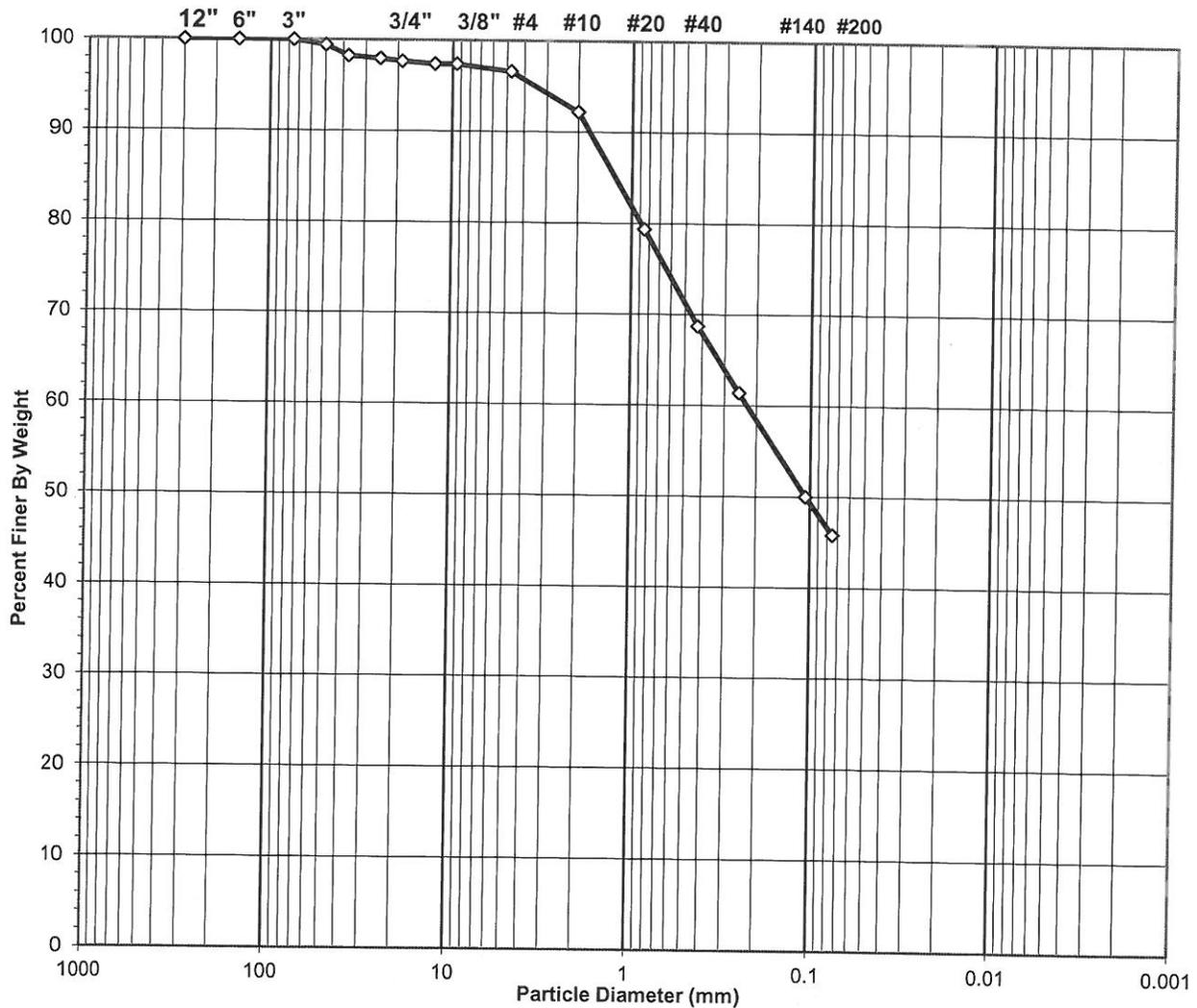
**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By SFS Date 10/1/2012 Checked By BW Date 10-3-12

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-03	Soil Color	REDDISH BROWN

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol** SM, TESTED

**USCS Classification** SILTY SAND

Tested By SFS Date 10/1/2012 Checked By BW Date 10-3-12

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-03	Soil Color	REDDISH BROWN

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	P12	Tare No.	822.00
Wgt. Tare + Wet Specimen (gm)	1263.20	Wgt. Tare + Wet Specimen (gm)	708.33
Wgt. Tare + Dry Specimen (gm)	1128.56	Wgt. Tare + Dry Specimen (gm)	689.70
Weight of Tare (gm)	196.32	Weight of Tare (gm)	136.94
Weight of Water (gm)	134.64	Weight of Water (gm)	18.63
Weight of Dry Soil (gm)	932.24	Weight of Dry Soil (gm)	552.76
<b>Moisture Content (%)</b>	<b>14.4</b>	<b>Moisture Content (%)</b>	<b>3.4</b>

Wet Weight -3/4" Sample (gm)	25650	Weight of the Dry Specimen (gm)	932.24
Dry Weight - 3/4" Sample (gm)	22413.0	Weight of minus #200 material (gm)	437.22
Wet Weight +3/4" Sample (gm)	552.74	Weight of plus #200 material (gm)	495.02
Dry Weight + 3/4" Sample (gm)	534.72		
Total Dry Weight Sample (gm)	22947.7	<b>J - Factor (Percent Finer than 3/4")</b>	<b>0.9767</b>

Sieve Size	Sieve Opening (mm)	Wgt. of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.0	0.0	100.0	100.0
6"	150	0.00	0.0	0.0	100.0	100.0
3"	75	0.00	0.0	0.0	100.0	100.0
2"	50	138.18	(*) 0.6	0.6	99.4	99.4
1 1/2"	37.5	276.40	1.2	1.7	98.3	98.3
1"	25	69.12	0.3	2.0	98.0	98.0
3/4"	19	69.04	0.3	2.3	97.7	97.7
1/2"	12.5	2.64	0.3	0.3	99.7	97.4
3/8"	9.5	0.00	0.0	0.3	99.7	97.4
#4	4.75	7.48	0.8	1.1	98.9	96.6
#10	2	42.07	4.5	5.6	94.4	92.2
#20	0.85	122.57	(**) 13.1	18.7	81.3	79.4
#40	0.425	101.52	10.9	29.6	70.4	68.7
#60	0.25	69.90	7.5	37.1	62.9	61.4
#140	0.106	108.58	11.6	48.8	51.2	50.0
#200	0.075	40.26	4.3	53.1	46.9	45.8
Pan	-	437.22	46.9	100.0	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By SFS Date 10/1/2012 Checked By BW Date 10-3-12



## MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID	2012-656-12-01		

Visual Description      TAN SANDY SILT

Total Weight of the Sample (gm)	22500
As Received Water Content(%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	0
Percent Retained on 3/8"	0
Percent Retained on #4	1
Oversize Material	INC.
Procedure Used	A

TestType	<b>STANDARD</b>	
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type	MECHANICAL	
Machine ID	R	174
Mold ID	R	172
Mold diameter		4"
Weight of the Mold		4284
Volume of the Mold(cc)		941

### Mold / Specimen

Point No.	1	2	3	4	5
Wt. of Mold & WS (gm)	6047	6129	6180	6204	6174
Wt. of Mold (gm)	4284	4284	4284	4284	4284
Wt. of WS	1764	1846	1897	1920	1890
Mold Volume (cc)	941	941	941	941	941

### Moisture Content / Density

Tare Number	307	827	803	818	8010
Wt. of Tare & WS (gm)	742.15	656.60	407.40	523.10	573.30
Wt. of Tare & DS (gm)	678.75	591.01	362.27	458.52	493.52
Wt. of Tare (gm)	110.41	136.40	103.60	137.30	136.10
Wt. of Water (gm)	63.40	65.59	45.13	64.58	79.78
Wt. of DS (gm)	568.34	454.61	258.67	321.22	357.42

Wet Density (gm/cc)	1.87	1.96	2.02	2.04	2.01
Wet Density (pcf)	116.9	122.4	125.7	127.3	125.3
<b>Moisture Content (%)</b>	<b>11.2</b>	<b>14.4</b>	<b>17.4</b>	<b>20.1</b>	<b>22.3</b>
<b>Dry Density (pcf)</b>	<b>105.2</b>	<b>106.9</b>	<b>107.1</b>	<b>106.0</b>	<b>102.4</b>

### Zero Air Voids

<b>Moisture Content (%)</b>	19.0	21.0	24.0
<b>Dry Unit Weight (pcf)</b>	111.4	107.5	102.2

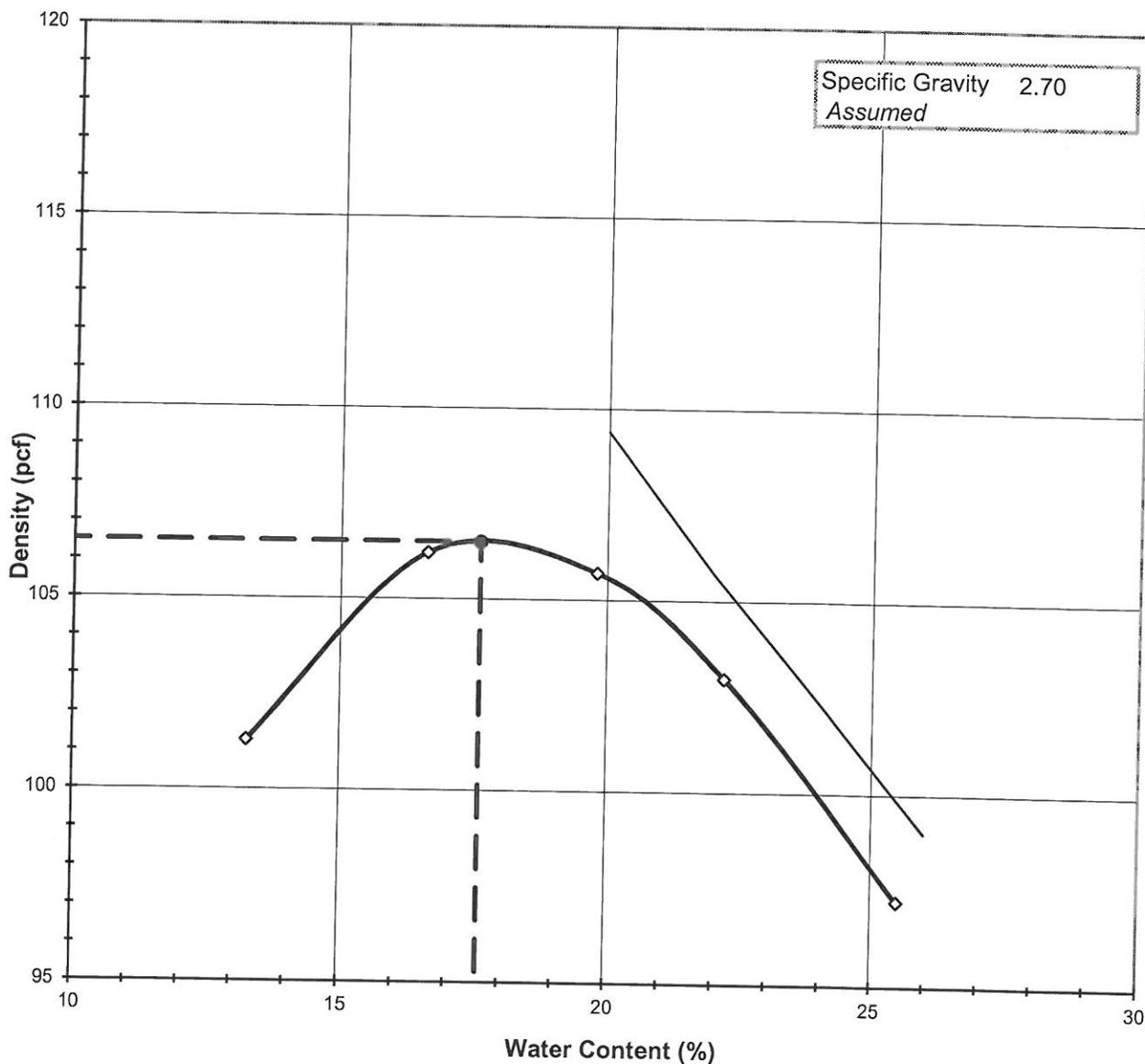
Tested By JBD      Date 9/28/2012      Checked By BW      Date 10/4/12

### MOISTURE DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID	2012-656-12-02	Test Method	<b>STANDARD</b>
Visual Description	BROWN SANDY SILT		

**Optimum Water Content 17.6**  
**Maximum Dry Density 106.5**



Tested By SFS Date 10/2/2012 Checked By BW Date 10/4/12

## MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID	2012-656-12-02		
Visual Description	BROWN SANDY SILT		

Total Weight of the Sample (gm)	24050
As Received Water Content(%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	2
Percent Retained on 3/8"	2
Percent Retained on #4	4
Oversize Material	INC.
Procedure Used	A

TestType	<b>STANDARD</b>	
Rammer Weight (lbs)	5.5	
Rammer Drop (in)	12	
Rammer Type	MECHANICAL	
Machine ID	R	174
Mold ID	R	172
Mold diameter	4"	
Weight of the Mold	4284	
Volume of the Mold(cc)	941	

### Mold / Specimen

Point No.	1	2	3	4	5
Wt. of Mold & WS (gm)	6014	6152	6194	6182	6124
Wt. of Mold (gm)	4284	4284	4284	4284	4284
Wt. of WS	1731	1868	1910	1898	1840
Mold Volume (cc)	941	941	941	941	941

### Moisture Content / Density

Tare Number	300	317	304	305	312
Wt. of Tare & WS (gm)	795.81	1049.91	819.29	872.73	780.45
Wt. of Tare & DS (gm)	715.55	912.34	702.17	729.63	639.06
Wt. of Tare (gm)	111.08	84.54	110.87	85.05	84.61
Wt. of Water (gm)	80.26	137.57	117.12	143.10	141.39
Wt. of DS (gm)	604.47	827.80	591.30	644.58	554.45

Wet Density (gm/cc)	1.84	1.98	2.03	2.02	1.96
Wet Density (pcf)	114.7	123.9	126.6	125.8	122.0
<b>Moisture Content (%)</b>	<b>13.3</b>	<b>16.6</b>	<b>19.8</b>	<b>22.2</b>	<b>25.5</b>
<b>Dry Density (pcf)</b>	<b>101.3</b>	<b>106.2</b>	<b>105.7</b>	<b>103.0</b>	<b>97.2</b>

### Zero Air Voids

Moisture Content (%)	17.0	19.0	23.2
Dry Unit Weight (pcf)	115.5	111.4	103.6

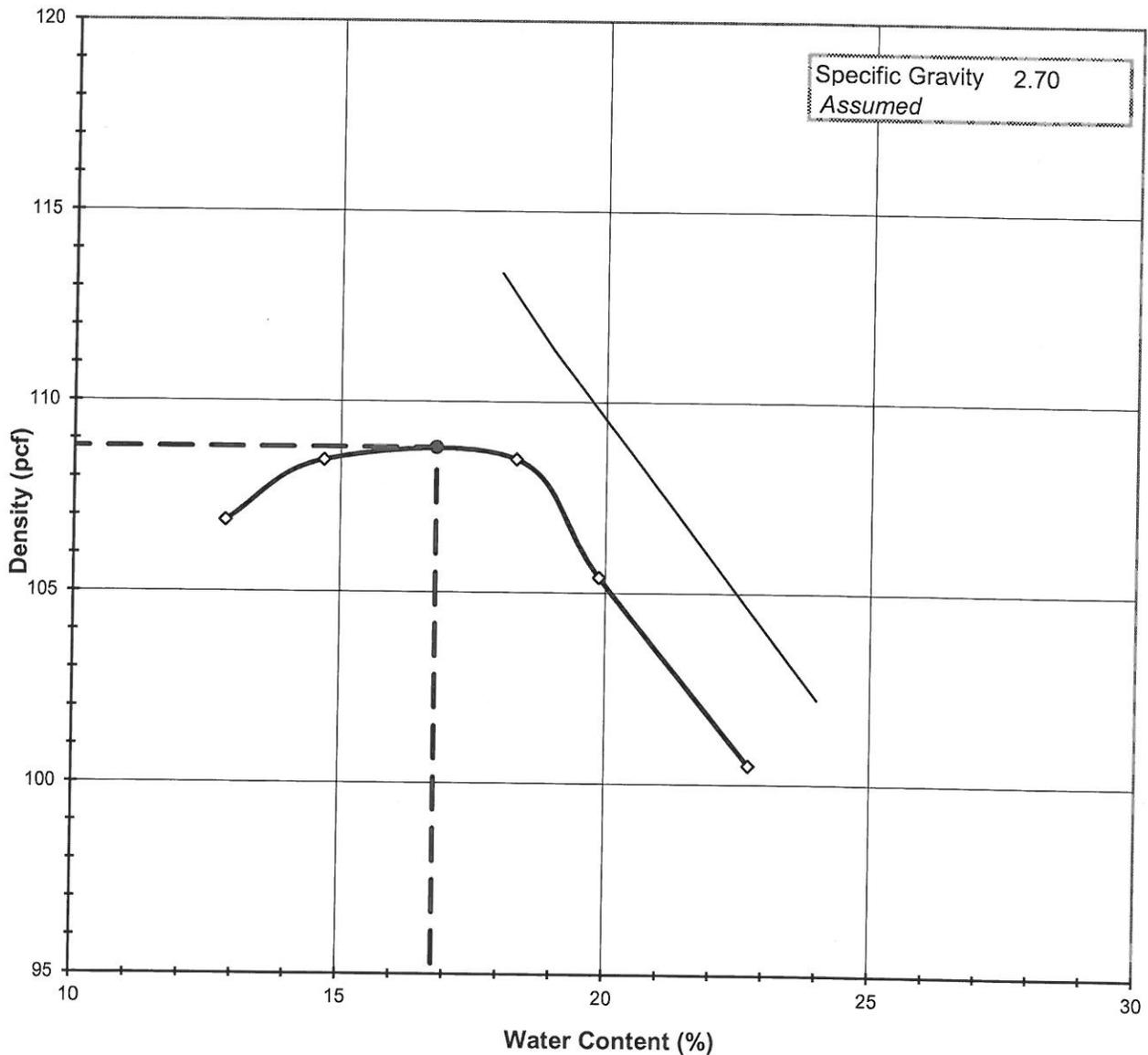
Tested By SFS Date 10/2/2012 Checked By BW Date 10/3/12

**MOISTURE DENSITY RELATIONSHIP**

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-03	Test Method	<b>STANDARD</b>
Visual Description	REDDISH BROWN SILTY SAND		

**Optimum Water Content 16.8**  
**Maximum Dry Density 108.8**



Tested By SFS Date 10/2/2012 Checked By BW Date 10-3-12

## MOISTURE - DENSITY RELATIONSHIP

ASTM D698-07e1 SOP-S12

Client	JOYCE ENGINEERING	Boring No.	NA
Client Reference	COBLE SR	Depth (ft)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID	2012-656-12-03		

Visual Description      REDDISH BROWN SILTY SAND

Total Weight of the Sample (gm)	25650
As Received Water Content(%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	2
Percent Retained on 3/8"	3
Percent Retained on #4	4
Oversize Material	INC.
Procedure Used	A

TestType	<b>STANDARD</b>	
Rammer Weight (lbs)		5.5
Rammer Drop (in)		12
Rammer Type	MECHANICAL	
Machine ID	R	174
Mold ID	R	172
Mold diameter		4"
Weight of the Mold		4284
Volume of the Mold(cc)		941

### Mold / Specimen

Point No.	1	2	3	4	5
Wt. of Mold & WS (gm)	6102	6160	6220	6189	6144
Wt. of Mold (gm)	4284	4284	4284	4284	4284
Wt. of WS	1819	1876	1936	1906	1860
Mold Volume (cc)	941	941	941	941	941

### Moisture Content / Density

	307	303	309	310	368
Tare Number	307	303	309	310	368
Wt. of Tare & WS (gm)	831.06	833.79	878.31	810.13	826.45
Wt. of Tare & DS (gm)	749.11	741.33	759.36	694.11	694.03
Wt. of Tare (gm)	110.45	111.55	109.58	110.40	111.36
Wt. of Water (gm)	81.95	92.46	118.95	116.02	132.42
Wt. of DS (gm)	638.66	629.78	649.78	583.71	582.67

Wet Density (gm/cc)	1.93	1.99	2.06	2.02	1.98
Wet Density (pcf)	120.6	124.4	128.4	126.4	123.3
<b>Moisture Content (%)</b>	<b>12.8</b>	<b>14.7</b>	<b>18.3</b>	<b>19.9</b>	<b>22.7</b>
<b>Dry Density (pcf)</b>	<b>106.9</b>	<b>108.5</b>	<b>108.5</b>	<b>105.4</b>	<b>100.5</b>

### Zero Air Voids

Moisture Content (%)	18.0	19.0	24.0
Dry Unit Weight (pcf)	113.4	111.4	102.2

Tested By    SFS      Date    10/2/2012    Checked By    BW      Date    10-3-12

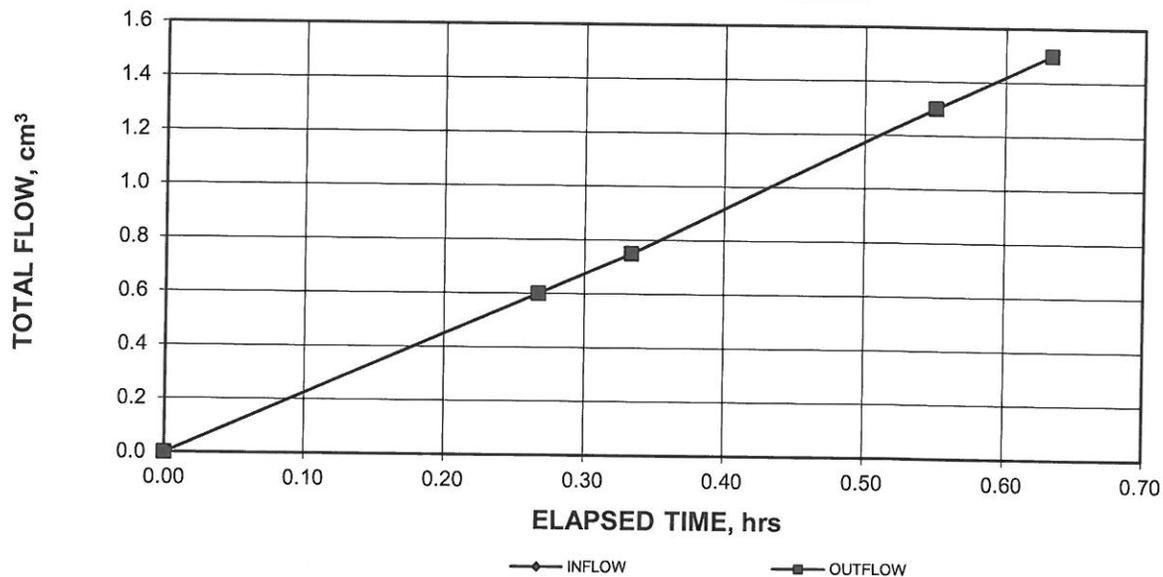
# PERMEABILITY TEST

ASTM D 5084-03

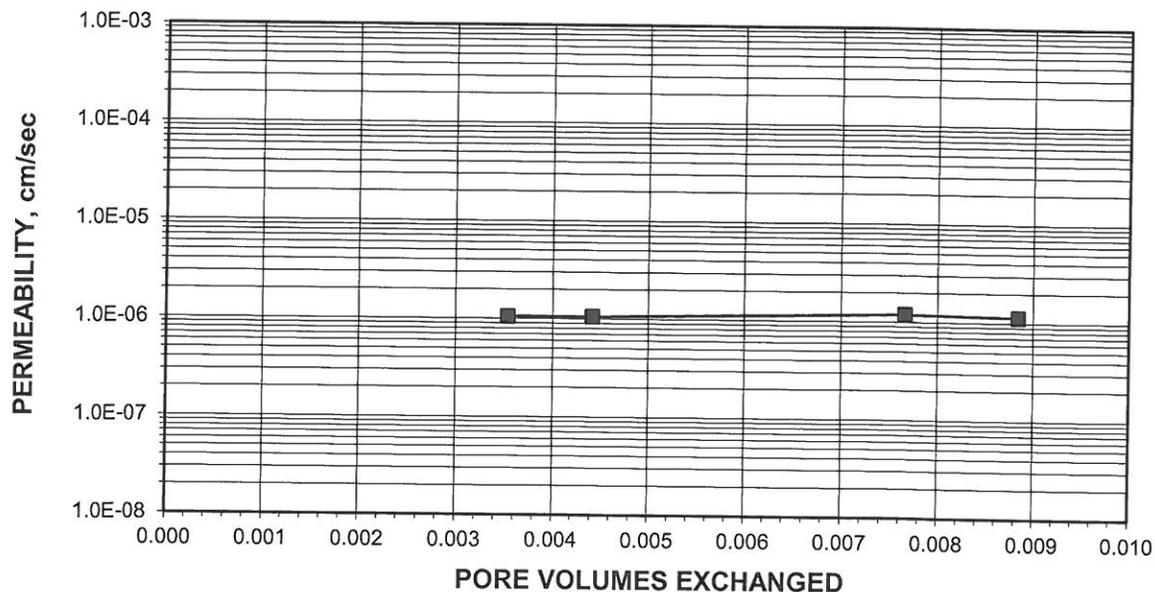
Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID No.	2012-656-12-02		

AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 10/4/2012 Checked By: *GM* Date: 10-8-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID No.	2012-656-12-02		

Specific Gravity	2.64 Measured
Sample Condition	Remolded

Visual Description: BROWN SANDY SILT

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	818	824
Wt. of Tare & WS (gm.)	331.00	429.98
Wt. of Tare & DS (gm.)	300.45	372.76
Wt. of Tare (gm.)	137.21	135.44
Wt. of Water (gm.)	30.55	57.22
Wt. of DS (gm.)	163.24	237.32
Moisture Content (%)	18.7	24.1

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2460.12	NA
Wt. of Tube (gm.)	1634.69	NA
Wt. of WS (calc.)(gm.)	825.43	862.95
Length 1 (in.)	4.003	4.054
Length 2 (in.)	4.003	4.008
Length 3 (in.)	4.003	4.086
Top Diameter (in.)	2.869	2.883
Middle Diameter (in.)	2.869	2.886
Bottom Diameter (in.)	2.869	2.879
Average Length (in.)	4.00	4.05
Average Area (in. <sup>2</sup> )	6.46	6.53
Sample Volume (cm <sup>3</sup> )	424.07	433.08
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.95	1.99
Unit Wet Wt. (pcf)	121.5	124.4
Unit Dry Wt. (pcf)	102.3	100.2
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.64	1.61
Void Ratio, e	0.61	0.64
Porosity, n	0.38	0.39
Pore Volume (cm <sup>3</sup> )	160.7	169.7
Total Wgt. Of Sample After Test		866.13

Tested By: BW

Date: 10/4/2012

Checked By: *GJM*

Date: 10-8-12

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-2
Lab ID No.	2012-656-12-02		

### Pressure Heads (Constant)

Top Cap (psi)	38.5
Bottom Cap (psi)	40.0
Cell (psi)	45.0
Total Pressure Head (cm)	105.5
Hydraulic Gradient	10.25

### Final Sample Dimensions

Sample Length (cm), L	10.29
Sample Diameter (cm)	7.32
Sample Area (cm <sup>2</sup> ), A	42.11
Inflow Burette Area (cm <sup>2</sup> ), a-in	0.877
Outflow Burette Area (cm <sup>2</sup> ), a-out	0.886
B Parameter (%)	96

**AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. ( °C )	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
10/5/2012	11	8	0.00	0.0	0.0	129.0	0	24.6	NA
10/5/2012	11	24	0.27	0.6	0.6	127.6	0	24.7	1.1E-06
10/5/2012	11	28	0.33	0.8	0.8	127.3	0	24.7	1.1E-06
10/5/2012	11	41	0.55	1.3	1.3	126.1	0	24.7	1.2E-06
10/5/2012	11	46	0.63	1.5	1.5	125.6	1	24.7	1.1E-06

Tested By: BW      Date: 10/4/2012      Checked By: *Cam*      Date: 10-8-12

# PERMEABILITY TEST

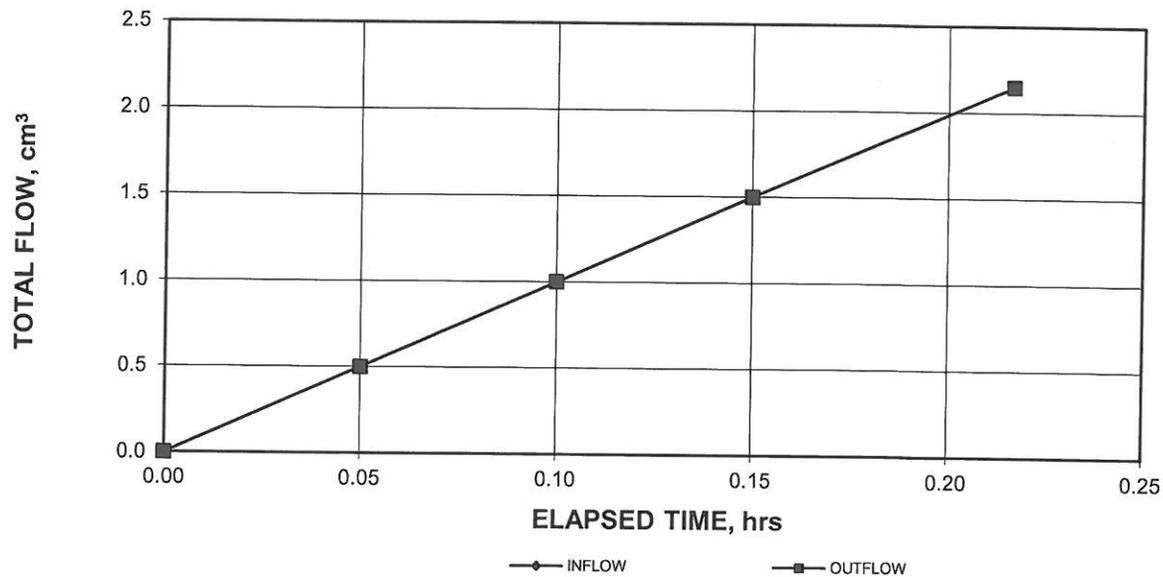
ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID No.	2012-656-12-01		

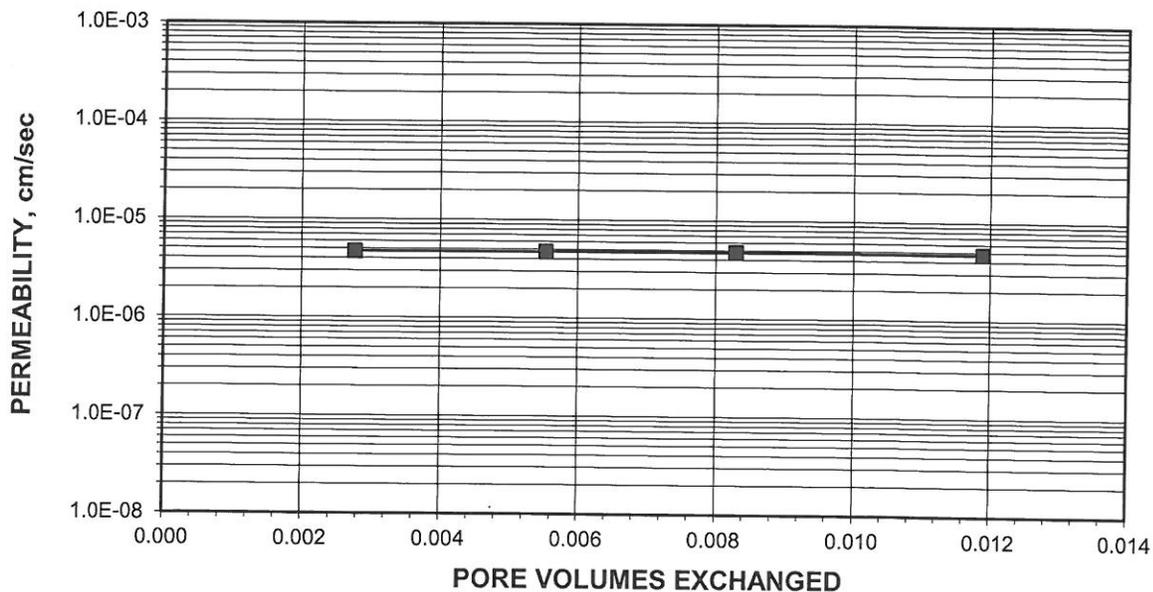
AVERAGE PERMEABILITY = 4.7E-06 cm/sec @ 20°C

AVERAGE PERMEABILITY = 4.7E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 10/4/2012 Checked By: *Gan* Date: 10-8-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID No.	2012-656-12-01		

Specific Gravity	2.68 Measured
Sample Condition	Remolded

Visual Description: TAN SANDY SILT

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	8010	8010
Wt. of Tare & WS (gm.)	315.33	441.37
Wt. of Tare & DS (gm.)	288.09	379.83
Wt. of Tare (gm.)	135.97	135.98
Wt. of Water (gm.)	27.24	61.54
Wt. of DS (gm.)	152.12	243.85
 Moisture Content (%)	 <b>17.9</b>	 <b>25.2</b>

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2452.42	NA
Wt. of Tube (gm.)	1634.12	NA
Wt. of WS (calc.)(gm.)	818.30	869.17
Length 1 (in.)	4.003	4.101
Length 2 (in.)	4.003	4.103
Length 3 (in.)	4.003	4.071
Top Diameter (in.)	2.869	2.893
Middle Diameter (in.)	2.869	2.896
Bottom Diameter (in.)	2.869	2.880
 Average Length (in.)	 4.00	 4.09
Average Area (in. <sup>2</sup> )	6.46	6.56
Sample Volume (cm <sup>3</sup> )	424.07	439.73
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.93	1.98
Unit Wet Wt. (pcf)	120.5	123.4
Unit Dry Wt. (pcf)	102.2	98.5
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.64	1.58
Void Ratio, e	0.64	0.70
Porosity, n	0.39	0.41
Pore Volume (cm <sup>3</sup> )	165.1	180.8
Total Wgt. Of Sample After Test		869.92

Tested By: BW      Date: 10/4/2012      Checked By: *GM*      Date: 10-8-12

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-1
Lab ID No.	2012-656-12-01		

### Pressure Heads (Constant)

Top Cap (psi)	38.5
Bottom Cap (psi)	40.0
Cell (psi)	45.0
Total Pressure Head (cm)	105.5
Hydraulic Gradient	10.15

### Final Sample Dimensions

Sample Length (cm), L	10.39
Sample Diameter (cm)	7.34
Sample Area (cm <sup>2</sup> ), A	42.31
Inflow Burette Area (cm <sup>2</sup> ), a-in	0.897
Outflow Burette Area (cm <sup>2</sup> ), a-out	0.878
B Parameter (%)	95

**AVERAGE PERMEABILITY = 4.7E-06 cm/sec @ 20°C**

**AVERAGE PERMEABILITY = 4.7E-08 m/sec @ 20°C**

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
10/5/2012	12	17	0.00	0.0	0.0	129.0	0	24.8	NA
10/5/2012	12	20	0.05	0.5	0.5	127.9	0	24.8	4.7E-06
10/5/2012	12	23	0.10	1.0	1.0	126.8	0	24.8	4.8E-06
10/5/2012	12	26	0.15	1.5	1.5	125.6	0	24.8	4.8E-06
10/5/2012	12	30	0.22	2.2	2.2	124.2	1	24.8	4.7E-06

Tested By: BW

Date: 10/4/2012

Checked By:

*GM*

Date: 10-8-12

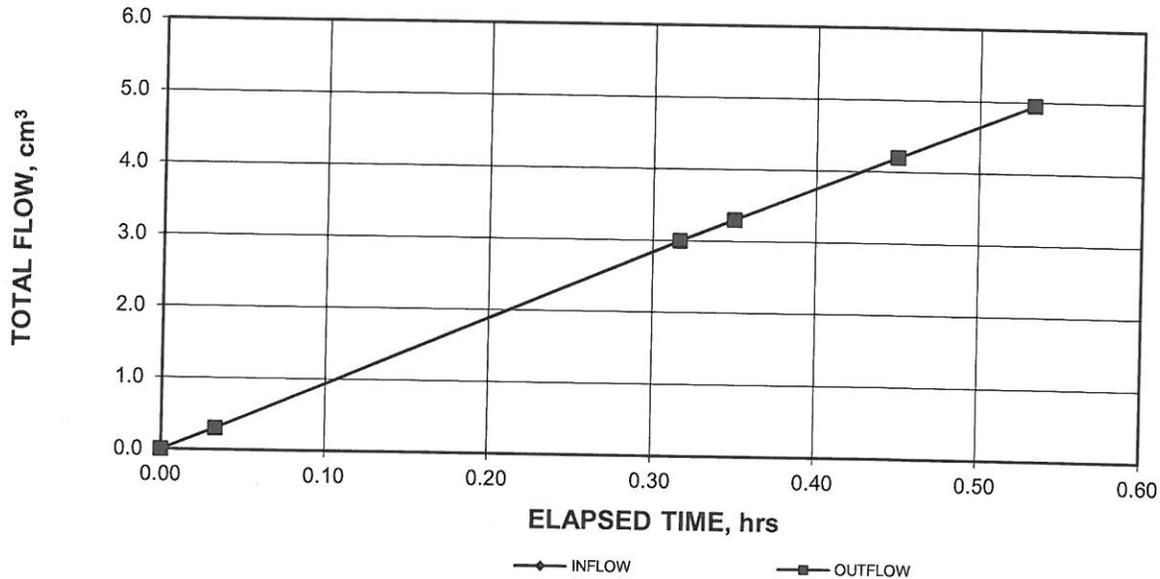
# PERMEABILITY TEST

ASTM D 5084-03

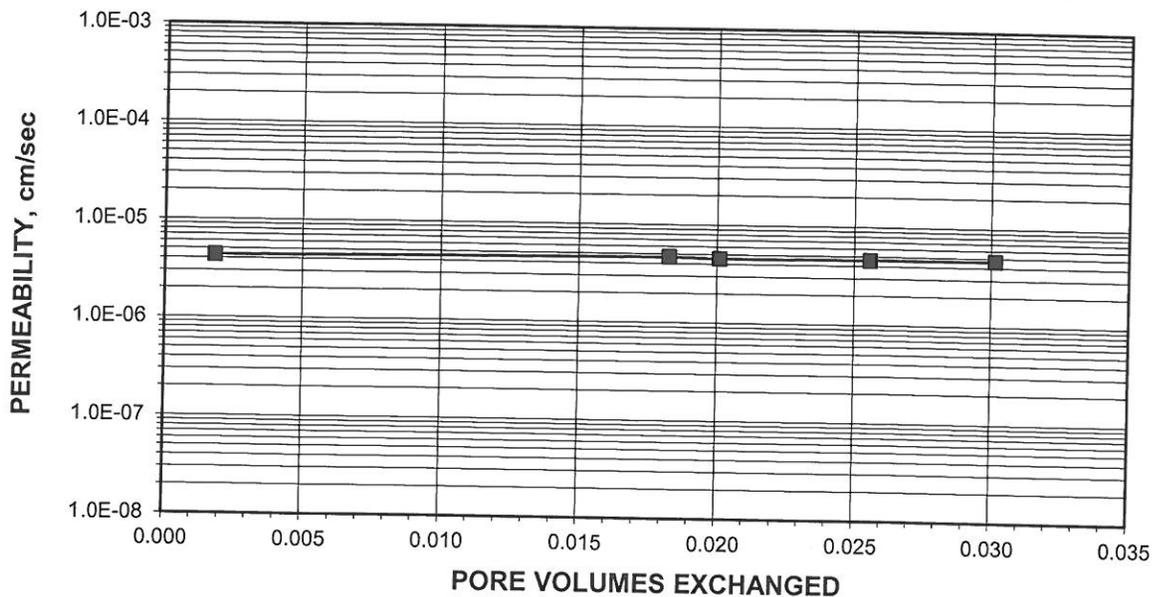
Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID No.	2012-656-12-03		

AVERAGE PERMEABILITY = 4.6E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 4.6E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 10/4/2012 Checked By: GJM Date: 10-8-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID No.	2012-656-12-03		

Specific Gravity	2.67 Measured
Sample Condition	Remolded

Visual Description: REDDISH BROWN SILTY SAND

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	6	825
Wt. of Tare & WS (gm.)	79.93	454.34
Wt. of Tare & DS (gm.)	73.06	396.13
Wt. of Tare (gm.)	36.63	137.07
Wt. of Water (gm.)	6.87	58.21
Wt. of DS (gm.)	36.43	259.06
Moisture Content (%)	<b>18.9</b>	<b>22.5</b>

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2469.20	NA
Wt. of Tube (gm.)	1633.99	NA
Wt. of WS (calc.)(gm.)	835.21	860.59
Length 1 (in.)	4.003	4.038
Length 2 (in.)	4.003	4.054
Length 3 (in.)	4.003	4.071
Top Diameter (in.)	2.869	2.847
Middle Diameter (in.)	2.869	2.868
Bottom Diameter (in.)	2.869	2.871
Average Length (in.)	4.00	4.05
Average Area (in. <sup>2</sup> )	6.46	6.43
Sample Volume (cm <sup>3</sup> )	424.07	427.41
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.97	2.01
Unit Wet Wt. (pcf)	122.9	125.7
Unit Dry Wt. (pcf)	103.4	102.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.66	1.64
Void Ratio, e	0.61	0.62
Porosity, n	0.38	0.38
Pore Volume (cm <sup>3</sup> )	160.9	164.2
Total Wgt. Of Sample After Test		867.01

Tested By: BW

Date: 10/4/2012 Checked By:

*Gan*

Date: 10-8-12

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	NA
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-12	Sample No.	P-3
Lab ID No.	2012-656-12-03		

### Pressure Heads (Constant)

Top Cap (psi)	38.5
Bottom Cap (psi)	40.0
Cell (psi)	45.0
Total Pressure Head (cm)	105.5
Hydraulic Gradient	10.24

### Final Sample Dimensions

Sample Length (cm), L	10.30
Sample Diameter (cm)	7.27
Sample Area (cm <sup>2</sup> ), A	41.50
Inflow Burette Area (cm <sup>2</sup> ), a-in	0.897
Outflow Burette Area (cm <sup>2</sup> ), a-out	0.878
B Parameter (%)	100

AVERAGE PERMEABILITY = 4.6E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 4.6E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
10/5/2012	11	5	0.00	0.0	0.0	127.9	0	24.6	NA
10/5/2012	11	7	0.03	0.3	0.3	127.2	0	24.6	4.3E-06
10/5/2012	11	24	0.32	3.0	3.0	121.2	0	24.7	4.7E-06
10/5/2012	11	26	0.35	3.3	3.3	120.5	0	24.7	4.6E-06
10/5/2012	11	32	0.45	4.2	4.2	118.5	0	24.7	4.6E-06
10/5/2012	11	37	0.53	5.0	5.0	116.8	1	24.7	4.7E-06

Tested By: BW

Date: 10/4/2012

Checked By:

*GM*

Date: 10-8-12

APPENDIX 2 – DAILY FIELD REPORTS

Day: Friday  
 Date: 13-Apr  
 Log No.: 1  
 Page: 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu Kempinenn
<b>Site Location:</b>	Kimesville, NC	<b>Time on Site:</b>	Arrived: 9:45 Departed: 3:00
<b>General Contractor:</b>	Cobles Sandrock LF	<b>Superintendent:</b>	Kent
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Sunny	<b>Temperature:</b>	65
<b>Contractor's Equipment:</b>			
<b>Contractor's Personnel:</b>			
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Arrived on site checked in at scale house and met with Hannu Kemmpinen of Joyce.</li> <li>▪ Hannu explained the site status and we then walked the area to be tested. The area was approximately 4 acres and included a test pad.</li> <li>▪ Hannu directed the testing on-site and identified the test locations. Several tests were taken over the 4 acre area.</li> <li>▪ Compaction testing with Nuclear Density gauge and Drive Cylinders was performed.(see attached)</li> <li>▪ Four shelby tube samples were taken for permeability testing.</li> </ul>			
<b>Prepared By:</b>	MPS	<b>Date:</b>	4/13/12
		<b>Checked By:</b>	<i>[Signature]</i>
		<b>Date:</b>	5/10



Client: JOYCE ENGINEERING  
 Project Name: COBLES SANDROCK LANDFILL  
 Project Number: 2012-656

### Field Density Report

Report Number: FDR-01  
 Date(s): 13-Apr  
 Geotechnics Representative: M. SMITH  
 Reviewed By: *MS*  
 Page: 1 OF 1  
 Date: 5/12

Contractor: COBLE SR LF  
 Borrow Source: ON-SITE

Compaction Equipment: Scraper pans, track hoe, compactor

Test Number	Test Location	Elevation/ Lift	Rod Depth	Proctor I.D. No.	Proctor Data		Measured In Place		Compaction		Comments
					MDD pcf	Opt. %M	WD (pcf)	% M	DD (pcf)	% C	
ND 01	ACRE 1	LIFT 1	6"	656-01-01	105.6	18.2	118.0	18.9	99.2	94.0%	90.0%
ND 02	ACRE 1	LIFT 1	6"	656-01-01	105.6	18.2	122.9	20.7	101.8	96.4%	90.0%
ND 03	ACRE 1	LIFT 1	6"	656-01-01	105.6	18.2	115.6	21.0	95.5	90.5%	90.0%
ND 04	ACRE 1	LIFT 1	6"	656-01-01	105.6	18.2	113.4	20.4	94.2	89.2%	90.0%
ND 05	ACRE 2	LIFT 1	6"	656-01-02	112.8	15.1	128.9	21.3	106.3	94.2%	90.0%
ND 06	ACRE 2	LIFT 1	6"	656-01-01	105.6	18.2	117.1	21.8	96.1	91.0%	90.0%
ND 07	ACRE 3	LIFT 1	6"	656-01-01	105.6	18.2	116.1	21.3	95.7	90.6%	90.0%
ND 08	ACRE 3	LIFT 1	6"	656-01-01	105.6	18.2	118.9	25.4	94.8	89.8%	90.0%
ND 09	ACRE 4	LIFT 1	6"	656-01-01	105.6	18.2	115.8	24.2	93.2	88.3%	90.0%
ND 10	ACRE 4	LIFT 1	6"	656-01-01	105.6	18.2	117.9	22.0	96.6	91.5%	90.0%
ND 11	ACRE 2	LIFT 1	6"	656-01-01	105.6	18.2	118.6	22.5	96.8	91.7%	90.0%
ND 12	ACRE 2	LIFT 1	6"	656-01-01	105.6	18.2	116.5	20.0	97.1	91.9%	90.0%
ND 13	ACRE 3	LIFT 1	6"	656-01-01	105.6	18.2	120.5	22.1	98.7	93.5%	90.0%
ND 14	ACRE 3	LIFT 1	6"	656-01-01	105.6	18.2	120.7	18.2	102.1	96.7%	90.0%
ND 15	ACRE 3	LIFT 1	6"	656-01-02	112.8	15.1	124.2	22.2	101.6	90.1%	90.0%
ND 16	ACRE 3	LIFT 1	6"	656-01-02	112.8	15.1	123.8	23.7	100.1	88.7%	90.0%
ND 17	ACRE 2	LIFT 1	6"	656-01-02	112.8	15.1	131.1	24.1	105.6	93.7%	90.0%
ND 18	ACRE 2	LIFT 1	6"	656-01-01	105.6	18.2	115.0	19.6	96.2	91.1%	90.0%
ND 19	ACRE 4	LIFT 1	6"	656-01-02	112.8	15.1	129.8	19.6	108.5	96.2%	90.0%
ND 20	ACRE 4	LIFT 1	6"	656-01-02	112.8	15.1	130.9	24.4	105.2	93.3%	90.0%
ND 21	ACRE 4	LIFT 1	6"	656-01-02	112.8	15.1	129.6	21.3	106.8	94.7%	90.0%
ND 22	ACRE 4	LIFT 1	6"	656-01-02	112.8	15.1	130.2	24.0	105.0	93.1%	90.0%
ND 23	ACRE 1	LIFT 1	6"	656-01-02	112.8	15.1	126.7	21.7	104.1	92.3%	90.0%
ND 24	ACRE 1	LIFT 1	6"	656-01-02	112.8	15.1	126.9	22.0	104.0	92.2%	90.0%

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3430	2431	644

Client: JOYCE ENGINEERING  
 Project Name : COBLES SANDROCK LANDFILL  
 Project Number : 2012-656



Report Number : FDR-01  
 Date (s) : 4/13/12

**Drive Cylinder - ASTM D 2937**

**Test Information**

Test Number :	DC-01	DC-02	DC-03	DC-04
Nuclear Test Number :				
Location:	T.P.	ACRE 2	ACRE 3	ACRE 4
Depth (ft):	LIFT 1	LIFT 1	LIFT 1	LIFT 1
Date :	13-Apr	13-Apr	13-Apr	13-Apr

**Mold**

Cylinder ID	Z	2	B	X
Weight of Cylinder (lbs.)	1.3	1.32	1.33	0.777
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033	0.033	0.0164

**Specimen**

Wt. of Cylinder & WS (lbs.)	5.54	5.46	5.38	2.88
Wt. of Cylinder (lbs.)	1.30	1.32	1.33	0.78
Wt. of WS	4.24	4.14	4.05	2.10
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033	0.033	0.016

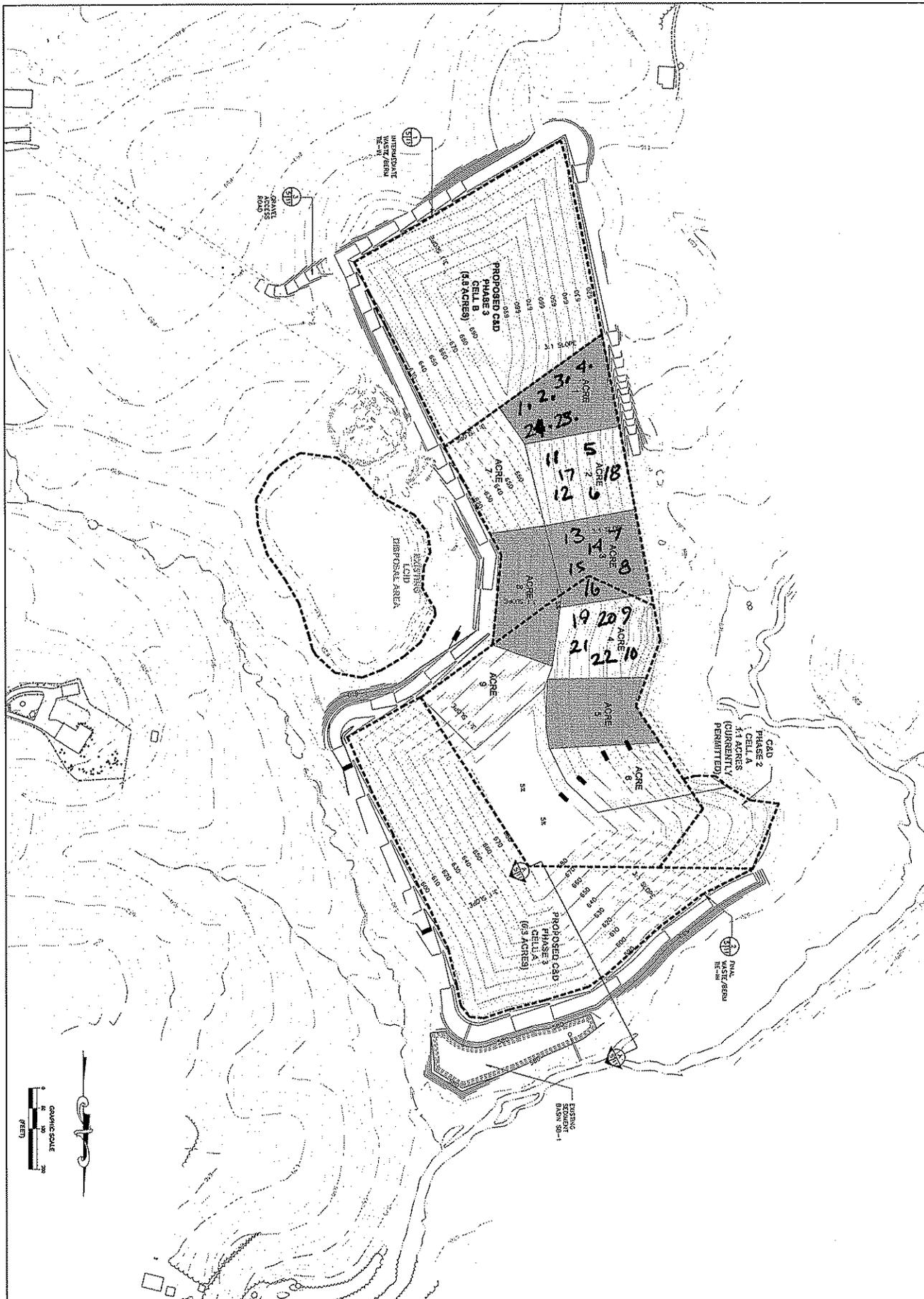
**Moisture / Density**

Tare Number	308	312	307	310
Wt. of Tare & WS (gm)	542.41	512.10	558.46	411.68
Wt. of Tare & DS (gm)	469.74	465.31	507.99	366.34
Wt. of Tare (gm)	88.58	84.58	110.87	110.25
Wt. of Water (gm)	72.67	46.79	50.47	45.34
Wt. of DS (gm)	381.16	380.73	397.12	256.09
Wet Density (pcf):	128.5	125.5	122.7	128.2
Moisture Content (%):	19.1	12.3	12.7	17.7
Dry Density (pcf):	107.9	111.7	108.9	108.9

Geotechnics Representative :

M. SMITH

*MS*



DRAWING NO. 01	AS SHOWN	SCALE 4/19/20	PROJECT NO. 419.20	COBLE'S SANDROCK, INC. KIMESVILLE, NORTH CAROLINA		<b>JOYCE ENGINEERING</b> 2211 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 324-4052 NC CORP. LIC. 60782	DESIGNED: SC	1. NAME: EJA 2. DATE: 04/13/2012
				1. DATE: 04/13/2012 2. DATE: 04/13/2012	1. DATE: 04/13/2012 2. DATE: 04/13/2012			
				<b>LANDFILL PARTIAL CLOSURE ACRE MAP</b>		<b>FDR-01</b> <b>13-APR-2012</b>		
						1. NAME: EJA 2. DATE: 04/13/2012		
						1. NAME: EJA 2. DATE: 04/13/2012		

Day: Friday  
 Date: 5/4/2012  
 Log No.: 2  
 Page: 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu Kempinenn
<b>Site Location:</b>	Kimesville, NC	<b>Time on Site:</b>	<b>Arrived:</b> 11:10 AM <b>Departed:</b> 6:00 PM
<b>General Contractor:</b>	Cobles Sandrock LF	<b>Superintendent:</b>	Kent
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Sunny	<b>Temperature:</b>	80
<b>Contractor's Equipment:</b>	1 - Cat D6 Dozer, 1 - Sheepfoot Trash Compactor, 1 - Skid Pan		
<b>Contractor's Personnel:</b>	-3		
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Geotechnics rep. Shannon Sisell arrived on-site and met with Hannu Kempinenn. Hannu Kempinenn gave a summary of the site's history and direction for the day's objectives.</li> <li>▪ Performed 25 Moisture/Density Test on previously compacted Sandy Clay Material as directed by Hannu Kempinenn. All test met the 90% required compaction (see FDR-02).</li> <li>▪ Geotechnics rep. collected 5 Shelby Tubes.</li> <li>▪ Geotechnics rep. collected 5 Drive Cylinders.</li> <li>▪ Geotechnics rep. departed site.</li> </ul>			
<b>Prepared By:</b>	SFS	<b>Date:</b>	5/4/12
		<b>Checked By:</b>	<i>[Signature]</i>
		<b>Date:</b>	5-10-12



Client: JOYCE ENGINEERING  
 Project Name: COBLES SANDROCK LANDFILL  
 Project Number: 2012-656

### Field Density Report

Report Number: FDR-02	Geotechnics Representative: SHANNON SISELL	Page: 1 OF 1
Date (s): 5/3/2012	Reviewed By:	Date:

Contractor: COBLE SR LF Borrow Source: ON-SITE

Compaction Equipment: 1 - Cat D6 Dozer, 1 - Sheepfoot Trash Compactor, 1 - Skid Pan

Test Number	Test Location	Elevation/ Lift	Rod Depth	Proctor I.D. No.	Proctor Data		Measured in Place			Compaction		Comments
					MDD pcf	Opt. %M	WD (pcf)	% M	DD (pcf)	% C	% Req.	
ND 1	Acre 1	Lift 2	6"		112.8	15.1	125.9	8.9	115.6	102.5%	90%	%M Corrected
ND 2	Acre 1	Lift 2	6"		112.8	15.1	118.8	11.0	107.1	94.9%	90%	%M Corrected
ND 3	Acre 1	Lift 2	6"		112.8	15.1	126.3	6.6	118.5	105.0%	90%	%M Corrected
ND 4	Acre 1	Lift 2	6"		112.8	15.1	120.6	10.4	109.2	96.8%	90%	%M Corrected
ND 5	Acre 1	Lift 2	6"		112.8	15.1	115.6	16.3	99.4	88.1%	90%	%M Corrected
ND 6	Acre 2	Lift 1	6"		112.8	15.1	121.2	17.8	102.9	91.2%	90%	%M Corrected
ND 7	Acre 2	Lift 1	6"		105.6	18.2	122.5	16.0	105.6	100.0%	90%	%M Corrected
ND 8	Acre 2	Lift 1	6"		105.6	18.2	114.6	12.6	101.8	96.4%	90%	%M Corrected
ND 9	Acre 2	Lift 1	6"		105.6	18.2	117.2	21.9	96.1	91.0%	90%	%M Corrected
ND 10	Acre 2	Lift 1	6"		105.6	18.2	121.0	23.8	97.7	92.6%	90%	%M Corrected
ND 11	Acre 3	Lift 2	6"		105.6	18.2	109.3	11.7	97.8	92.6%	90%	%M Corrected
ND 12	Acre 3	Lift 2	6"		105.6	18.2	116.1	17.8	98.5	93.3%	90%	%M Corrected
ND 13	Acre 3	Lift 2	6"		105.6	18.2	116.7	18.1	98.8	93.6%	90%	%M Corrected
ND 14	Acre 3	Lift 2	6"		105.6	18.2	124.1	10.7	112.2	106.2%	90%	%M Corrected
ND 15	Acre 3	Lift 2	6"		105.6	18.2	119.2	20.4	99.0	93.8%	90%	%M Corrected
ND 16	Acre 4	Lift 2	6"		105.6	18.2	118.4	16.4	101.7	96.3%	90%	%M Corrected
ND 17	Acre 4	Lift 2	6"		112.8	15.1	126.3	11.9	112.8	100.0%	90%	%M Corrected
ND 18	Acre 4	Lift 2	6"		112.8	15.1	124.3	16.2	107.0	94.9%	90%	%M Corrected
ND 19	Acre 4	Lift 2	6"		112.8	15.1	122.8	15.6	106.2	94.2%	90%	%M Corrected
ND 20	Acre 4	Lift 2	6"		112.8	15.1	122.0	12.9	108.1	95.8%	90%	%M Corrected
ND 21	Acre 2	Lift 2	6"		112.8	15.1	120.8	14.4	105.6	93.6%	90%	%M Corrected
ND 22	Acre 2	Lift 2	6"		105.6	18.2	117.5	13.4	103.6	98.1%	90%	%M Corrected
ND 23	Acre 2	Lift 2	6"		105.6	18.2	111.9	13.4	98.7	93.4%	90%	%M Corrected
ND 24	Acre 2	Lift 2	6"		105.6	18.2	117.7	13.8	103.4	97.9%	90%	%M Corrected
ND 25	Acre 2	Lift 2	6"		112.8	15.1	125.0	10.6	113.0	100.2%	90%	%M Corrected

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2438	639



Client: JOYCE ENGINEERING  
 Project Name: COBLES SANDROCK LANDFILL  
 Project Number: 2012-656

### Field Density Report

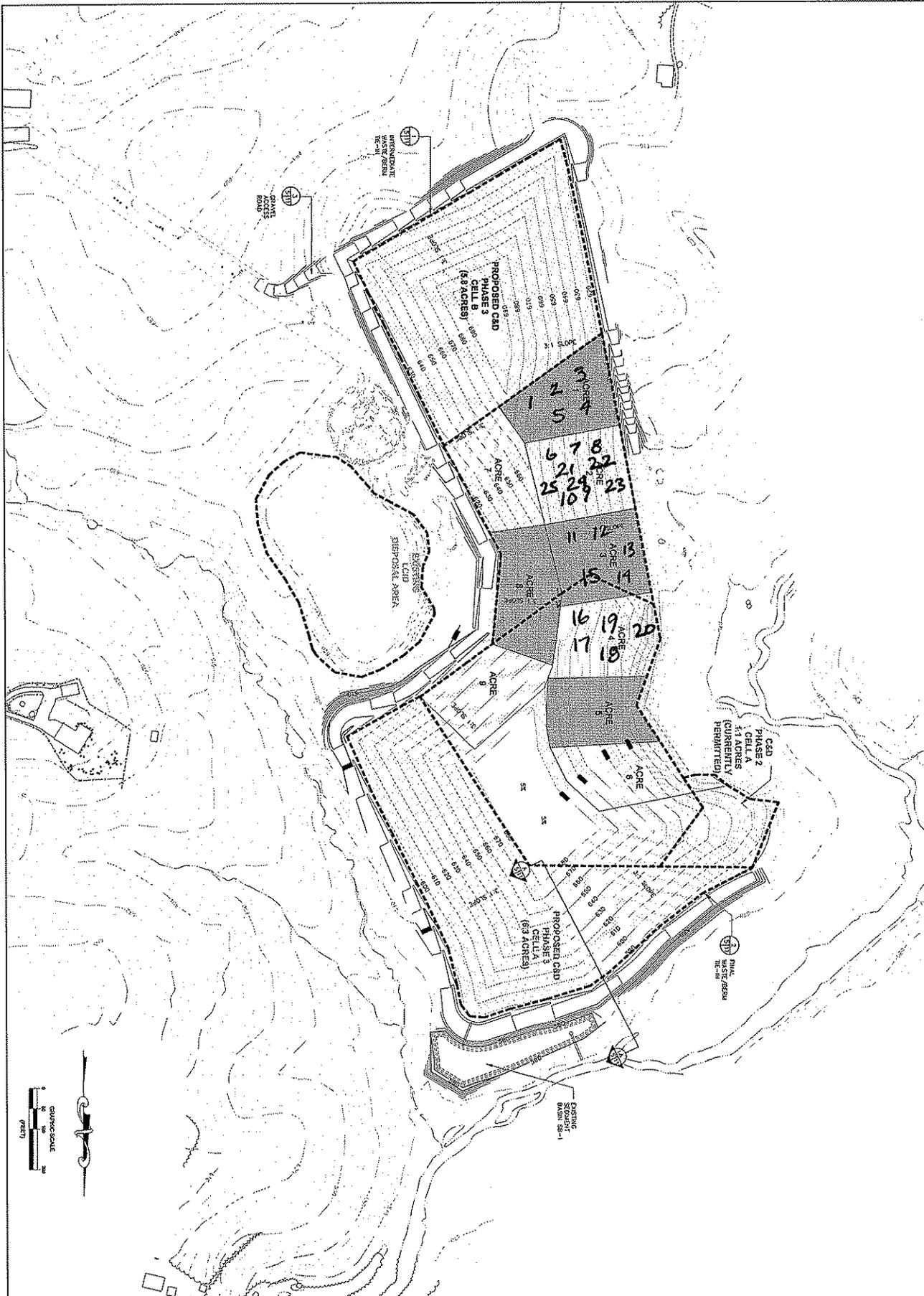
Report Number: FDR-02  
 Date (s): 5/3/2012  
 Geotechnics Representative: SHANNON SISELL  
 Reviewed By: *MSY*  
 Page: 1 OF 1  
 Date: 5/10/12

Contractor: COBLE SR LF  
 Borrow Source: ON-SITE

Compaction Equipment: 1 - Cat D6 Dozer, 1 - Sheepfoot Trash Compactor, 1 - Skid Pan

Test Number	Test Location	Elevation/ Lift	Rod Depth	Proctor I.D. No.	Proctor Data		Measured In Place			Compaction		Comments
					MDD pcf	Opt. %M	WD (pcf)	% M	DD (pcf)	% C	% Req.	
ND 1	Acre 1	Lift 2	6"		112.8	15.1	125.9	12.8	111.6	98.9%	90%	
ND 2	Acre 1	Lift 2	6"		112.8	15.1	118.8	13.4	104.8	92.9%	90%	
ND 3	Acre 1	Lift 2	6"		112.8	15.1	126.3	10.0	114.8	101.3%	90%	
ND 4	Acre 1	Lift 2	6"		112.8	15.1	120.6	11.2	108.5	96.1%	90%	DC & ST
ND 5	Acre 1	Lift 2	6"		112.8	15.1	115.6	12.7	102.6	90.9%	90%	
ND 6	Acre 2	Lift 1	6"		112.8	15.1	121.2	15.9	104.6	92.7%	90%	
ND 7	Acre 2	Lift 1	6"		105.6	18.2	122.5	17.5	104.3	98.7%	90%	
ND 8	Acre 2	Lift 1	6"		105.6	18.2	114.6	16.8	98.1	92.9%	90%	
ND 9	Acre 2	Lift 1	6"		105.6	18.2	117.2	14.9	102.0	96.6%	90%	DC & ST
ND 10	Acre 2	Lift 1	6"		105.6	18.2	121.0	22.2	99.0	93.8%	90%	
ND 11	Acre 3	Lift 2	6"		105.6	18.2	109.3	12.4	97.2	92.1%	90%	
ND 12	Acre 3	Lift 2	6"		105.6	18.2	116.1	20.0	96.8	91.6%	90%	
ND 13	Acre 3	Lift 2	6"		105.6	18.2	116.7	18.7	98.3	93.1%	90%	DC & ST
ND 14	Acre 3	Lift 2	6"		105.6	18.2	124.1	18.8	104.5	98.9%	90%	
ND 15	Acre 3	Lift 2	6"		105.6	18.2	119.2	23.0	96.9	91.8%	90%	
ND 16	Acre 4	Lift 2	6"		105.6	18.2	118.4	18.5	99.9	94.6%	90%	
ND 17	Acre 4	Lift 2	6"		112.8	15.1	126.3	12.0	112.8	100.0%	90%	
ND 18	Acre 4	Lift 2	6"		112.8	15.1	124.3	15.1	108.0	95.7%	90%	DC & ST
ND 19	Acre 4	Lift 2	6"		112.8	15.1	122.8	16.6	105.3	93.4%	90%	
ND 20	Acre 4	Lift 2	6"		112.8	15.1	122.0	11.2	109.7	97.3%	90%	
ND 21	Acre 2	Lift 2	6"		112.8	15.1	120.8	11.2	108.6	96.3%	90%	DC & ST
ND 22	Acre 2	Lift 2	6"		105.6	18.2	117.5	16.3	101.0	95.7%	90%	
ND 23	Acre 2	Lift 2	6"		105.6	18.2	111.9	16.0	96.5	91.3%	90%	
ND 24	Acre 2	Lift 2	6"		105.6	18.2	117.7	12.8	104.3	98.8%	90%	
ND 25	Acre 2	Lift 2	6"		112.8	15.1	125.0	14.1	109.6	97.1%	90%	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2438	639



DRAWING NO. 01	AS SHOWN	PROJECT NO. 419.20	<b>COBLE'S SANDROCK, INC.</b> KIMESVILLE, NORTH CAROLINA  <b>LANDFILL PARTIAL CLOSURE</b> <b>ACRE MAP</b>	<b>JOYCE ENGINEERING</b> 8211 W. WISDOMVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 365-4522 NC CORP LIC: C-4782	DESIGNED: <b>EG</b>	<b>FAR-02</b> <b>5-3-2012</b>
		SCALE			DRAWN: <b>RD</b> CHECKED: <b>KA</b> APPROVED: <b>KA</b> DATE: 01/20/12	

Client: JOYCE ENGINEERING  
 Project Name : COBLES SANDROCK LANDFILL  
 Project Number : 2012-656



Report Number : FDR-02  
 Date (s) : 5/3/12

**Drive Cylinder - ASTM D 2937**

**Test Information**

Test Number :	1	2	3	4	5
Nuclear Test Number :	4	9	13	18	21
Location:	Acre 1	Acre 2	Acre 3	Acre 4	Acre 5
Depth (ft):	Lift 2	Lift 1	Lift 2	Lift 2	Lift 2
Date :	5/3/2012	5/3/2012	5/3/2012	5/3/2012	5/3/2012

**Mold**

Cylinder ID	--	--	--	--	--
Weight of Cylinder (lbs.)	1.243	1.243	1.2475	1.2475	1.3915
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033	0.033	0.033	0.033

**Specimen**

Wt. of Cylinder & WS (lbs.)	5.33	5.13	5.13	5.45	5.38
Wt. of Cylinder (lbs.)	1.24	1.24	1.25	1.25	1.39
Wt. of WS	4.08	3.89	3.88	4.20	3.99
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033	0.033	0.033	0.033

**Moisture / Density**

Tare Number	310	311	317	303	300
Wt. of Tare & WS (gm)	748.35	568.68	826.12	911.31	730.37
Wt. of Tare & DS (gm)	702.90	490.33	715.97	802.44	668.59
Wt. of Tare (gm)	110.30	84.39	84.39	111.38	110.72
Wt. of Water (gm)	45.45	78.35	110.15	108.87	61.78
Wt. of DS (gm)	592.60	405.94	631.58	691.06	557.87

Wet Density (pcf):	123.8	117.9	117.7	127.2	121.0
--------------------	-------	-------	-------	-------	-------

Moisture Content (%):	7.7	19.3	17.4	15.8	11.1
Dry Density (pcf):	115.0	98.8	100.2	109.9	108.9

Compaction (%):	101.9%	93.6%	94.9%	97.4%	96.6%
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Geotechnics Representative : SHANNON SISELL

*SS*



**MOISTURE CONTENT**  
ASTM D 2216 (SOP-S1)

Client                   JOYCE ENGINEERING  
Client Reference       COBLES SANDROCK LANDFILL  
Project No.             2012-656

Test Number:	1	2	3	4	5
Nuclear Test Number:	1	2	3	4	5
Location:	Acre 1	Acre 1	Acre 1	Acre 1	Acre 1
Depth:	Lift 2	Lift 2	Lift 2	Lift 2	Lift 2
Tare Number	806	811	ss-4	827	809
Wt. of Tare & WS (gm)	539.96	636.08	416.03	401.65	394.12
Wt. of Tare & DS (gm)	504.07	583.75	396.41	376.56	354.93
Wt. of Tare (gm)	101.99	106.11	100.03	136.21	114.82
Wt. of Water (gm)	35.89	52.33	19.62	25.09	39.19
Wt. of DS (gm)	402.08	477.64	296.38	240.35	240.11
<b>Water Content (%)</b>	<b>8.9</b>	<b>11.0</b>	<b>6.6</b>	<b>10.4</b>	<b>16.3</b>

Test Number:	6	7	8	9	10
Nuclear Test Number:	6	7	8	9	10
Location:	Acre 2				
Depth:	Lift 1				
Tare Number	818	Y-3	813	Z-14	A-5
Wt. of Tare & WS (gm)	327.35	304.48	287.95	291.46	322.92
Wt. of Tare & DS (gm)	298.61	276.04	268.22	256.75	279.71
Wt. of Tare (gm)	137.29	98.37	111.98	98.48	98.18
Wt. of Water (gm)	28.74	28.44	19.73	34.71	43.21
Wt. of DS (gm)	161.32	177.67	156.24	158.27	181.53
<b>Water Content (%)</b>	<b>17.8</b>	<b>16.0</b>	<b>12.6</b>	<b>21.9</b>	<b>23.8</b>

Notes :   NA

---

Tested By   SFS                   Date           5/3/2012           Checked By   #1021                   Date   5/10



**MOISTURE CONTENT**  
ASTM D 2216 (SOP-S1)

Client                   JOYCE ENGINEERING  
Client Reference       COBLES SANDROCK LANDFILL  
Project No.            2012-656

Test Number:	11	12	13	14	15
Nuclear Test Number:	11	12	13	14	15
Location:	Acre 3				
Depth:	Lift 2				
Tare Number	820	821	822	802	314
Wt. of Tare & WS (gm)	354.70	323.26	313.24	308.35	292.69
Wt. of Tare & DS (gm)	331.76	294.86	286.19	288.63	257.46
Wt. of Tare (gm)	136.27	135.61	136.91	103.54	84.59
Wt. of Water (gm)	22.94	28.4	27.05	19.72	35.23
Wt. of DS (gm)	195.49	159.25	149.28	185.09	172.87
<b>Water Content (%)</b>	<b>11.7</b>	<b>17.8</b>	<b>18.1</b>	<b>10.7</b>	<b>20.4</b>

Test Number:	16	17	18	19	20
Nuclear Test Number:	16	17	18	19	20
Location:	Acre 4				
Depth:	Lift 2				
Tare Number	B-4	SS-5	305	SS-2	G-5
Wt. of Tare & WS (gm)	314.15	372.24	350.03	310.9	459.6
Wt. of Tare & DS (gm)	283.58	342.97	313.1	282.41	424
Wt. of Tare (gm)	97.52	97.5	84.66	99.9	147.41
Wt. of Water (gm)	30.57	29.27	36.93	28.49	35.6
Wt. of DS (gm)	186.06	245.47	228.44	182.51	276.59
<b>Water Content (%)</b>	<b>16.4</b>	<b>11.9</b>	<b>16.2</b>	<b>15.6</b>	<b>12.9</b>

Notes :    NA

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Tested By    SFS                    Date            5/3/2012            Checked By    JMS                    Date            5/10



**MOISTURE CONTENT**  
ASTM D 2216 (SOP-S1)

Client JOYCE ENGINEERING  
 Client Reference COBLES SANDROCK LANDFILL  
 Project No. 2012-656

Test Number:	21	22	23	24	25
Nuclear Test Number:	21	22	23	24	25
Location:	Acre 2				
Depth:	Lift 2				
Tare Number	315	308	398	318	312
Wt. of Tare & WS (gm)	366.96	318.70	309.03	324.96	319.95
Wt. of Tare & DS (gm)	334.74	291.42	282.41	296.03	297.37
Wt. of Tare (gm)	110.42	88.42	84.21	86.67	84.29
Wt. of Water (gm)	32.22	27.28	26.62	28.93	22.58
Wt. of DS (gm)	224.32	203	198.2	209.36	213.08
<b>Water Content (%)</b>	<b>14.4</b>	<b>13.4</b>	<b>13.4</b>	<b>13.8</b>	<b>10.6</b>

Notes : NA

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Tested By SFS Date 5/3/2012 Checked By *[Signature]* Date 5/10

Day: Fri  
 Date: 18-May  
 Log No.: 4  
 Page: 1



## Daily Field Report

<b>Project Name:</b> Cobles Sandrock LF		<b>Project No.:</b> 2012-656	
<b>Client Name:</b> Joyce Engineering		<b>Client Contact:</b> Hannu Kempinenn	
<b>Site Location:</b> Kimesville, NC		<b>Time on Site:</b> Arrived: 11:00 AM Departed: 5:00 PM	
<b>General Contractor:</b> Cobles Sandrock LF		<b>Superintendent:</b> Kent	
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b> Sunny		<b>Temperature:</b> 70	
<b>Contractor's Equipment:</b>			
<b>Contractor's Personnel:</b>			
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Arrived on site checked in at scale house and met with Hannu Kemmpinen of Joyce.</li> <li>▪ Hannu explained the site status and we then walked the area to be tested. The area was approximately 4 acres and included a test pad.</li> <li>▪ Hannu informed technician where and number of test needed per acre. Several tests were taken over the 4 acre area.</li> <li>▪ Compaction testing with Nuclear Density gauge and Drive Cylinders was performed.(see attached)</li> <li>▪ Four shelby tube samples were taken for permeability testing.</li> </ul>			
<b>Prepared By:</b> AG		<b>Date:</b> 5/18/12	
<b>Checked By:</b> <i>AWB</i>		<b>Date:</b> 5/23	

Day: Mon  
 Date: 21-May  
 Log No.: 5  
 Page: 1



### Daily Field Report

<b>Project Name:</b> Cobles Sandrock LF		<b>Project No.:</b> 2012-656	
<b>Client Name:</b> Joyce Engineering		<b>Client Contact:</b> Hannu Kempinenn	
<b>Site Location:</b> Kimesville, NC		<b>Time on Site:</b> Arrived: 2:00 PM Departed: 4:00 PM	
<b>General Contractor:</b> Cobles Sandrock LF		<b>Superintendent:</b> Kent	
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b> Sunny		<b>Temperature:</b> 77	
<b>Contractor's Equipment:</b>			
<b>Contractor's Personnel:</b>			
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Arrived on site, checked in at scale house.</li> <li>▪ Technician completed all compaction testing started the previous Friday.</li> <li>▪ Shelby tubes and drive cylinders samples were taken.</li> <li>▪ Technician departed from jobsite.</li> </ul>			
<b>Prepared By:</b> AG		<b>Date:</b> 5/21/12	
<b>Checked By:</b> <i>MDS</i>		<b>Date:</b> 5/23	



Client: JOYCE ENGINEERING  
 Project Name: COBLES SANDROCK LANDFILL  
 Project Number: 2012-656

## Field Density Report

Report Number : FDR-04	Geotechnics Representative : A. GAETA	Page : 1 OF 1
Date (s) : 5/18/12-5/21/12	Reviewed By :	Date :

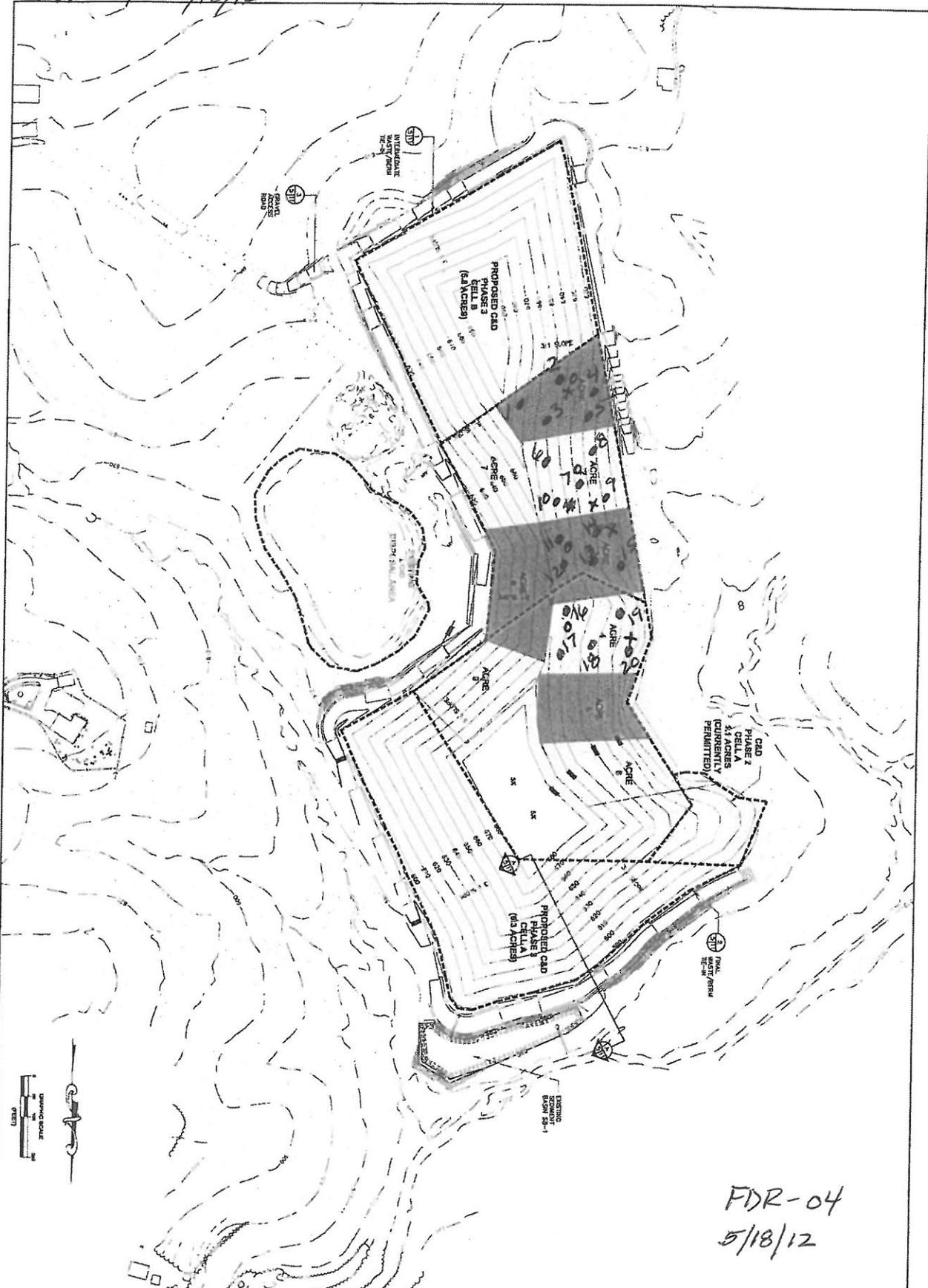
Contractor : COBLE SR L/F	Borrow Source : ON-SITE
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Compaction Equipment : Scraper pans, track hoe, compactor

Test Number	Test Location	Elevation/ Lift	Rod Depth	Proctor I.D. No.	Proctor Data			Measured In Place			Compaction		Comments
					MDD pcf	Opt. %M	WD (pcf)	% M	DD (pcf)	% C	% Req.		
ND 01	ACRE 1	LIFT 3	6"	656-01-02	112.8	15.1	125.4	18.6	105.7	93.7%	90.0%		
ND 02	ACRE 1	LIFT 3	6"	656-01-02	112.8	15.1	133.7	15.7	115.6	102.4%	90.0%	ST-A1/TP-03, DC1	
ND 03	ACRE 1	LIFT 3	6"	656-01-01	105.6	18.2	121.4	22.1	99.4	94.2%	90.0%		
ND 04	ACRE 1	LIFT 3	6"	656-01-01	105.6	18.2	121.4	24.3	97.7	92.5%	90.0%		
ND 05	ACRE 1	LIFT 3	6"	656-01-02	105.6	18.2	120.3	19.2	100.9	95.6%	90.0%		
ND 06	ACRE 2	LIFT 3	6"	656-01-01	105.6	18.2	116.8	21.3	96.3	91.2%	90.0%		
ND 07	ACRE 2	LIFT 3	6"	656-01-01	105.6	18.2	124.6	21.7	102.4	97.0%	90.0%	ST-A2-03	
ND 08	ACRE 2	LIFT 3	6"	656-01-01	105.6	18.2	118.0	21.6	97.0	91.9%	90.0%		
ND 09	ACRE 2	LIFT 3	6"	656-01-02	112.8	15.1	116.3	12.2	103.7	91.9%	90.0%	DC2	
ND 10	ACRE 2	LIFT 3	6"	656-01-01	105.6	18.2	121.0	21.6	99.5	94.2%	90.0%		
ND 11	ACRE 3	LIFT 3	6"	656-01-01	105.6	18.2	119.1	23.3	96.6	91.5%	90.0%	ST-A3-03	
ND 12	ACRE 3	LIFT 3	6"	656-01-01	105.6	18.2	115.1	12.8	102.0	96.6%	90.0%		
ND 13	ACRE 3	LIFT 3	6"	656-01-01	105.6	18.2	117.9	27.4	92.5	87.6%	90.0%	DC3	
ND 14	ACRE 3	LIFT 3	6"	656-01-01	105.6	18.2	116.3	12.2	103.7	98.2%	90.0%		
ND 15	ACRE 3	LIFT 3	6"	656-01-02	105.6	18.2	124.6	24.0	100.5	95.2%	90.0%		
ND 16	ACRE 4	LIFT 3	6"	656-01-02	112.8	15.1	126.8	17.4	108.0	95.8%	90.0%	ST-A4-03	
ND 17	ACRE 4	LIFT 3	6"	656-01-02	105.6	18.2	122.3	21.6	100.6	95.2%	90.0%		
ND 18	ACRE 4	LIFT 3	6"	656-01-01	105.6	18.2	120.3	19.1	101.0	95.7%	90.0%		
ND 19	ACRE 4	LIFT 3	6"	656-01-02	105.6	18.2	120.9	25.3	96.5	91.4%	90.0%		
ND 20	ACRE 4	LIFT 3	6"	656-01-02	105.6	18.2	121.4	24.3	97.7	92.5%	90.0%	DC4	

Gauge Number	Gauge Model	Density Count	Moisture Count
32387	3440	2782	91

FDR-04 5/18/12



FDR-04  
5/18/12

DRAWING NO. 01	AS SHOWN	SCALE 4/18/20	PROJECT NO. 419.20	COBLE'S SANDROCK, INC. KIMESVILLE, NORTH CAROLINA		<b>JOYCE ENGINEERING</b> 2211 W. MEADOWVIEW ROAD GARDENSBORO, NC 27047 PHONE: 252-324-0282 NC CDRP LIC. C-0782	DESIGNED: MC	1/11/11 REVISIONS AND RECORD OF ISSUE
				CHECKED: EA APPROVED: JA DATE: 05/18/12	1/11/11 DATE			

**Client:** JOYCE ENGINEERING  
**Project Name :** COBLES SANDROCK LANDFILL  
**Project Number :** 2012-656



**Report Number :** FDR-04  
**Date (s) :** 5/21/12

**Drive Cylinder - ASTM D 2937**

**Test Information**

Test Number :	DC-01	DC-02	DC-03	DC-04
Nuclear Test Number :	ND-02	ND-09	ND-14	ND-20
Location:	Acre 1	ACRE 2	ACRE 3	ACRE 4
Depth (ft):	LIFT 3	LIFT 3	LIFT 3	LIFT 3
Date :	21-May	21-May	21-May	21-May

**Mold**

Cylinder ID	#3	#4	#5	#6
Weight of Cylinder (lbs.)	1.24	1.3	1.36	1.23
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033	0.033	0.033

**Specimen**

Wt. of Cylinder & WS (lbs.)	5.60	5.36	5.42	5.26
Wt. of Cylinder (lbs.)	1.24	1.30	1.36	1.23
Wt. of WS	4.36	4.06	4.06	4.03
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033	0.033	0.033

**Moisture / Density**

Tare Number	820	809	805	807
Wt. of Tare & WS (gm)	376.70	360.80	361.60	358.80
Wt. of Tare & DS (gm)	340.20	329.60	330.57	309.98
Wt. of Tare (gm)	136.20	115.10	106.40	104.80
Wt. of Water (gm)	36.50	31.20	31.03	48.82
Wt. of DS (gm)	204.00	214.50	224.17	205.18
Wet Density (pcf):	132.1	123.0	123.0	122.1
Moisture Content (%):	17.9	14.5	13.8	23.8
Dry Density (pcf):	112.1	107.4	108.1	98.6

Geotechnics Representative :

A. Gaeta

*MMS*

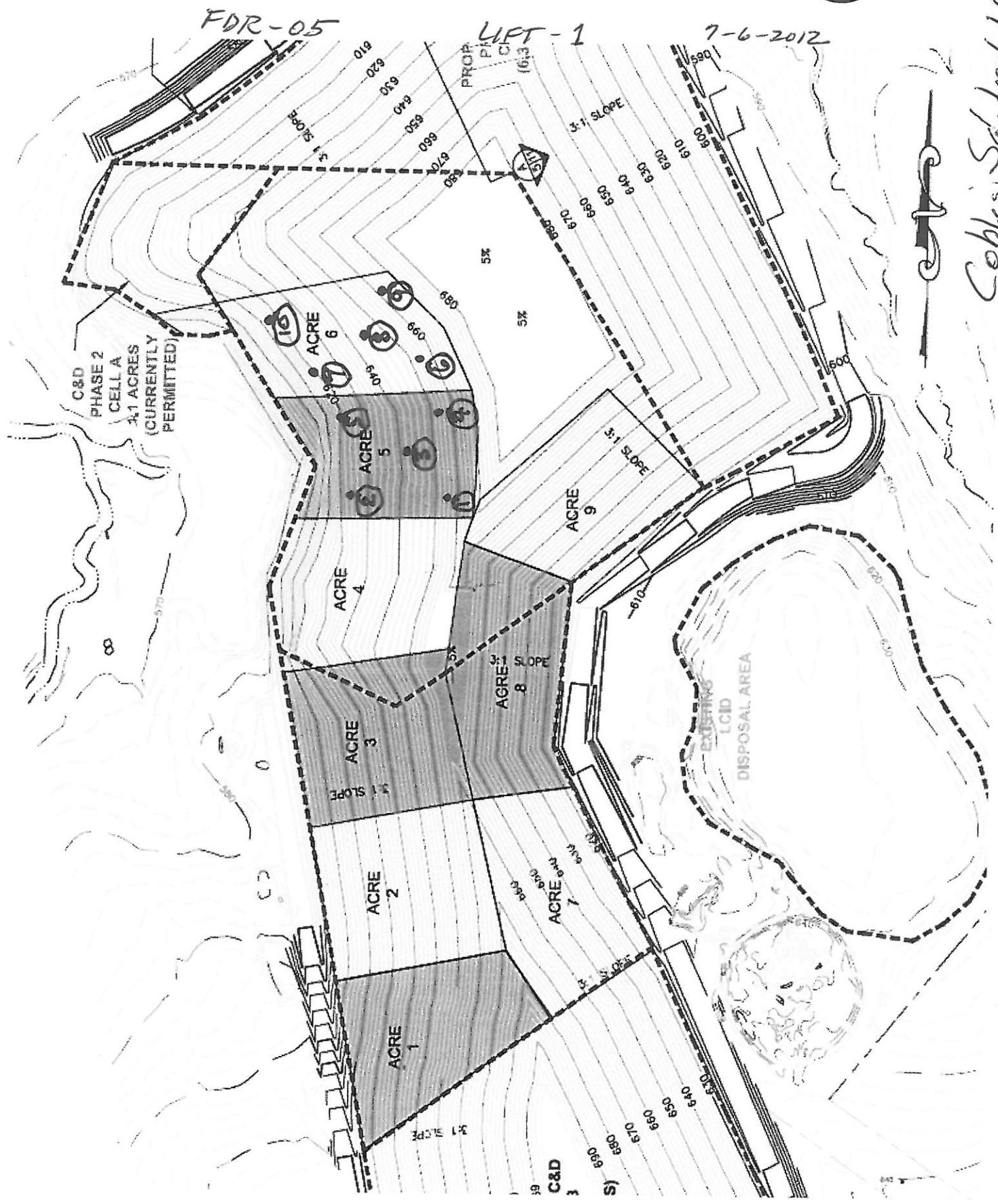
Day: Friday  
 Date: 7/6/2012  
 Log No.: 6  
 Page: 1



## Daily Field Report

<b>Project Name:</b> Cobles Sandrock LF		<b>Project No.:</b> 2012-656	
<b>Client Name:</b> Joyce Engineering		<b>Client Contact:</b> Hannu Kempainen	
<b>Site Location:</b> Kimesville, NC		<b>Time on Site:</b> Arrived: 8:30 AM Departed: 2:20 PM	
<b>General Contractor:</b> Cobles Sandrock LF		<b>Superintendent:</b> Kent	
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<b><u>Firm / Sub-Contractor</u></b> Joyce Engineering, Inc		<b><u>Representative's Name and Title</u></b> Mr. Hannu Kempainen, P.G.	
<b>Weather Conditions:</b> Clear and Hot		<b>Temperature:</b> 102 degrees	
<b>Contractor's Equipment:</b>			
<b>Contractor's Personnel:</b>			
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Arrived on site checked in at scale house and met with Kent (Landfill owner) who then proceeded to drive me out to the site and show me the two areas (acre 5 and 6) to be tested. The areas were approximately 1 acre each that required 5 nuclear density tests each area.</li> <li>▪ Geotechnic technician performed five nuclear density (ND) tests and one drive cylinder and shelby tube samples per acre. A total of 10 field density tests was performed.</li> <li>▪ Mr. Hannu Kempainen arrived on site to observe the site conditions and the testing. He asked the undersigned to collect a 5 gallon bucket of borrow soil and bring it back to the lab and put it on HOLD. The soil may be used later for another site. One 5 gallon bucket sample was collected and returned to the lab for possible testing.</li> <li>▪ Two shelby tubes (one per area) were taken for permeability testing.</li> <li>▪ Testing protocol was as follows:          5 Nuclear density tests per acre          1 Drive Cylinder per acre          1 Shelby tube per acre</li> <li>▪ The undersigned left and returned to the office.</li> </ul>			
<b>Prepared By:</b> JAS		<b>Date:</b> 7/6/2012	
<b>Checked By:</b> <i>[Signature]</i>		<b>Date:</b> 7/11	





*Coble's Sandrock LP  
Report No. FDR-05  
July 6, 2017*

Client: JOYCE ENGINEERING  
Project Name : COBLES SANDROCK LANDFILL  
Project Number : 2012-656



Report Number : FDR 05  
Date (s) : 7/6/12

### Drive Cylinder - ASTM D 2937

#### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-03	ND-08
Location:	Acre 5	ACRE 6
Depth (ft):	LIFT 1	LIFT 1
Date :	6-Jul	6-Jul

#### Mold

Cylinder ID	#3	#5
Weight of Cylinder (lbs.)	1.224	1.358
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

#### Specimen

Wt. of Cylinder & WS (lbs.)	4.72	5.08
Wt. of Cylinder (lbs.)	1.22	1.36
Wt. of WS	3.50	3.73
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

#### Moisture / Density

Tare Number	801	Y 1
Wt. of Tare & WS (gm)	480.51	444.32
Wt. of Tare & DS (gm)	441.56	395.00
Wt. of Tare (gm)	107.13	95.59
Wt. of Water (gm)	38.95	49.32
Wt. of DS (gm)	334.43	299.41

Wet Density (pcf):	105.9	112.9
--------------------	-------	-------

Moisture Content (%):	11.6	16.5
Dry Density (pcf):	94.9	96.9

Geotechnics Representative :

J SCHIFF



**MOISTURE CONTENT**  
ASTM D 2216 (SOP-S1)

Client JOYCE ENGINEERING  
Client Reference COBLES SANDROCK LANDFILL  
Project No. 2012-656

Test Number:	1	2	3
Nuclear Test Number:	ND-01	ND-07	ND-09
Location:	ACRE 5	ACRE 6	ACRE 6
Depth:	Lift 1	Lift 1	Lift 1
Tare Number	811	807	SS-2
Wt. of Tare & WS (gm)	465.19	471.22	495.47
Wt. of Tare & DS (gm)	414.92	441.74	455.92
Wt. of Tare (gm)	106.36	104.77	99.44
Wt. of Water (gm)	50.27	29.48	39.55
Wt. of DS (gm)	308.56	336.97	356.48
<b>Water Content (%)</b>	<b>16.3</b>	<b>8.7</b>	<b>11.1</b>

Test Number:  
Nuclear Test Number:  
Location:  
Depth:

Tare Number  
Wt. of Tare & WS (gm)  
Wt. of Tare & DS (gm)  
Wt. of Tare (gm)  
Wt. of Water (gm)  
Wt. of DS (gm)

**Water Content (%)**

Notes : NA

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Tested By JS Date 7/6/2012 Checked By *MM* Date 7/11

Day: Friday  
 Date: 7/20/2012  
 Log No.: 7  
 Page: 1

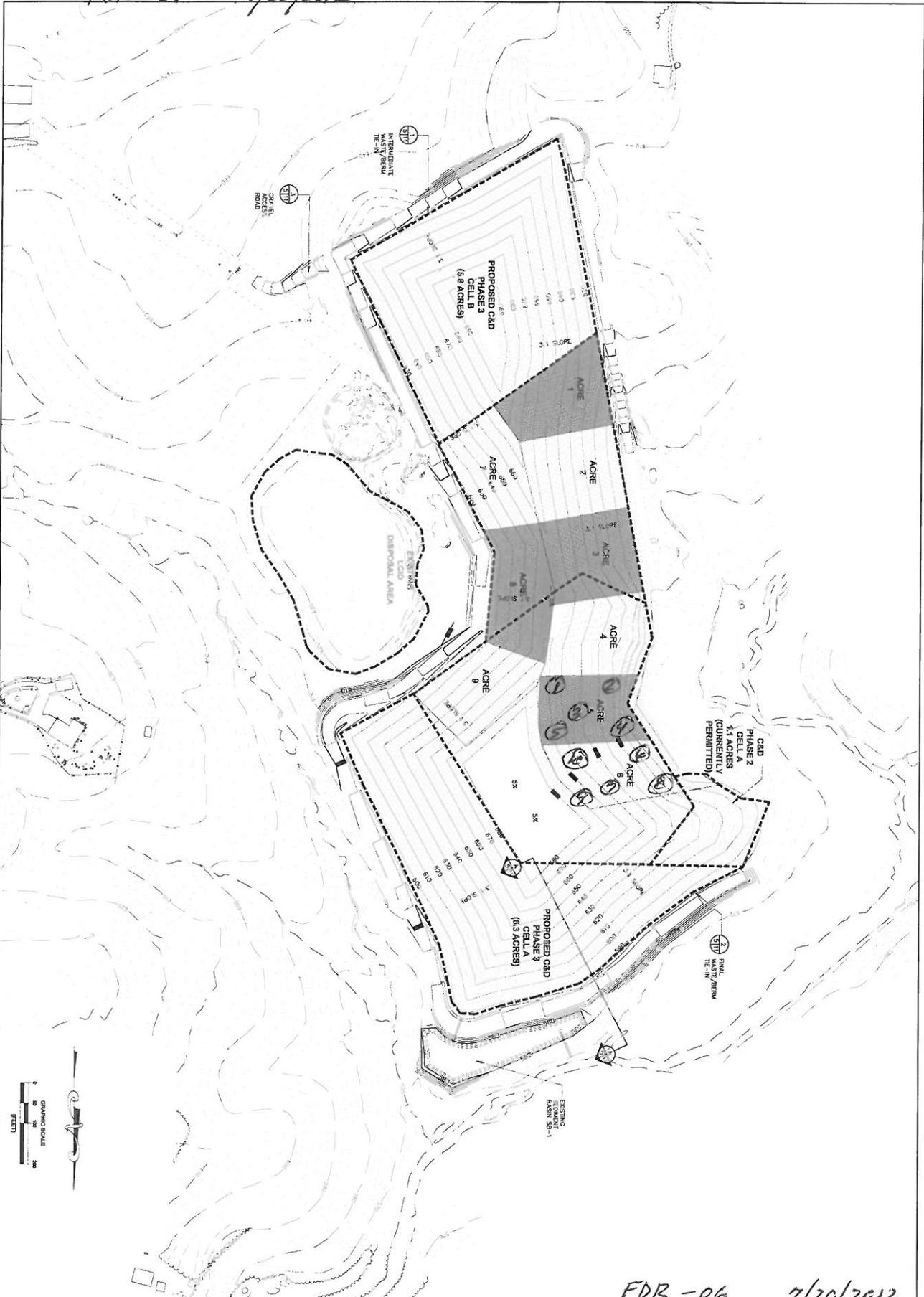


### Daily Field Report

<b>Project Name:</b> Cobles Sandrock C&D LF	<b>Project No.:</b> 2012-656
<b>Client Name:</b> Joyce Engineering, Inc.	<b>Client Contact:</b> Hannu K.
<b>Site Location:</b> Alamance, NC	<b>Time on Site:</b> Arrived: 11:20 AM Departed: 3:30 PM
<b>General Contractor:</b> Cobles Sandrock	<b>Superintendent:</b> Kent Coble
<b>Other Firms / Sub-Contractor Represented On Site</b>	
<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>
<b>Weather Conditions:</b> Cloudy	<b>Temperature:</b> 88
<b>Contractor's Equipment:</b> 2- Trash Compacting Rolles, 1- D6 CAT Dozer, 2- Pan Loaders	
<b>Contractor's Personnel:</b> ~4	
<b>Description of Daily Activities &amp; Events</b>	
<ul style="list-style-type: none"> <li>▪ Geotechnics representative, Shannon Sisell, arrived onsite.</li> <li>▪ Performed 15 nuclear moisture/density test at location Acre 5&amp;6 of Lift 2 (see FDR-06 for results).</li> <li>▪ Performed 2 drive cylinder test to verify gauge readings (see results).</li> <li>▪ Collected 2 Shelby Tube Samples, one per acre.</li> <li>▪ Geotechnics rep. departed site</li> </ul>	
<b>Prepared By:</b> SFS	<b>Date:</b> 7/20/2012
<b>Checked By:</b> <i>SMS</i>	<b>Date:</b> 7/23



FDR-06 7/20/2012



FDR-06 7/20/2012

DRAWING NO. 01	AS SHOWN SCALE 419.20	PROJECT NO. 419.20	COBLE'S SANDROCK, INC. KIMESVILLE, NORTH CAROLINA	<b>JOYCE ENGINEERING</b> 2111 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 324-0002 NC CORP. LIC. C-4782	DESIGNED SC	11/27/11 DATE	1 RWH, EEA, EBA NO. BY CK, APP
		LANDFILL PARTIAL CLOSURE ACRE MAP	CHECKED EA APPROVED EA DATE 01/30/12		REVISED CLOSURE GRADERS REVISIONS AND RECORD OF ISSUE		

L:\Coble Sandrock\ldg\CLOSURE OCTOBER 2011\sheet set\ACRE MAP FOR CONTRACTOR\ldg Layout\Layout1



**Client:** JOYCE ENGINEERING  
**Project Name :** COBLES SANDROCK C&D LF  
**Project Number :** 2012-656

**Report Number :** FDR-06  
**Date (s) :** Friday, 7/20/12

### Drive Cylinder - ASTM D 2937

#### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-1	ND-9
Location:	AC. 5	AC. 6
Depth (ft):	LIFT 2	LIFT 2
Date :	7/20/2012	7/20/2012

#### Mold

Cylinder ID	1	2
Weight of Cylinder (lbs.)	1.381	1.323
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

#### Specimen

Wt. of Cylinder & WS (lbs.)	5.21	5.22
Wt. of Cylinder (lbs.)	1.38	1.32
Wt. of WS	3.83	3.90
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

#### Moisture / Density

Tare Number	310	304
Wt. of Tare & WS (gm)	465.32	461.32
Wt. of Tare & DS (gm)	431.98	421.09
Wt. of Tare (gm)	110.29	110.62
Wt. of Water (gm)	33.34	40.23
Wt. of DS (gm)	321.69	310.47

Wet Density (pcf):	116.0	118.1
--------------------	-------	-------

<b>Moisture Content (%):</b>	<b>10.4</b>	<b>13.0</b>
<b>Dry Density (pcf):</b>	<b>105.1</b>	<b>104.5</b>

<b>% Compaction:</b>	<b>99.6%</b>	<b>99.0%</b>
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Geotechnics Representative : Shannon F. Sisell

*SHS*



**MOISTURE CONTENT**  
ASTM D 2216 (SOP-S1)

Client                   JOYCE ENGINEERING  
Client Reference       COBLES SANDROCK C&D LF  
Project No.             **2012-656**

Test Number:	.001	.002	.003	.004	.005
Nuclear Test Number:	ND-1	ND-2	ND-3	ND-4	ND-5
Location:	AC.-5	AC.-5	AC.-5	AC.-5	AC.-5
Depth:	-2"	-2"	-2"	-2"	-2"
Tare Number	802	825	819	SS-1	A-1
Wt. of Tare & WS (gm)	371.93	429.88	561.97	355.11	409.49
Wt. of Tare & DS (gm)	342.03	394.65	503.53	322.26	368.17
Wt. of Tare (gm)	103.63	136.99	135.48	93.49	93.58
Wt. of Water (gm)	29.9	35.23	58.44	32.85	41.32
Wt. of DS (gm)	238.4	257.66	368.05	228.77	274.59
<b>Water Content (%)</b>	<b>12.5</b>	<b>13.7</b>	<b>15.9</b>	<b>14.4</b>	<b>15.0</b>

Test Number:	.006	.007	.008	.009	.010
Nuclear Test Number:	ND-6	ND-7	ND-8	ND-9	ND-10
Location:	AC.-6	AC.-6	AC.-6	AC.-6	AC.-6
Depth:	-2"	-2"	-2"	-2"	-2"
Tare Number	312	317	809	307	368
Wt. of Tare & WS (gm)	425.72	381.90	356.81	331.49	368.14
Wt. of Tare & DS (gm)	386.19	344.54	320.02	302.89	335.48
Wt. of Tare (gm)	84.35	84.32	114.93	110.31	111.41
Wt. of Water (gm)	39.53	37.36	36.79	28.6	32.66
Wt. of DS (gm)	301.84	260.22	205.09	192.58	224.07
<b>Water Content (%)</b>	<b>13.1</b>	<b>14.4</b>	<b>17.9</b>	<b>14.9</b>	<b>14.6</b>

Notes :    NA

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Tested By    SFS                   Date           7/20/2012    Checked By    *AMMS*                   Date    7/23

Day: Tues.  
 Date: 7.31.12  
 Log No.: 08  
 Page: 1 of 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock C&D LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering, Inc.	<b>Client Contact:</b>	Hannu K.
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	<b>Arrived:</b> 10:30am <b>Departed:</b> 12:30pm
<b>General Contractor:</b>	Cobles Sandrock	<b>Superintendent:</b>	Kent Coble
Other Firms / Sub-Contractor Represented On Site			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Cloudy, Humid	<b>Temperature:</b>	80's
<b>Contractor's Equipment:</b>	NA		
<b>Contractor's Personnel:</b>	NA		
Description of Daily Activities & Events			
<ul style="list-style-type: none"> <li>▪ Geotechnics Rep. Jacob R. Buda arrived on site.</li> <li>▪ Geotechnics Rep. performed CQA Moisture / Density testing of previously placed and compacted Low-perm Soil Liner material in Acres 5, 6, and 9 (see FDR-07 for results).</li> <li>▪ Geotechnics Rep. obtained Undisturbed Shelby Tube samples from Acres 5, 6, and 9.</li> <li>▪ Geotechnics Rep. departed the site.</li> </ul>			
<b>Prepared By:</b>	JRB	<b>Date:</b>	7.31.12
<b>Checked By:</b>	<i>JRB</i>	<b>Date:</b>	8.1.12

Client: JOYCE ENGINEERING  
 Project Name : COBLES SANDROCK C & D LANDFILL  
 Project Number : 2012-656



## Field Density Report

Report Number : <b>FDR-07</b>	Geotechnics Representative : JACOB R. BUDA
Date (s) : <b>7.31.12</b>	Reviewed By : <i>JRB</i> Date: <b>8.1.12</b>

Contractor : COBLES SANDROCK	Borrow Source : Geotechnics Rep. was not present during placement operations
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Gauge Number 13957	Gauge Model 3401-B	Compaction Equipment :	Geotechnics Rep. was not present during compaction operations
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Test Number	Test Location	Elevation/ Lift	Rod Depth	Proctor I.D. No.	Proctor Data		Measured In Place			Compaction		Comments
					MDD pcf	Opt. %M	WD (pcf)	% M	DD (pcf)	% C	% Req.	
ND - 01	ACRE 5	LIFT 3	6"	656-01-01	105.6	18.2	120.2	19.2	100.8	95.5%	90.0%	%M Corrected
ND - 02	ACRE 5	LIFT 3	6"	656-01-01	105.6	18.2	113.7	17.8	96.5	91.4%	90.0%	%M Corrected
DC - 01	ACRE 5	LIFT 3	NA	656-01-01	105.6	18.2	114.8	17.8	97.5	92.3%	90.0%	
ND - 03	ACRE 5	LIFT 3	6"	656-01-01	105.6	18.2	117.8	18.6	99.3	94.1%	90.0%	%M Corrected
ND - 04	ACRE 5	LIFT 3	6"	656-01-01	105.6	18.2	116.4	17.4	99.1	93.9%	90.0%	%M Corrected
ND - 05	ACRE 5	LIFT 3	6"	656-01-01	105.6	18.2	119.8	19.0	100.7	95.3%	90.0%	%M Corrected
ND - 06	ACRE 6	LIFT 3	6"	656-01-01	105.6	18.2	118.2	16.5	101.5	96.1%	90.0%	%M Corrected
ND - 07	ACRE 6	LIFT 3	6"	656-01-01	105.6	18.2	120.2	16.0	103.6	98.1%	90.0%	%M Corrected
DC - 02	ACRE 6	LIFT 3	NA	656-01-01	105.6	18.2	121.5	16.0	104.7	99.2%	90.0%	
ND - 08	ACRE 6	LIFT 3	6"	656-01-01	105.6	18.2	119.4	16.1	102.8	97.4%	90.0%	%M Corrected
ND - 09	ACRE 6	LIFT 3	6"	656-01-01	105.6	18.2	116.9	16.8	100.1	94.8%	90.0%	%M Corrected
ND - 10	ACRE 6	LIFT 3	6"	656-01-01	105.6	18.2	115.1	17.2	98.2	93.0%	90.0%	%M Corrected
ND - 11	ACRE 9	LIFT 1	6"	656-01-01	105.6	18.2	115.9	18.2	98.1	92.9%	90.0%	%M Corrected
ND - 12	ACRE 9	LIFT 1	6"	656-01-01	105.6	18.2	117.3	18.0	99.4	94.1%	90.0%	%M Corrected
DC - 03	ACRE 9	LIFT 1	NA	656-01-01	105.6	18.2	116.7	18.0	98.9	93.7%	90.0%	
ND - 13	ACRE 9	LIFT 1	6"	656-01-01	105.6	18.2	119.9	16.8	102.7	97.2%	90.0%	%M Corrected
ND - 14	ACRE 9	LIFT 1	6"	656-01-01	105.6	18.2	114.7	17.2	97.9	92.7%	90.0%	%M Corrected
ND - 15	ACRE 9	LIFT 1	6"	656-01-01	105.6	18.2	115.7	17.1	98.8	93.6%	90.0%	%M Corrected

**Client:** JOYCE ENGINEERING  
**Project Name :** COBLES SANDROCK C & D LANDFILL  
**Project Number :** 2012-656



**Report Number :** FDR-07  
**Date (s) :** 7.31.12

## **Drive Cylinder - ASTM D 2937**

### **Test Information**

Test Number :	DC-01	DC-02	DC-03
Nuclear Test Number :	ND-02	ND-07	ND-12
Location:	ACRE 5	ACRE 6	ACRE 9
Depth (ft):	LIFT 3	LIFT 3	LIFT 1
Date :	7.31.12	7.31.12	7.31.12

### **Mold**

Cylinder ID	JB-01	JB-02	JB-03
Weight of Cylinder (lbs.)	1.36	1.34	1.33
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033	0.033

### **Specimen**

Wt. of Cylinder & WS (lbs.)	5.15	5.35	5.18
Wt. of Cylinder (lbs.)	1.36	1.34	1.33
Wt. of WS	3.79	4.01	3.85
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033	0.033

### **Moisture / Density**

Tare Number	368	311	368
Wt. of Tare & WS (gm)	321.04	305.77	311.19
Wt. of Tare & DS (gm)	289.43	275.23	280.75
Wt. of Tare (gm)	111.38	84.46	111.38
Wt. of Water (gm)	31.61	30.54	30.44
Wt. of DS (gm)	178.05	190.77	169.37

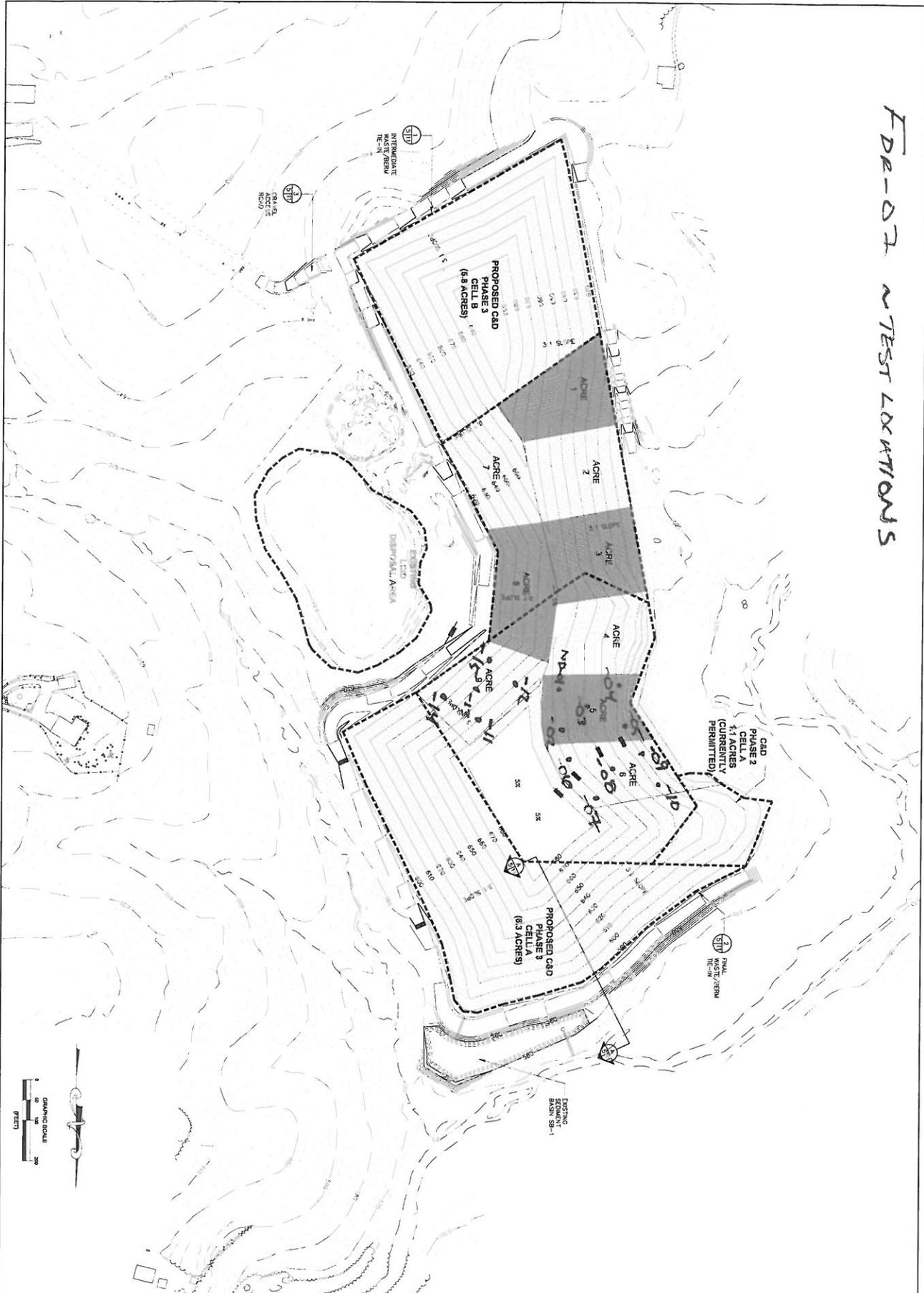
Wet Density (pcf):	114.8	121.5	116.7
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<b>Moisture Content (%):</b>	<b>17.8</b>	<b>16.0</b>	<b>18.0</b>
<b>Dry Density (pcf):</b>	<b>97.5</b>	<b>104.7</b>	<b>98.9</b>

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Geotechnics Representative : JACOB R. BUDA

FDR-07 ~ TEST LOCATIONS



DRAWING NO. 01	AS SHOWN	SCALE 1" = 20'	PROJECT NO. 419.20	COBLE'S SANDROCK, INC. KIMESVILLE, NORTH CAROLINA	DESIGNED: SC	
			LANDFILL PARTIAL CLOSURE ACRE MAP	<b>JOYCE</b> ENGINEERING 2211 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 323-0092 NC CORP LIC: C-0782	DRAWN: BR CHECKED: EA APPROVED: EA DATE: 9/15/07	1 11/01 DATE: REVISED CLOSURE GRADINGS REVISIONS AND RECORD OF ISSUE 1 11/01 E&T/EA NO. BY: CK, APH

L:\Coble Sandrock\dwg\CLOSURE 2011\sheet set\ACRE MAP FOR CONTRACTOR\dwg Layout-Layout1

Day: Friday  
 Date: 8.17.12  
 Log No.: 9  
 Page: 1 of 1



### Daily Field Report

<b>Project Name:</b> Coble Sandrock Landfill	<b>Project No.:</b>
<b>Client Name:</b> Joyce Engineering	<b>Client Contact:</b> Hannu K.
<b>Site Location:</b> Liberty, NC	<b>Time on Site:</b> <b>Arrived:</b> 2:30 PM <b>Departed:</b> 5:30PM
<b>General Contractor:</b> Cobles	<b>Superintendent:</b> Kent Coble

**Other Firms / Sub-Contractor Represented On Site**

<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>

**Weather Conditions:** Sunny **Temperature:** 92

**Contractor's Equipment:**

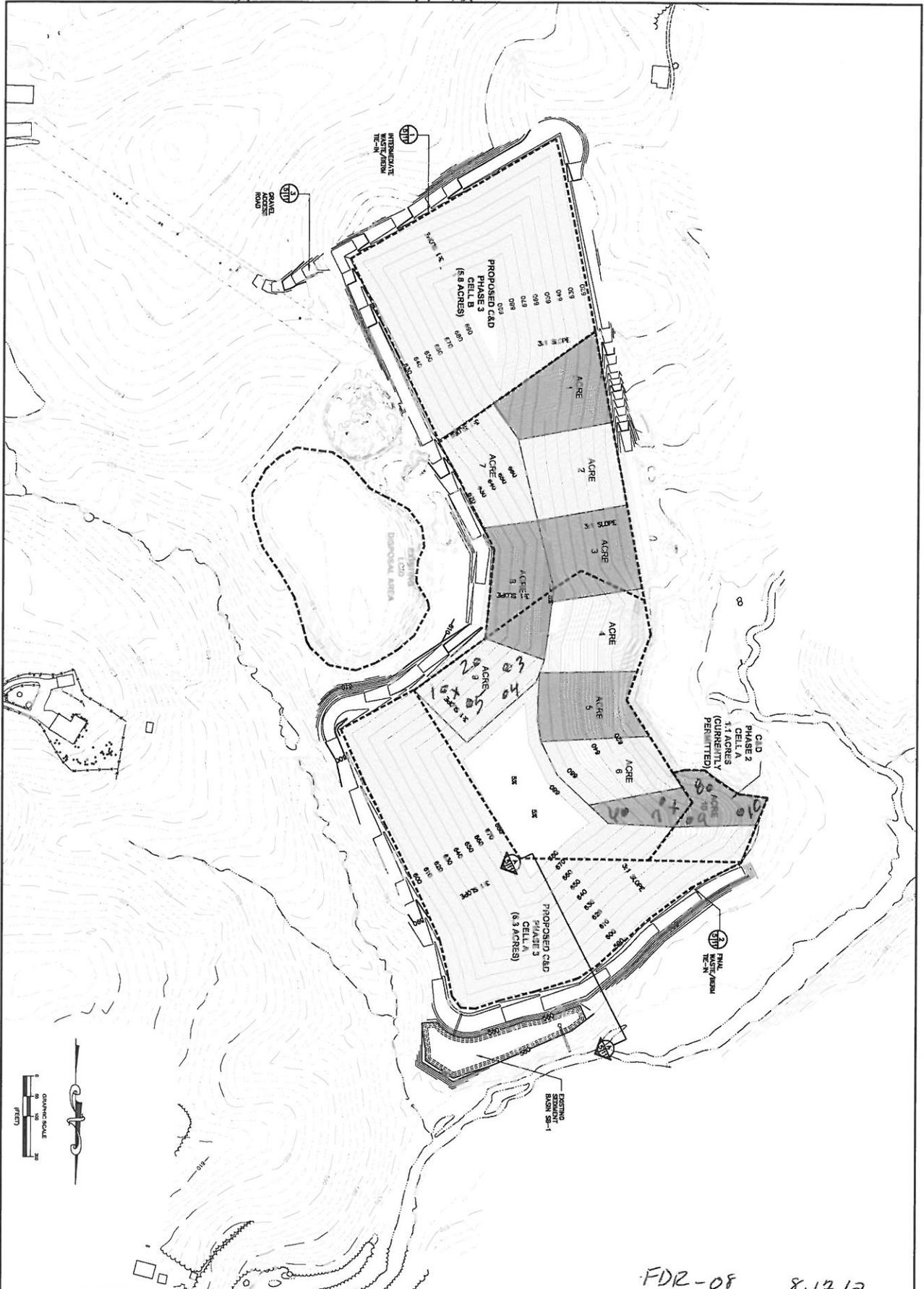
**Contractor's Personnel:**

**Description of Daily Activities & Events**

- Geotechnics representative arrived at jobsite.
- Fill was previously placed and compacted, then tested for required compaction.
- Rep. performed nuclear density, drive cylinder and pushed shelby tubes for Acres 9 & 10.
- Geotechnics representative departed jobsite.

**Prepared By:** AG **Date:** 8.17.12 **Checked By:** *AMBS* **Date:** 8/24





FDR-08 8.17.12

DRAWING NO. 01	AS SHOWN	SCALE 419.20	PROJECT NO. 419.20	COBLE'S SANDROCK, INC. KIMESVILLE, NORTH CAROLINA		<b>JOYCE ENGINEERING</b> 2211 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 324-0092 NC CORP LIC: C-0782	DESIGNED SC	11/11 DATE	REVISIONS AND RECORD OF ISSUE	1 RWH-CEA NC BY LCK APP
				DRAWN SB	REVISIONS AND RECORD OF ISSUE					
CHECKED EA	DATE									
APPROVED EA										
DATE: 8/15/07										



**Client:** Joyce Engineering  
**Project Name :** Coble's Sandrock Landfill  
**Project Number :**

**Report Number :** FDR-08  
**Date (s) :** 8.17.12

### Drive Cylinder - ASTM D 2937

#### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-01	ND-07
Location:	Acre 9	Acre 10
Depth (ft):	Lift 2	Lift 1
Date :	8.17.12	8.17.12

#### Mold

Cylinder ID	#2	#2
Weight of Cylinder (lbs.)	1.33	1.33
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

#### Specimen

Wt. of Cylinder & WS (lbs.)	5.10	5.07
Wt. of Cylinder (lbs.)	1.33	1.33
Wt. of WS	3.77	3.74
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

#### Moisture / Density

Tare Number	#887	#887
Wt. of Tare & WS (gm)	192.00	181.80
Wt. of Tare & DS (gm)	161.20	158.20
Wt. of Tare (gm)	0.00	
Wt. of Water (gm)	30.80	23.60
Wt. of DS (gm)	161.20	158.20

Wet Density (pcf):	114.2	113.3
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<b>Moisture Content (%):</b>	<b>19.1</b>	<b>14.9</b>
<b>Dry Density (pcf):</b>	<b>95.9</b>	<b>98.6</b>

Geotechnics Representative : Abram Gaeta

Day: Friday  
 Date: 8.24.12  
 Log No.: 10  
 Page: 1 of 1



### Daily Field Report

<b>Project Name:</b>	Coble Sandrock Landfill	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu K.
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	<b>Arrived:</b> 10:30 AM <b>Departed:</b> 2:30 PM
<b>General Contractor:</b>	Cobles	<b>Superintendent:</b>	Kent Coble

**Other Firms / Sub-Contractor Represented On Site**

<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>

**Weather Conditions:** partly cloudy      **Temperature:** 85

**Contractor's Equipment:**

**Contractor's Personnel:**

**Description of Daily Activities & Events**

- Geotechnics representative arrived at jobsite checked in at scale house & met with Kent Coble.
- Closure fill was previously placed and compacted, then tested for required compaction.
- Rep. performed 5 nuclear densityper acre, drive cylinder and pushed shelby tubes for Acres 9 & 10.
- Acre 9 was tested for lift 3 and acre 10 for lift 2.
- Geotechnics representative departed jobsite.

**Prepared By:** MB      **Date:** 24-Aug      **Checked By:** *MB*      **Date:** 8/27



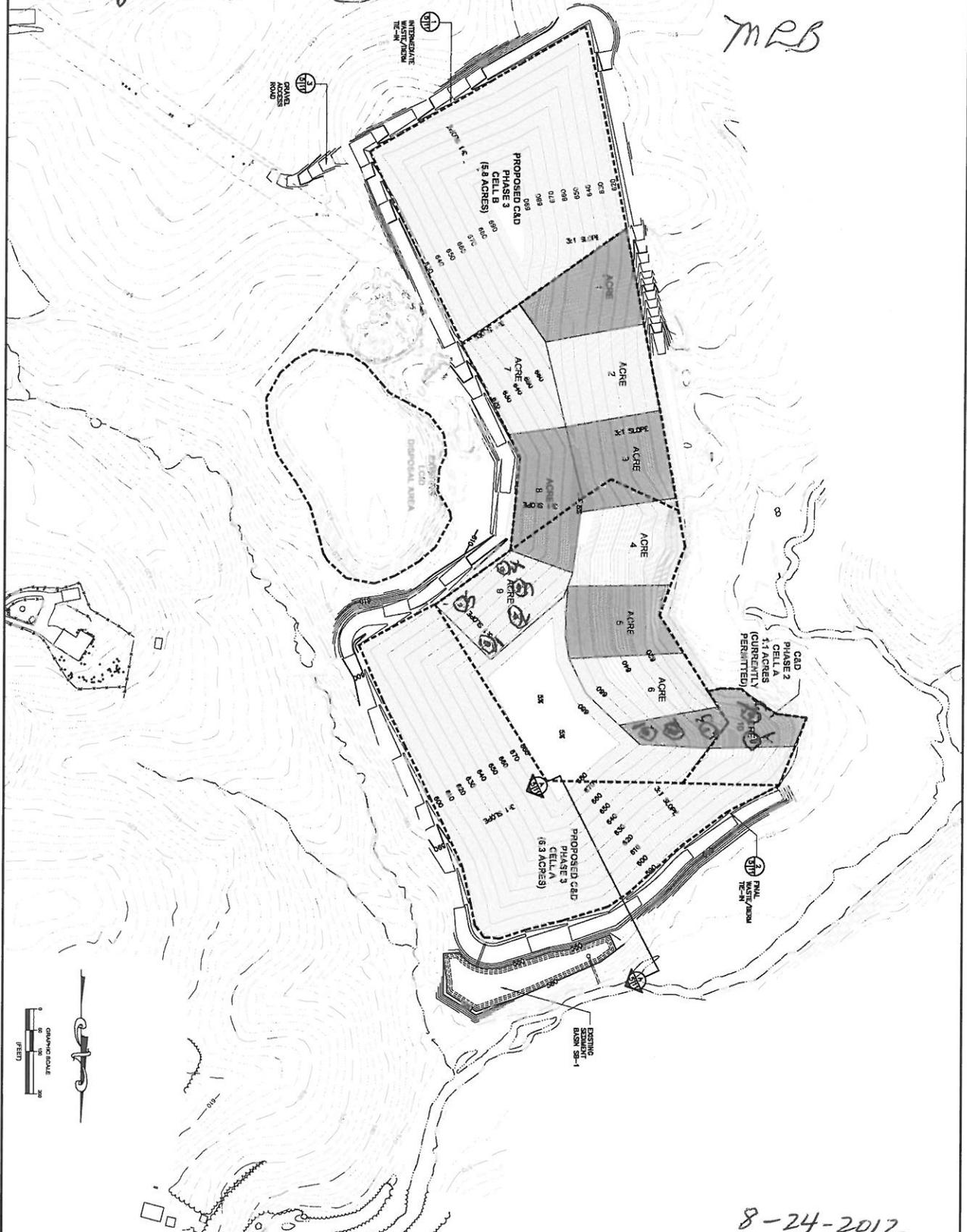
Cobles Sandrock LF  
 Joyce Engineering

Proj. #

2012-656

8-24-12

MRS



8-24-2012

DRAWING NO. 01	AS SHOWN SCALE 4:19.20	PROJECT NO. 419.20	DESIGNED SC	DATE 8/15/07	DATE	DATE	DATE	DATE	DATE
		COBLE'S SANDROCK, INC. KIMESVILLE, NORTH CAROLINA	DRAWN RE						
LANDFILL PARTIAL CLOSURE ACRE MAP			<b>JOYCE ENGINEERING</b> 2111 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE: (336) 324-0262 NC CORP LIC. C-0782		© 2007 Joyce Engineering, Inc. All Rights Reserved		10/11/11 11/09/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100/101/102/103/104/105/106/107/108/109/110/111/112/113/114/115/116/117/118/119/120/121/122/123/124/125/126/127/128/129/130/131/132/133/134/135/136/137/138/139/140/141/142/143/144/145/146/147/148/149/150/151/152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000/1001/1002/1003/1004/1005/1006/1007/1008/1009/1010/1011/1012/1013/1014/1015/1016/1017/1018/1019/1020/1021/1022/1023/1024/1025/1026/1027/1028/1029/1030/1031/1032/1033/1034/1035/1036/1037/1038/1039/1040/1041/1042/1043/1044/1045/1046/1047/1048/1049/1050/1051/1052/1053/1054/1055/1056/1057/1058/1059/1060/1061/1062/1063/1064/1065/1066/1067/1068/1069/1070/1071/1072/1073/1074/1075/1076/1077/1078/1079/1080/1081/1082/1083/1084/1085/1086/1087/1088/1089/1090/1091/1092/1093/1094/1095/1096/1097/1098/1099/1100/1101/1102/1103/1104/1105/1106/1107/1108/1109/1110/1111/1112/1113/1114/1115/1116/1117/1118/1119/1120/1121/1122/1123/1124/1125/1126/1127/1128/1129/1130/1131/1132/1133/1134/1135/1136/1137/1138/1139/1140/1141/1142/1143/1144/1145/1146/1147/1148/1149/1150/1151/1152/1153/1154/1155/1156/1157/1158/1159/1160/1161/1162/1163/1164/1165/1166/1167/1168/1169/1170/1171/1172/1173/1174/1175/1176/1177/1178/1179/1180/1181/1182/1183/1184/1185/1186/1187/1188/1189/1190/1191/1192/1193/1194/1195/1196/1197/1198/1199/1200/1201/1202/1203/1204/1205/1206/1207/1208/1209/1210/1211/1212/1213/1214/1215/1216/1217/1218/1219/1220/1221/1222/1223/1224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Client: Joyce Engineering  
Project Name : Coble's Sandrock Landfill  
Project Number : 2012-656



Report Number : **FDR-09**  
Date (s) : 8.24.12

### Drive Cylinder - ASTM D 2937

#### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-02	ND-06
Location:	Acre 9	Acre 10
Depth (ft):	LIFT 3	LIFT 2
Date :	24-Aug	24-Aug

#### Mold

Cylinder ID	1	2
Weight of Cylinder (lbs.)	1.39	1.32
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

#### Specimen

Wt. of Cylinder & WS (lbs.)	5.24	5.49
Wt. of Cylinder (lbs.)	1.39	1.32
Wt. of WS	3.85	4.17
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

#### Moisture / Density

Tare Number	300	310
Wt. of Tare & WS (gm)	594.60	578.62
Wt. of Tare & DS (gm)	507.57	520.31
Wt. of Tare (gm)	110.81	110.31
Wt. of Water (gm)	87.03	58.31
Wt. of DS (gm)	396.76	410.00

Wet Density (pcf):	116.7	126.4
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Moisture Content (%):	21.9	14.2
Dry Density (pcf):	95.7	110.6

Geotechnics Representative :

M. BLACKLEY

Day: Wed.  
 Date: 9.5.12  
 Log No.: 11  
 Page: 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu Kempainen
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	<b>Arrived:</b> 10:30 AM <b>Departed:</b> 2:00 PM
<b>General Contractor:</b>	Cobles Sandrock LF	<b>Superintendent:</b>	Kent
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Mostly Cloudy, Humid	<b>Temperature:</b>	88
<b>Contractor's Equipment:</b>	NA		
<b>Contractor's Personnel:</b>	NA		
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Geotechnics Rep. Mark Blackley arrived onsite and checked in at scale house. Geotechnics Rep. was informed that approx. 5" of rain has accumulated on site since Friday, 8.31.12.</li> <li>▪ Geotechnics Rep. proceeded to Acre 10 - Lift 3 area and checked for suitability of soil for testing. Acre 10 appeared acceptable for testing.</li> <li>▪ 5 nuclear density tests were performed with results of all 5 meeting the 90% compaction requirement. A drive cylinder and shelby tube sample was obtained at location ND-01.</li> <li>▪ Acres 7 and 8 were scheduled for testing but no fill had been placed due to wet site conditions.</li> <li>▪ Geotechnics Rep. departed the site.</li> </ul>			
<b>Prepared By:</b>	MB	<b>Date:</b>	9.5.12
<b>Checked By:</b>	JPB	<b>Date:</b>	9.12.12



**Client:** JOYCE ENGINEERING  
**Project Name :** COBLES SANDROCK LANDFILL  
**Project Number :** 2012-656

**Report Number :** **FDR-10**  
**Date (s) :** 9.5.12

## **Drive Cylinder - ASTM D 2937**

### **Test Information**

**Test Number :** DC-01  
**Nuclear Test Number :** ND-01  
**Location:** Acre 10  
**Depth (ft):** LIFT 3  
**Date :** 9.5.12

### **Mold**

**Cylinder ID** 2  
**Weight of Cylinder (lbs.)** 1.32  
**Volume of Cylinder (ft<sup>3</sup>)** 0.033

### **Specimen**

**Wt. of Cylinder & WS (lbs.)** 5.50  
**Wt. of Cylinder (lbs.)** 1.32  
**Wt. of WS** 4.18  
**Cylinder Volume (ft<sup>3</sup>)** 0.033

### **Moisture / Density**

**Tare Number** 318  
**Wt. of Tare & WS (gm)** 868.85  
**Wt. of Tare & DS (gm)** 772.25  
**Wt. of Tare (gm)** 86.60  
**Wt. of Water (gm)** 96.60  
**Wt. of DS (gm)** 685.65

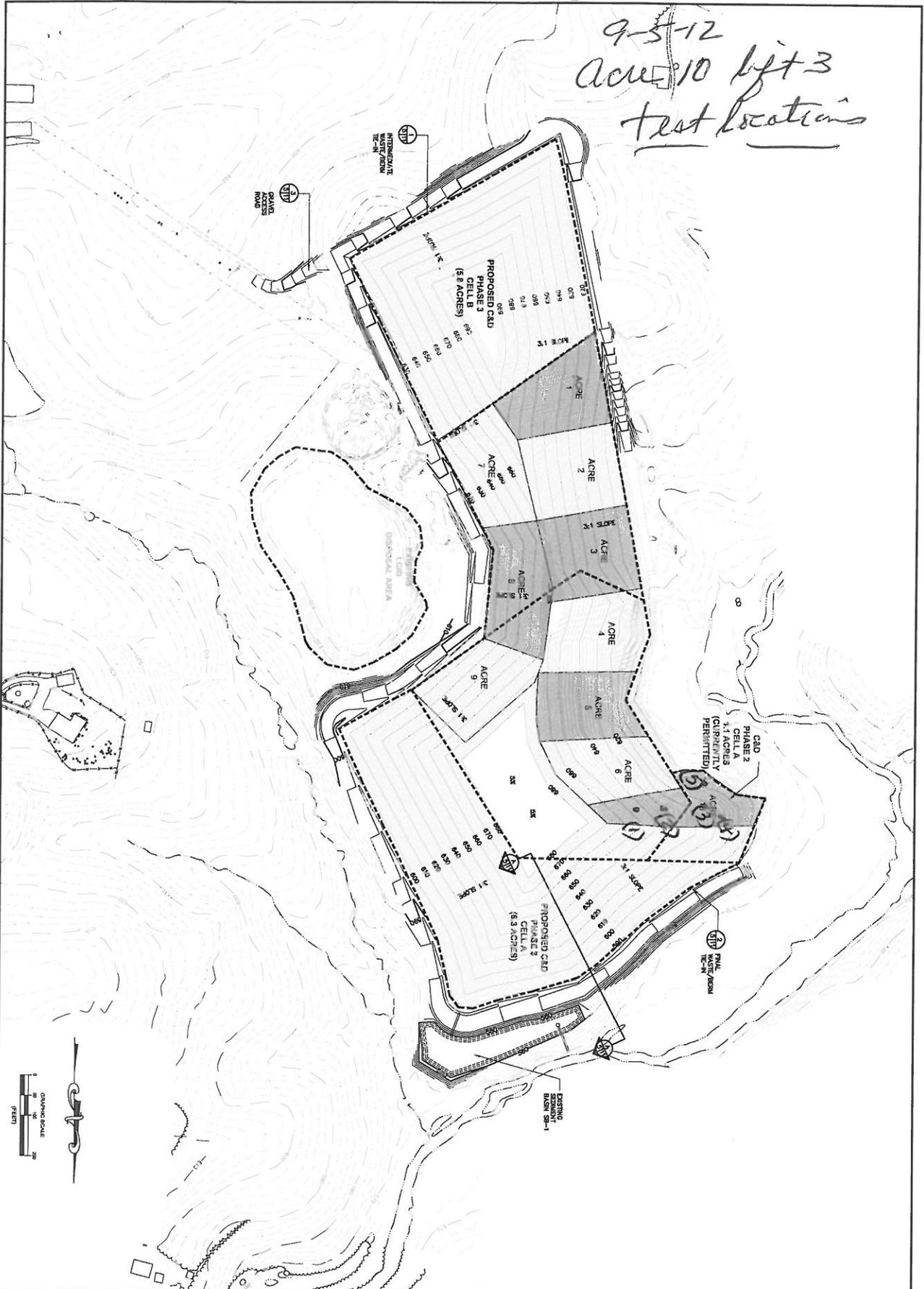
**Wet Density (pcf):** 126.7

**Moisture Content (%):** **14.1**  
**Dry Density (pcf):** **111.0**

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Geotechnics Representative : Mark Blackley

Coble LF  
 9-5-12  
 Area 10 left 3  
 test locations



DRAWING NO. 01	SCALE AS SHOWN	PROJECT NO. 419.20	<b>COBLE'S SANDROCK, INC.</b> KIMESVILLE, NORTH CAROLINA  <b>LANDFILL PARTIAL CLOSURE</b> <b>ACRE MAP</b>	<b>JOYCE ENGINEERING</b> 2211 W. MEADOWVIEW ROAD GREENSBORO, NC 27407 PHONE (336) 325-0292 NC CORP LIC: C-0792	DESIGNED: SC	10/01 DATE	1. REVISED DRAWING ENDS REVISIONS AND RECORD OF ISSUE	1. REVISED E&A NC BY: CK J&P
		DRAWN: JEB CHECKED: EA APPROVED: EA DATE: 8/15/07						

L:\Coble Sandrock\Map\CLOSURE OCTOBER 2011\Sheet set\ACRE MAP FOR CONTRACTOR\Layout\Layout1

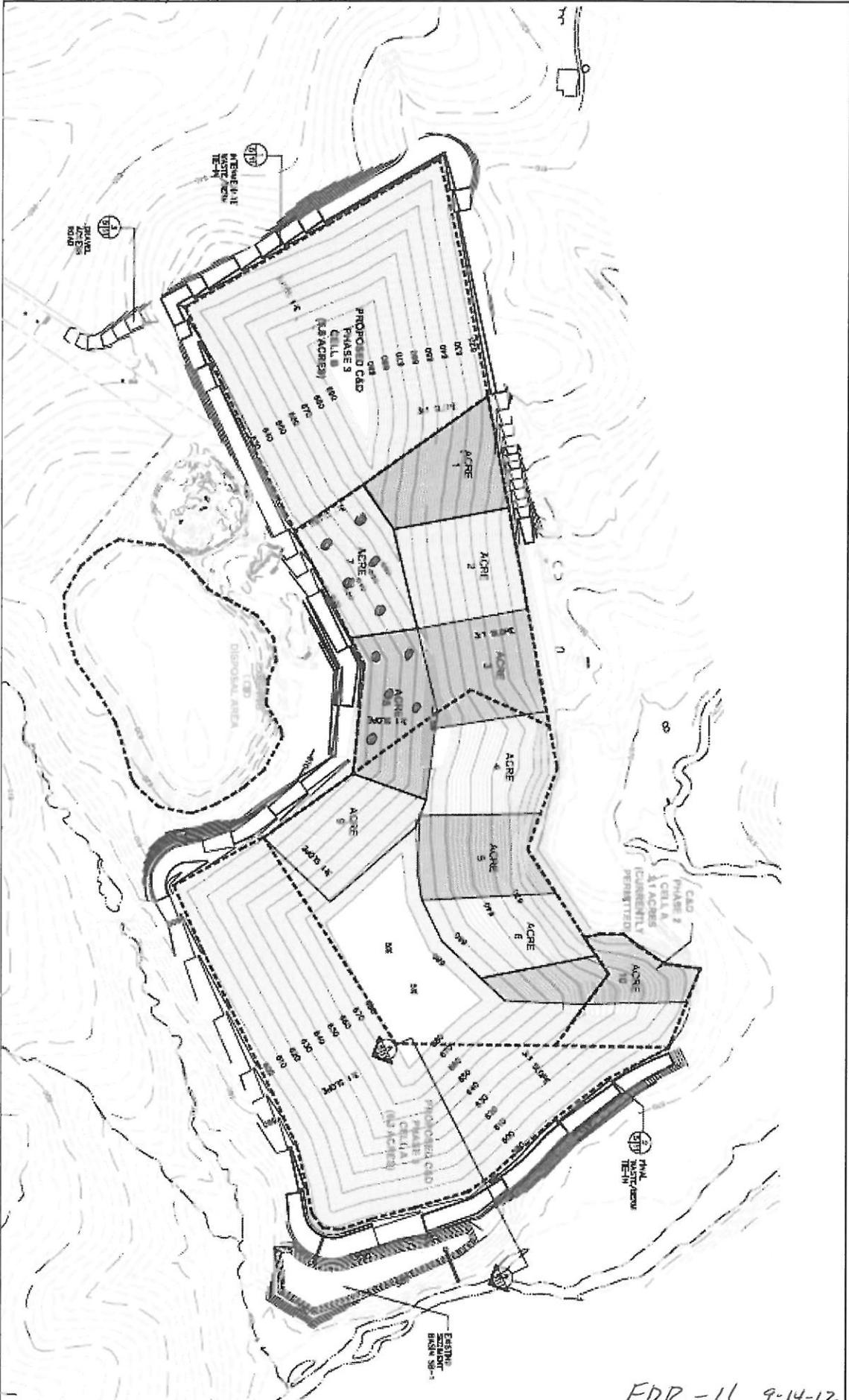
Day: Friday  
 Date: 9.14.12  
 Log No.: 12  
 Page: 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu Kemppinen
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	Arrived: 9:00 AM Departed: 12:15 PM
<b>General Contractor:</b>	Cobles Sandrock LF	<b>Superintendent:</b>	Kent
Other Firms / Sub-Contractor Represented On Site			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Partly Cloudy	<b>Temperature:</b>	80
<b>Contractor's Equipment:</b>	NA		
<b>Contractor's Personnel:</b>	NA		
Description of Daily Activities & Events			
<ul style="list-style-type: none"> <li>▪ Geotechnics Rep. Mark Blackley arrived onsite and checked in at scale house.</li> <li>▪ Geotechnics Rep. proceeded to Acre 7 &amp; 8 - Lift 1 area and checked for suitability of soil for testing. Acre 7 &amp; 8 appeared acceptable for testing.</li> <li>▪ 5 nuclear density tests were performed per acre with results of all Meeting the 90% comp. req. Drive cylinders and shelby tube samples were obtained.</li> <li>▪ Geotechnics Rep. departed the site.</li> </ul>			
<b>Prepared By:</b>	MB	<b>Date:</b>	9.14.12
<b>Checked By:</b>	<i>MB</i>	<b>Date:</b>	<i>9/25</i>





Client: JOYCE ENGINEERING  
Project Name : COBLES SANDROCK LANDFILL  
Project Number : 2012-656



Report Number : FDR-11  
Date (s) : 9.14.12

### Drive Cylinder - ASTM D 2937

#### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-01	ND-06
Location:	ACRE 8	ACRE 7
Depth (ft):	LIFT 1	LIFT 1
Date :	14-Sep	14-Sep

#### Mold

Cylinder ID	1	2
Weight of Cylinder (lbs.)	1.3	1.24
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

#### Specimen

Wt. of Cylinder & WS (lbs.)	5.30	5.00
Wt. of Cylinder (lbs.)	1.30	1.24
Wt. of WS	4.00	3.76
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

#### Moisture / Density

Tare Number	312	307
Wt. of Tare & WS (gm)	713.18	686.70
Wt. of Tare & DS (gm)	598.93	615.99
Wt. of Tare (gm)	84.41	110.44
Wt. of Water (gm)	114.25	70.71
Wt. of DS (gm)	514.52	505.55

Wet Density (pcf):	121.2	113.9
--------------------	-------	-------

Moisture Content (%):	22.2	14.0
Dry Density (pcf):	99.2	100.0

Geotechnics Representative : Mark Blackley

Day: Monday  
 Date: 9.24.12  
 Log No.: 13  
 Page: 1



## Daily Field Report

<b>Project Name:</b> Cobles Sandrock LF	<b>Project No.:</b> 2012-656
<b>Client Name:</b> Joyce Engineering	<b>Client Contact:</b> Hannu Kempainen
<b>Site Location:</b> Liberty, NC	<b>Time on Site:</b> Arrived: 10:00 AM Departed: 11:20 AM
<b>General Contractor:</b> Cobles Sandrock LF	<b>Superintendent:</b> Kent

### Other Firms / Sub-Contractor Represented On Site

<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>

**Weather Conditions:** Clear **Temperature:** 75

**Contractor's Equipment:** NA

**Contractor's Personnel:** NA

### Description of Daily Activities & Events

- Geotechnics Rep. Mark Blackley arrived onsite and checked in at scale house.
- Geotechnics Rep. proceeded to Acre 7 & 8 - Lift 2 area and checked for suitability of soil for testing.
- Acre 7 & 8 appeared to be too wet for testing.
- 4 nuclear density tests were performed with results showing low compaction and high moisture.
- Informed Kent of the failing results, area will need to dry, be reworked and recompacted.
- Geotechnics Rep. departed the site.

**Prepared By:** MB **Date:** 9.24.12 **Checked By:** *MB* **Date:** *9/24*



Day: Wednesday  
 Date: 9/26/2012  
 Log No.: 14  
 Page: 1



## Daily Field Report

<b>Project Name:</b> Cobles Sandrock LF	<b>Project No.:</b> 2012-656
<b>Client Name:</b> Joyce Engineering	<b>Client Contact:</b> Hannu Kempainen
<b>Site Location:</b> Liberty, NC	<b>Time on Site:</b> Arrived: 12:30 PM Departed: 3:30 PM
<b>General Contractor:</b> Cobles Sandrock LF	<b>Superintendent:</b> Kent

### Other Firms / Sub-Contractor Represented On Site

<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>

**Weather Conditions:** clear **Temperature:** 85

**Contractor's Equipment:** NA

**Contractor's Personnel:** NA

### Description of Daily Activities & Events

- Geotechnics Rep. Mark Blackley arrived onsite and checked in at scale house.
- Geotechnics Rep. proceeded to Acre 7 & 8 - Lift 2 area and checked for suitability of soil for testing. Acre 7 & 8 appeared to be ready for testing.
- 5 nuclear density tests were performed per acre with results of all meeting the 90% comp. req. Drive cylinders and shelly tube samples were obtained.
- Bulk soil sampling was obtained.
- Geotechnics Rep. departed the site.

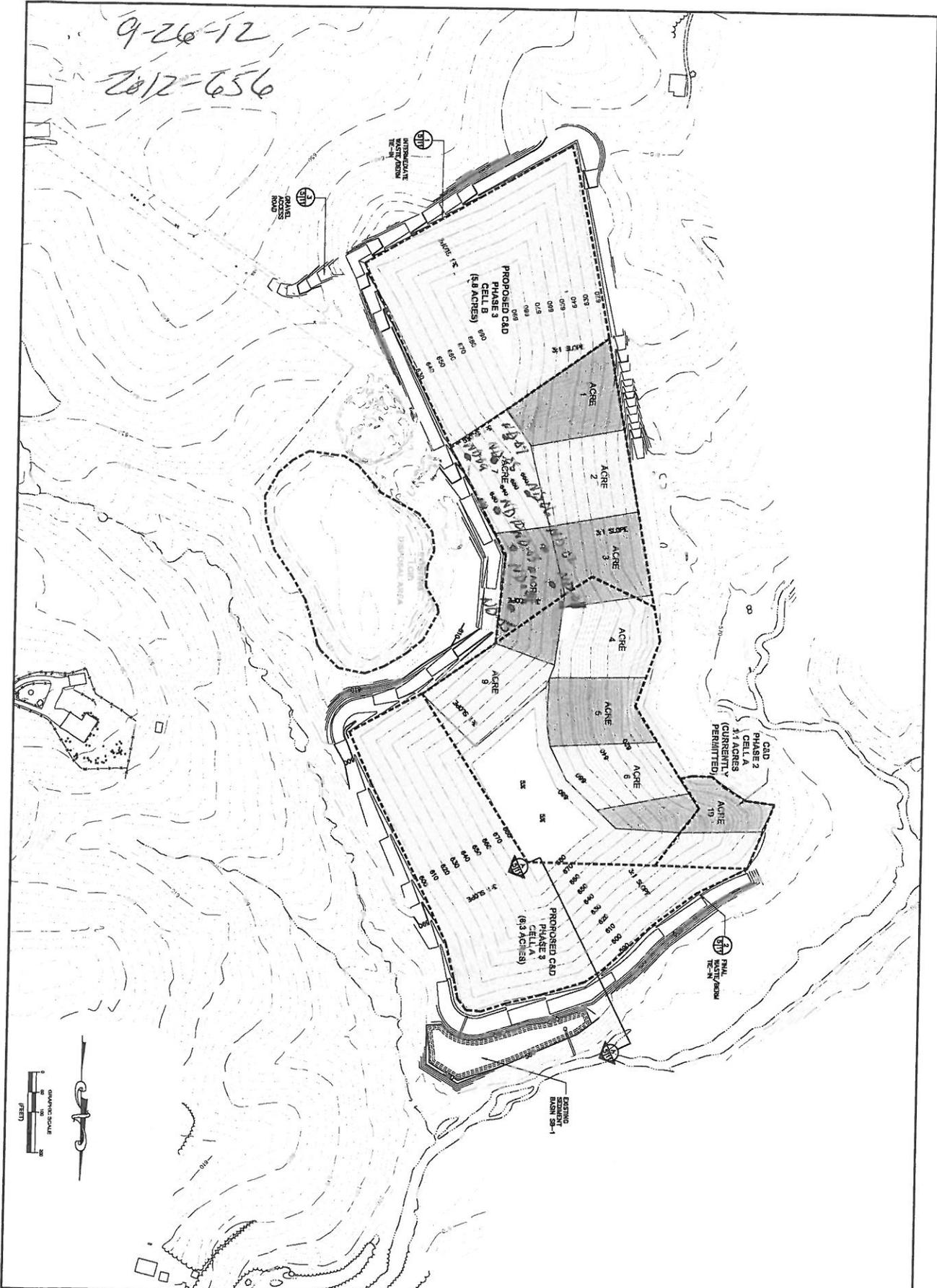
**Prepared By:** MB **Date:** 9/26/2012 **Checked By:** MB **Date:** 9/28



Cobles Sandrock LF

9-26-12

2012-656



COBLE'S SANDROCK, INC.  
KIMESVILLE, NORTH CAROLINA

LANDFILL PARTIAL CLOSURE  
ACRE MAP

**JOYCE**  
ENGINEERING

2211 W. WOODVIEW ROAD  
GREENSBORO, NC 27407  
PHONE: (336) 323-0092  
NC CORP LIC: C-0782

DESIGNED: SC  
DRAWN: RB  
CHECKED: EA  
APPROVED: EA  
DATE: 8/15/07

NO.	DATE	REVISIONS AND RECORD OF USE	BY	CHK	APP
1		REVISED CLOSURE GRIDS			

Client: JOYCE ENGINEERING  
Project Name : COBLES SANDROCK LANDFILL  
Project Number : 2012-656



Report Number : FDR-13  
Date (s) : 9.26.12

### Drive Cylinder - ASTM D 2937

#### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-01	ND-07
Location:	ACRE 8	ACRE 7
Depth (ft):	LIFT 2	LIFT 2
Date :	26-Sep	26-Sep

#### Mold

Cylinder ID	1	2
Weight of Cylinder (lbs.)	1.32	1.31
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

#### Specimen

Wt. of Cylinder & WS (lbs.)	5.41	5.35
Wt. of Cylinder (lbs.)	1.32	1.31
Wt. of WS	4.09	4.04
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

#### Moisture / Density

Tare Number	318	307
Wt. of Tare & WS (gm)	940.17	702.00
Wt. of Tare & DS (gm)	786.69	610.22
Wt. of Tare (gm)	86.60	110.41
Wt. of Water (gm)	153.48	91.78
Wt. of DS (gm)	700.09	499.81

Wet Density (pcf):	123.9	122.4
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Moisture Content (%):	21.9	18.4
Dry Density (pcf):	101.7	103.4

Geotechnics Representative : Mark Blackley

*MBS*

Day: Thurs.  
 Date: 10.18.12  
 Log No.: 15  
 Page: 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu Kempainen
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	<b>Arrived:</b> 9:30am <b>Departed:</b> 12:30pm
<b>General Contractor:</b>	Cobles Sandrock LF	<b>Superintendent:</b>	Kent Cobles
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Partly Cloudy to Cloudy	<b>Temperature:</b>	70
<b>Contractor's Equipment:</b>	NA		
<b>Contractor's Personnel:</b>	NA		
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Geotechnics Rep. Mark Blackley arrived onsite and checked in at scale house.</li> <li>▪ Geotechnics Rep. performed density tests including drive cylinder and shelly tubes on acres 7 and 8 - lift 3. 10 Nuclear density , 2 Drive Cylinder, and 2 Shelby tube tests were performed.</li> <li>▪ All nuclear density tests meet or exceeded the 90% compaction requirements.</li> <li>▪ Geotechnics Rep. departed the site and transported shelly tube and drive cylinder samples to Geotechnics laboratory facility for further testing.</li> </ul>			
<b>Prepared By:</b>	JRB	<b>Date:</b>	10.24.12
<b>Checked By:</b>	JRB	<b>Date:</b>	10.24.12



**Client:** JOYCE ENGINEERING  
**Project Name :** COBLES SANDROCK LANDFILL  
**Project Number :** 2012-656

**Report Number :** FDR-14  
**Date (s) :** 10.18.12

## Drive Cylinder - ASTM D 2937

### Test Information

Test Number :	DC-01	DC-02
Nuclear Test Number :	ND-01	ND-07
Location:	ACRE 8	ACRE 7
Depth (ft):	LIFT 3	LIFT 3
Date :	10.18.12	10.18.12

### Mold

Cylinder ID	1	2
Weight of Cylinder (lbs.)	1.31	1.32
Volume of Cylinder (ft <sup>3</sup> )	0.033	0.033

### Specimen

Wt. of Cylinder & WS (lbs.)	5.36	5.41
Wt. of Cylinder (lbs.)	1.31	1.32
Wt. of WS	4.05	4.09
Cylinder Volume (ft <sup>3</sup> )	0.033	0.033

### Moisture / Density

Tare Number	398	311
Wt. of Tare & WS (gm)	680.39	790.12
Wt. of Tare & DS (gm)	555.39	664.53
Wt. of Tare (gm)	84.39	84.75
Wt. of Water (gm)	125.00	125.59
Wt. of DS (gm)	471.00	579.78

Wet Density (pcf):	122.7	123.9
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<b>Moisture Content (%):</b>	<b>26.5</b>	<b>21.7</b>
<b>Dry Density (pcf):</b>	<b>97.0</b>	<b>101.9</b>

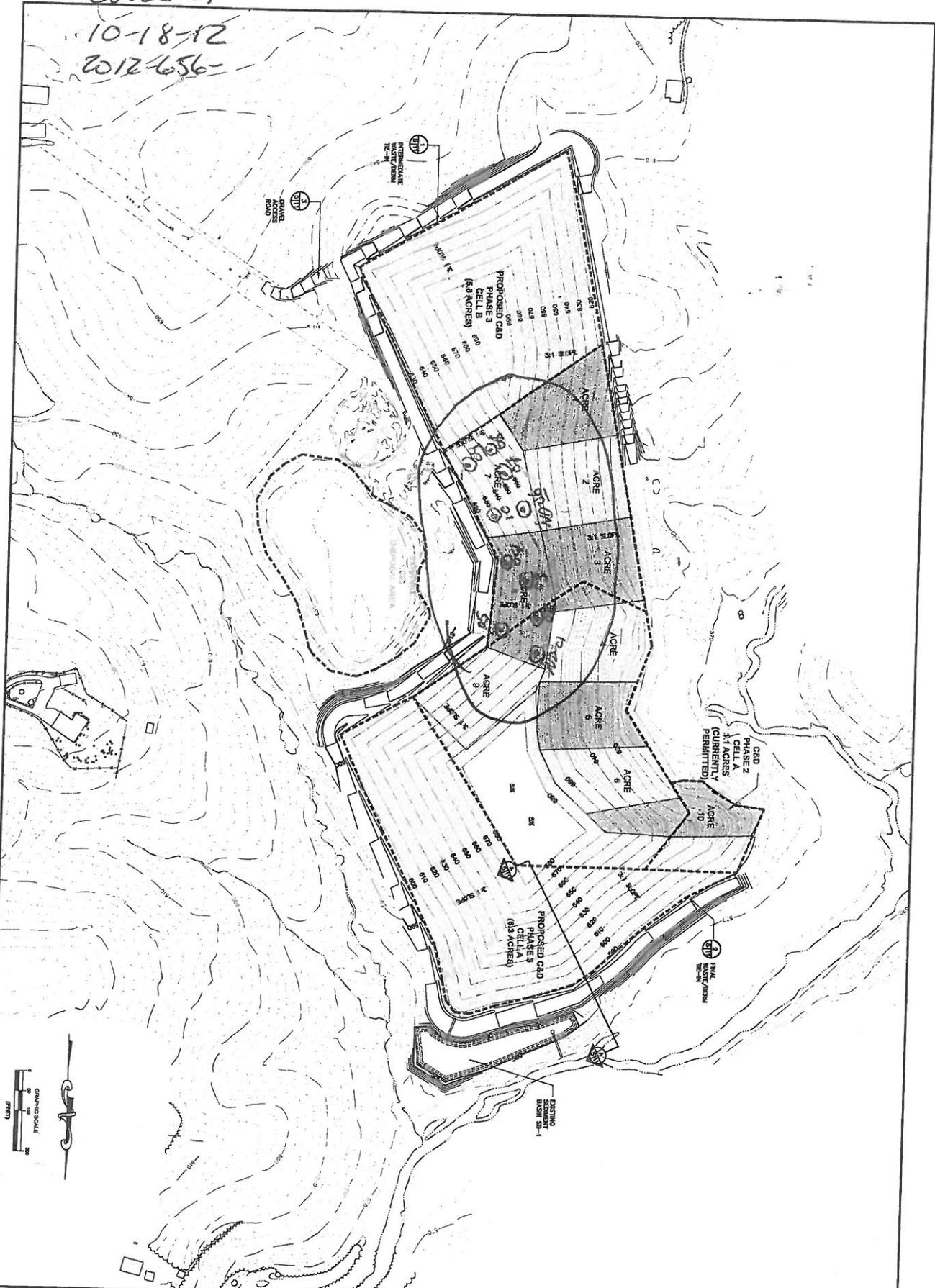
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Geotechnics Representative : Mark Blackley

Cobles L.F.

10-18-12

2012-656-



COBLE'S SANDROCK, INC.  
KIMESVILLE, NORTH CAROLINA

LANDFILL PARTIAL CLOSURE  
ACRE MAP

**JOYCE**  
ENGINEERING

2211 W. MEADOWVIEW ROAD  
GREENSBORO, NC 27407  
PHONE: (336) 323-0282  
NC CORP LIC: C-0782

DESIGNED	SC
DRAWN	RS
CHECKED	VA
APPROVED	EA
DATE	8/16/07

NO.	DATE	REVISIONS AND RECORD OF ISSUE	BY	CHK	APP
1	8/16/07	REVISED SURFACE GRADE	RS	EA	SCA

L:\Coble Bero\2012\CLOSURE OCTOBER 2011\new.mxd\ACRE MAP FOR CONTRACTOR\Layout-Layout

Day: Thurs.  
 Date: 10.25.12  
 Log No.: 16  
 Page: 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock LF	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu Kempainen
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	<b>Arrived:</b> 11:15am <b>Departed:</b> 12:15pm
<b>General Contractor:</b>	Cobles Sandrock LF	<b>Superintendent:</b>	Kent Cobles
<b>Other Firms / Sub-Contractor Represented On Site</b>			
<u>Firm / Sub-Contractor</u>		<u>Representative's Name and Title</u>	
<b>Weather Conditions:</b>	Sunny	<b>Temperature:</b>	70
<b>Contractor's Equipment:</b>	NA		
<b>Contractor's Personnel:</b>	NA		
<b>Description of Daily Activities &amp; Events</b>			
<ul style="list-style-type: none"> <li>▪ Geotechnics Rep. Jacob R. Buda arrived on site.</li> <li>▪ Geotechnics Rep. performed CQA Moisture / Density testing of Acre 7 - Lift 3. 5 Nuclear density and 1 Drive Cylinder tests were performed.</li> <li>▪ Geotechnics Rep. obtained an Undisturbed Shelby Tube sample for laboratory testing.</li> <li>▪ Geotechnics Rep. departed the site.</li> </ul>			
<b>Prepared By:</b>	JRB	<b>Date:</b>	10.25.12
<b>Checked By:</b>	JRB	<b>Date:</b>	10.29.12



**Client:** JOYCE ENGINEERING  
**Project Name :** COBLES SANDROCK LANDFILL  
**Project Number :** 2012-656

**Report Number :** **FDR-15**  
**Date (s) :** 10.25.12

## **Drive Cylinder - ASTM D 2937**

### **Test Information**

Test Number : DC-01  
Nuclear Test Number : ND-03  
Location: ACRE 7  
Depth (ft): LIFT 3  
Date : 10.24.12

### **Mold**

Cylinder ID DC-01  
Weight of Cylinder (lbs.) 1.32  
Volume of Cylinder (ft<sup>3</sup>) 0.033

### **Specimen**

Wt. of Cylinder & WS (lbs.) 5.41  
Wt. of Cylinder (lbs.) 1.32  
Wt. of WS 4.09  
Cylinder Volume (ft<sup>3</sup>) 0.033

### **Moisture / Density**

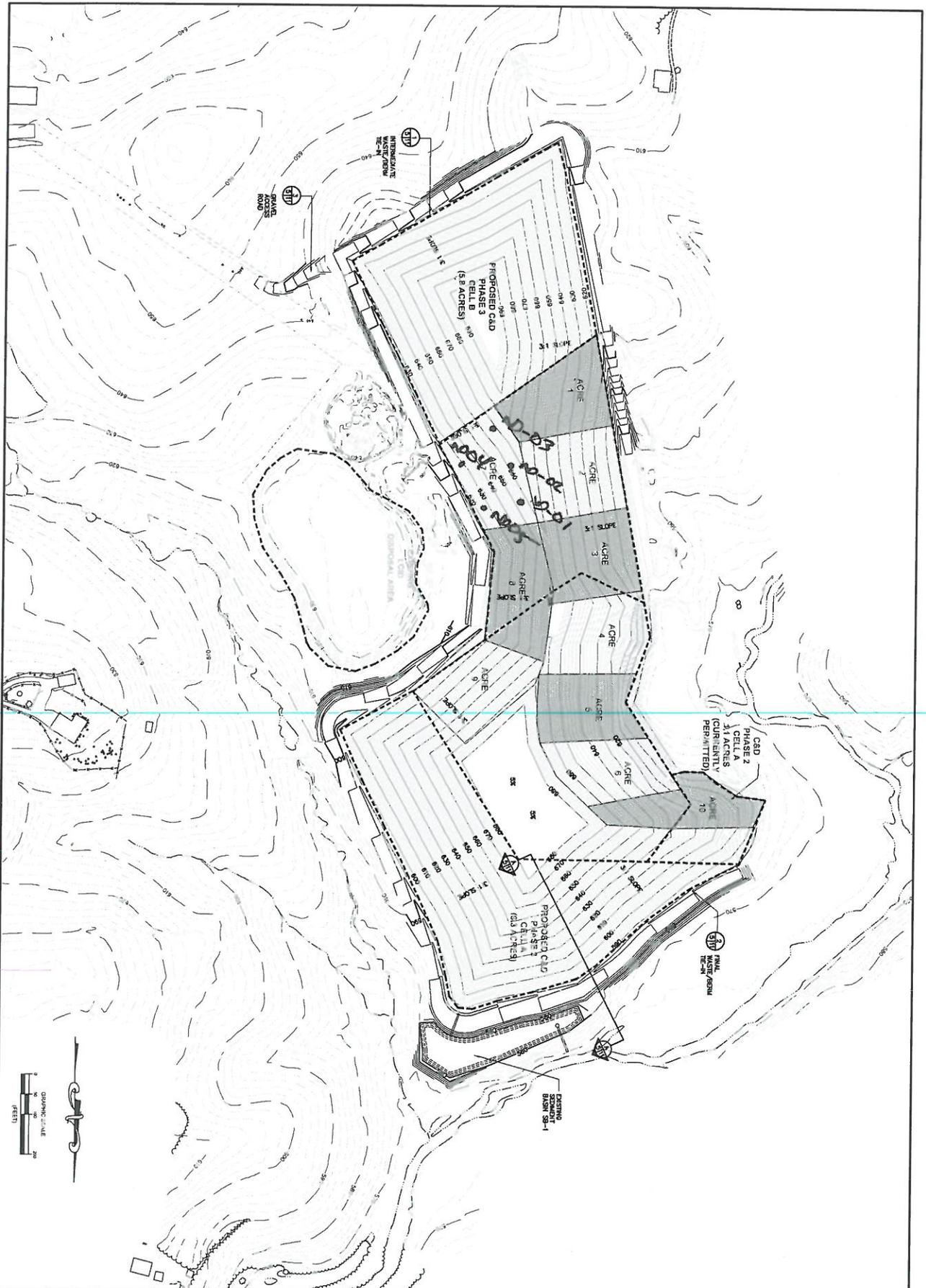
Tare Number 314  
Wt. of Tare & WS (gm) 324.10  
Wt. of Tare & DS (gm) 285.30  
Wt. of Tare (gm) 84.70  
Wt. of Water (gm) 38.80  
Wt. of DS (gm) 200.60

Wet Density (pcf): 123.9

**Moisture Content (%): 19.3**  
**Dry Density (pcf): 103.9**

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Geotechnics Representative : Jacob R. Buda



DRAWING NO. 01	AS SHOWN	SCALE	PROJECT NO.	<b>COBLE'S SANDROCK, INC.</b> KIMESVILLE, NORTH CAROLINA  <b>LANDFILL PARTIAL CLOSURE</b> <b>ACRE MAP</b>	<b>JOYCE ENGINEERING</b> 5311 W. MEADOWVIEW ROAD RALEIGH, NC 27607 PHONE: (704) 304-0000 NC CORP LIC: 0-0782	DESIGNED	SC	REVISIONS AND RECORD OF ISSUE NO. BY DATE APP
			419.20			DRAWN	RB	

Day: Monday  
 Date: 12.10.12  
 Log No.: 17  
 Page: 1 of 1



### Daily Field Report

<b>Project Name:</b>	Cobles Sandrock C&D Landfill	<b>Project No.:</b>	2012-656
<b>Client Name:</b>	Joyce Engineering	<b>Client Contact:</b>	Hannu K.
<b>Site Location:</b>	Liberty, NC	<b>Time on Site:</b>	Arrived: 1:00 PM Departed: 3:15 PM
<b>General Contractor:</b>	Cobles Sandrock C&D Landfill	<b>Superintendent:</b>	Kent Cobles

#### Other Firms / Sub-Contractor Represented On Site

<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>

**Weather Conditions:** Sunny **Temperature:** 56

**Contractor's Equipment:** N/A

**Contractor's Personnel:** N/A

#### Description of Daily Activities & Events

- Geotechnics representative Abe Gaeta arrived on jobsite.
- Geotechnics Rep. performed CQA Moisture / Density testing of Acre 11 - Lift 1. 5 Nuclear density and 1 Drive Cylinder tests were performed.
- Geotechnics Rep. obtained an Undisturbed Shelby Tube and 1 back-up sample for laboratory testing.
- Geotechnics representative departed jobsite.

**Prepared By:** AG **Date:** 12.10.12 **Checked By:** *PAVS* **Date:** 12/13





**Client:** Joyce Engineering  
**Project Name :** Cobles Sandrock Landfill  
**Project Number :** 2012-656



**Report Number :** DFR-17  
**Date (s) :** 12.10.12

## **Drive Cylinder - ASTM D 2937**

### **Test Information**

**Test Number :** DC-02  
**Nuclear Test Number :** ND-01  
**Location:** Acre 11  
**Depth (ft):** Lift 1  
**Date :** 12.10.12

### **Mold**

**Cylinder ID** #1  
**Weight of Cylinder (lbs.)** 1.34  
**Volume of Cylinder (ft<sup>3</sup>)** 0.033

### **Specimen**

**Wt. of Cylinder & WS (lbs.)** 5.20  
**Wt. of Cylinder (lbs.)** 1.34  
**Wt. of WS** 3.86  
**Cylinder Volume (ft<sup>3</sup>)** 0.033

### **Moisture / Density**

**Tare Number** #311  
**Wt. of Tare & WS (gm)** 248.20  
**Wt. of Tare & DS (gm)** 219.87  
**Wt. of Tare (gm)** 84.90  
**Wt. of Water (gm)** 28.33  
**Wt. of DS (gm)** 134.97

**Wet Density (pcf):** 117.0

**Moisture Content (%):** 21.0  
**Dry Density (pcf):** 96.7

**Compaction (%)** 91.6

---

Geotechnics Representative : Abe Gaeta

Day: Thursday  
 Date: 1.9.13  
 Log No.: 18  
 Page: 1 of 1



### Daily Field Report

<b>Project Name:</b> Cobles Sandrock C&D Landfill	<b>Project No.:</b> 2013-606
<b>Client Name:</b> Joyce Engineering	<b>Client Contact:</b> Hannu K.
<b>Site Location:</b> Liberty, NC	<b>Time on Site:</b> Arrived: 12:30 PM Departed: 3:00 PM
<b>General Contractor:</b> Cobles Sandrock C&D Landfill	<b>Superintendent:</b> Kent Cobles

**Other Firms / Sub-Contractor Represented On Site**

<u>Firm / Sub-Contractor</u>	<u>Representative's Name and Title</u>

**Weather Conditions:** Sunny **Temperature:** 59

**Contractor's Equipment:** N/A

**Contractor's Personnel:** N/A

**Description of Daily Activities & Events**

- Geotechnics representative Abe Gaeta arrived on jobsite.
- Geotechnics Rep. performed CQA Moisture / Density testing of Acre 11 - Lift 2. (5) Nuclear density tests, and (1) Drive Cylinder test were performed onsite.
- Geotechnics Rep. obtained an Undisturbed Shelby Tube, and 1 back-up sample for laboratory testing.
- Geotechnics representative departed jobsite.

**Prepared By:** AG **Date:** 1.9.13 **Checked By:** *APPS* **Date:** 1/11



Client: Joyce Engineering  
Project Name : Cobles Sandrock Landfill  
Project Number : 2013-606



Report Number : **DFR-18**  
Date (s) : 1.9.13

## Drive Cylinder - ASTM D 2937

### Test Information

Test Number : DC-01  
Nuclear Test Number : ND-01  
Location: Acre 11  
Depth (ft): Lift 2  
Date : 1.9.13

### Mold

Cylinder ID #1  
Weight of Cylinder (lbs.) 1.04  
Volume of Cylinder (ft<sup>3</sup>) 0.034

### Specimen

Wt. of Cylinder & WS (lbs.) 5.20  
Wt. of Cylinder (lbs.) 1.04  
Wt. of WS 4.16  
Cylinder Volume (ft<sup>3</sup>) 0.034

### Moisture / Density

Tare Number SS-5  
Wt. of Tare & WS (gm) 367.60  
Wt. of Tare & DS (gm) 344.20  
Wt. of Tare (gm) 95.00  
Wt. of Water (gm) 23.40  
Wt. of DS (gm) 249.20

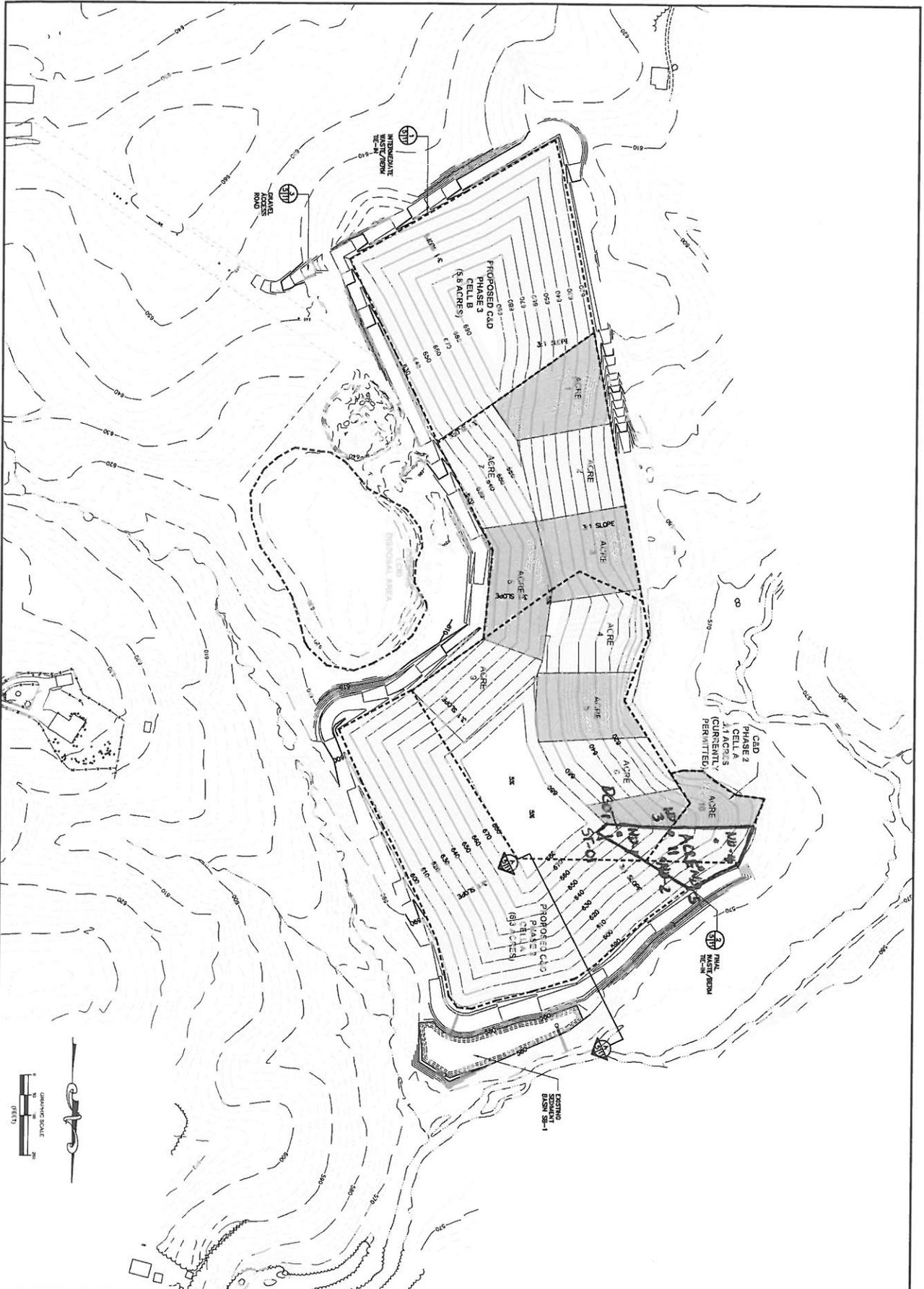
Wet Density (pcf): 122.4

**Moisture Content (%) : 9.4**  
**Dry Density (pcf): 111.9**

Compaction (%) 99.2

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Geotechnics Representative : Abe Gaeta



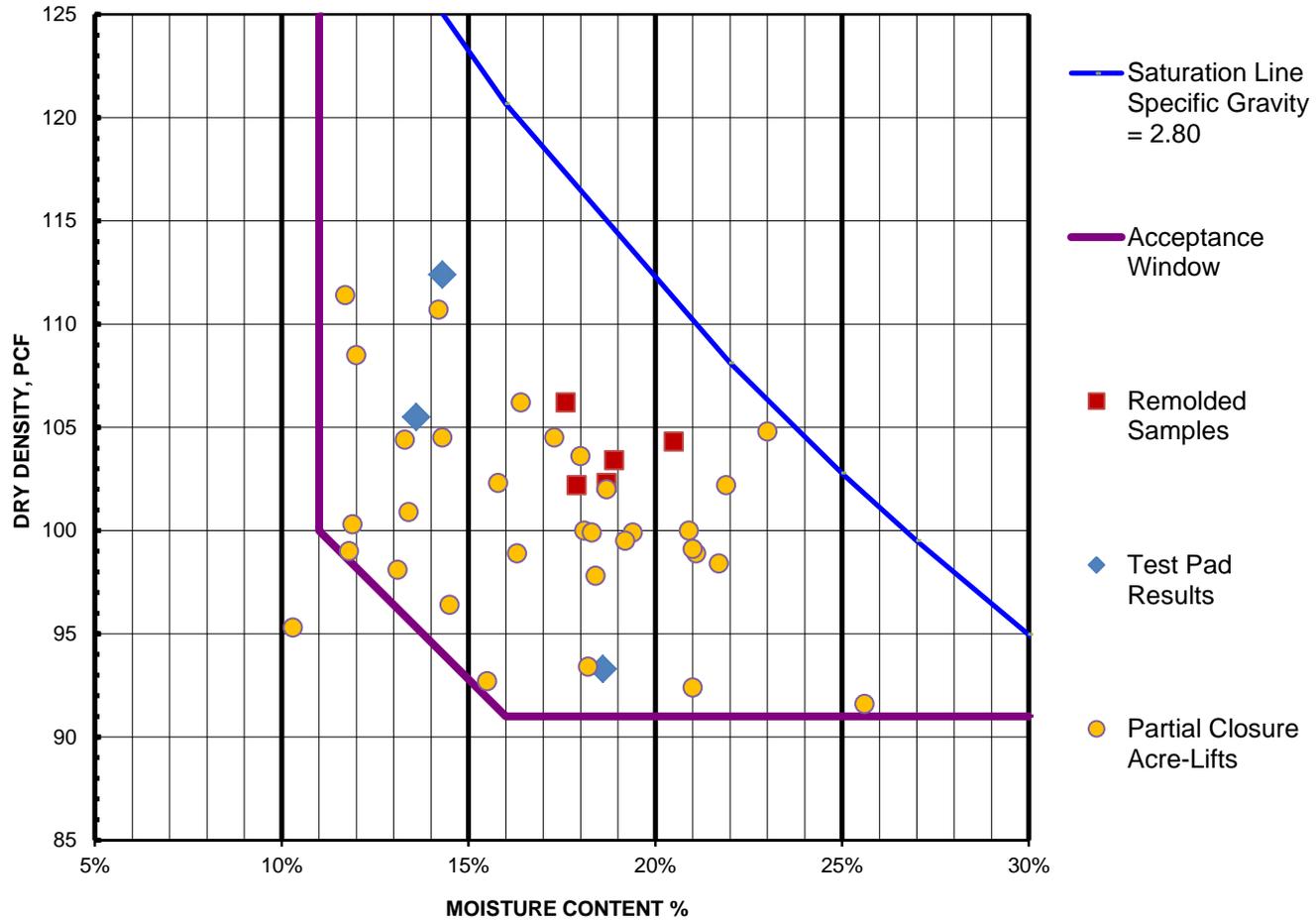
ACRE 11 - 214-2 1/9/13

DRAWING NO. 01	SCALE AS SHOWN	PROJECT NO. 419.20	<b>COBLE'S SANDROCK, INC.</b> KIMESVILLE, NORTH CAROLINA  <b>LANDFILL PARTIAL CLOSURE</b> <b>ACRE MAP</b>	<b>JOYCE ENGINEERING</b> 2211 W. MEADOWS LANE ROAD URANCEBORO, NC 27884 PHONE: 336-254-0402 NO. CORP. LI. 54700	DESIGNED: SC	REVIEWED: [ ] DATE: 01/15/13	DATE: [ ] REVISIONS AND RECORD OF ISSUE: [ ]
		CHECKED: EA APPROVED: EA			DRAWN: RB DATE: 01/15/13		

L:\coble\Site\rock\ug\CL\13\URE 419\TOBER 2013\revised\ACRE MAP FOR CONTRACT 01.dwg (1/15/13) Layout

**APPENDIX 3 – HYDRAULIC CONDUCTIVITY TEST RESULTS**

**MOISTURE-DENSITY RESULTS OF CLAY SOIL SAMPLES  
PERMEABILITY LESS THAN 1.0E-05 CM/SEC**



PRE-CONSTRUCTION TESTING			Standard Proctor		Remolded Lab Samples				Perm	Atterberg Limits			
Lab ID	Sample	USCS	OMC	MDD	MC	OMC-MC	DD	DD/MDD	(cm/sec)	Fines	LL	PL	PI
2012-656-01-01	Lowperm	ML	18.2%	105.6	20.5%	2.3%	104.3	98.8%	1.1E-06	66.7%	37	30	7
2012-656-01-02	Intermed	CL	15.1%	112.8	17.6%	2.5%	106.2	94.1%	4.7E-07	56.0%	39	25	14
CONSTRUCTION TESTING			Standard Proctor		Remolded Lab Samples				Perm	Atterberg Limits			
Lab ID	Sample	USCS	OMC	MDD	MC	OMC-MC	DD	DD/MDD	(cm/sec)	Fines	LL	PL	PI
2012-656-12-01	P-1	ML	16.0%	107.1	17.9%	1.9%	102.2	95.4%	4.7E-06	66.7%	39	30	9
12-02	P-2	ML	17.6%	106.5	18.7%	1.1%	102.3	96.1%	1.1E-06	56.0%	41	27	14
12-03	P-3	SM	16.8%	108.8	18.9%	2.1%	103.4	95.0%	4.6E-06	56.0%	38	28	10
TEST PAD			Standard Proctor		Test Pad Lab Samples				Perm				
Lab ID	Sample	USCS	OMC	MDD	MC	OMC-MC	DD	DD/MDD	(cm/sec)	Fines	LL	PL	PI
2012-656-02-01	ST-TP-01	ML	18.2%	105.6	18.6%	0.4%	93.3	88.4%	1.7E-06				
03-01	ST-TP-02	ML	18.2%	105.6	13.6%	-4.6%	105.5	99.9%	5.0E-06				
04-01	ST-TP-03	CL	15.1%	112.8	14.3%	-0.8%	112.4	99.6%	3.8E-07				
CLOSURE CAP			Standard Proctor		Shelby Tube Samples				Perm				
Lab ID	Sample	USCS	OMC	MDD	MC	OMC-MC	DD	DD/MDD	(cm/sec)	Fines	LL	PL	PI
2012-656-02-01	A1 L1	ML	18.2%	105.6	18.6%	0.4%	93.3	88.4%	1.7E-06				
03-01	A1 L2	ML	16.0%	107.1	13.6%	-2.4%	105.5	98.5%	5.0E-06				
04-01	A1 L3	CL	15.1%	112.8	14.3%	-0.8%	112.4	99.6%	3.8E-07				
2012-656-03-02	A2 L1	ML	18.2%	105.6	21.1%	2.9%	98.9	93.7%	3.7E-08				
03-05	A2 L2	ML	18.2%	105.6	11.8%	-6.4%	99.0	93.8%	6.1E-07				
04-02	A2 L3	ML	18.2%	105.6	23.0%	4.8%	104.8	99.2%	6.3E-08				
2012-656-02-03	A3 L1	ML	18.2%	105.6	11.9%	-6.3%	100.3	95.0%	2.2E-06				
03-03	A3 L2	ML	18.2%	105.6	18.1%	-0.1%	100.0	94.7%	2.1E-06				
04-03	A3 L3	ML	18.2%	105.6	21.9%	3.7%	102.2	96.8%	3.1E-08				
2012-656-02-04	A4 L1	ML	18.2%	105.6	14.3%	-3.9%	104.5	99.0%	3.5E-06				
03-04	A4 L2	ML	18.2%	105.6	18.0%	-0.2%	103.6	98.1%	4.6E-08				
04-04	A4 L3	ML	16.0%	107.1	16.4%	0.4%	106.2	99.2%	1.9E-07				
2012-656-05-01	A5 L1	ML	18.2%	105.6	10.3%	-7.9%	95.3	90.2%	5.5E-06				
06-01	A5 L2	ML	18.2%	105.6	16.3%	-1.9%	98.9	93.7%	3.7E-06				
07-01	A5 L3	ML	18.2%	105.6	25.6%	7.4%	91.6	86.7%	3.9E-07				
2012-656-05-02	A6 L1	ML	18.2%	105.6	18.4%	0.2%	97.8	92.6%	1.1E-06				
06-02	A6 L2	ML	18.2%	105.6	13.4%	-4.8%	100.9	95.5%	1.5E-06				
07-02	A6 L3	ML	18.2%	105.6	21.7%	3.5%	98.4	93.2%	1.5E-06				
2012-656-11-02	A7 L1	ML	18.2%	105.6	14.5%	-3.7%	96.4	91.3%	5.3E-06				
13-02	A7 L2	ML	18.2%	105.6	19.4%	1.2%	99.9	94.6%	2.4E-06				
14-01	A7 L3	ML	18.2%	105.6	18.3%	0.1%	99.9	94.6%	2.4E-05				
15-01	A7 L3R	ML	18.2%	105.6	18.7%	0.5%	102.0	96.6%	1.7E-07				
2012-656-11-01	A8 L1	ML	18.2%	105.6	15.5%	-2.7%	92.7	87.8%	4.3E-06				
13-01	A8 L2	ML	18.2%	105.6	19.2%	1.0%	99.5	94.2%	2.9E-06				
14-02	A8 L3	ML	18.2%	105.6	20.9%	2.7%	100.0	94.7%	7.1E-07				
2012-656-07-03	A9 L1	ML	18.2%	105.6	13.1%	-5.1%	98.1	92.9%	1.7E-06				
08-02	A9 L2	ML	18.2%	105.6	18.2%	0.0%	93.4	88.4%	8.4E-06				
09-01	A9L3	ML	18.2%	105.6	21.0%	2.8%	99.1	93.8%	1.1E-06				
2012-656-08-01	A10 L1	ML	18.2%	105.6	13.3%	-4.9%	104.4	98.9%	5.6E-06				
09-02	A10 L2	CL	15.1%	112.8	14.2%	-0.9%	110.7	98.1%	6.1E-06				
10-01	A10 L3	CL	15.1%	112.8	11.7%	-3.4%	111.4	98.8%	1.5E-06				
2012-656-16-01	A11L1	ML	18.2%	105.6	21.0%	2.8%	92.4	87.5%	9.0E-06				
2013-606-01-01	A11L2	ML	18.2%	105.6	15.8%	-2.4%	102.3	96.9%	2.5E-05				
01-01	A11L2R	ML	15.1%	112.8	12.0%	-3.1%	108.5	96.2%	1.3E-06				
02-01	A11L3	ML	18.2%	105.6	17.3%	-0.9%	104.5	99.0%	3.3E-07				

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

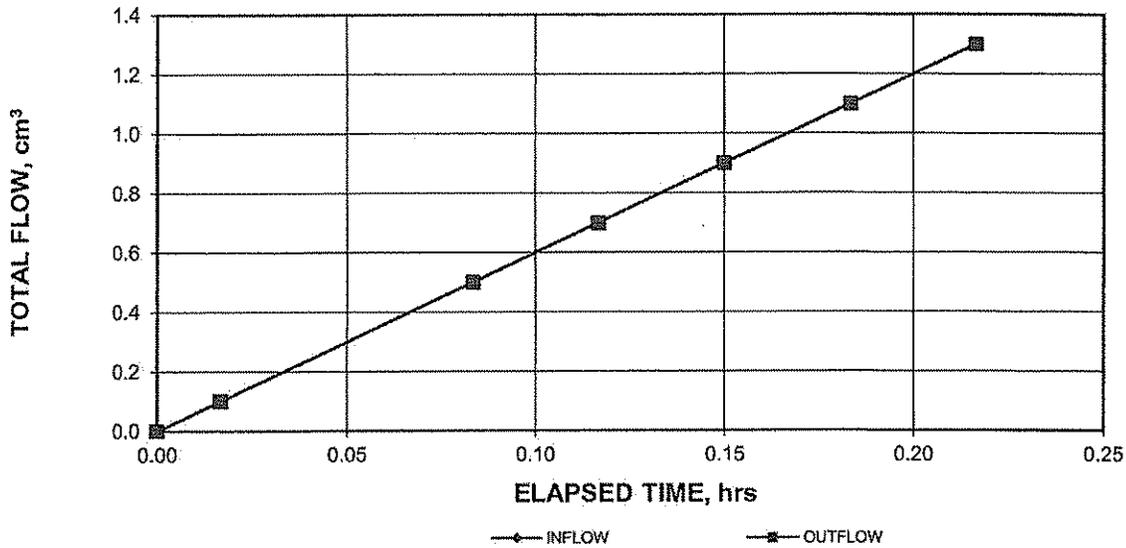
Client  
Client Project  
Project No.  
Lab ID No.

JOYCE ENGINEERING  
COBLE SR  
2012-656-02  
2012-656-02-01

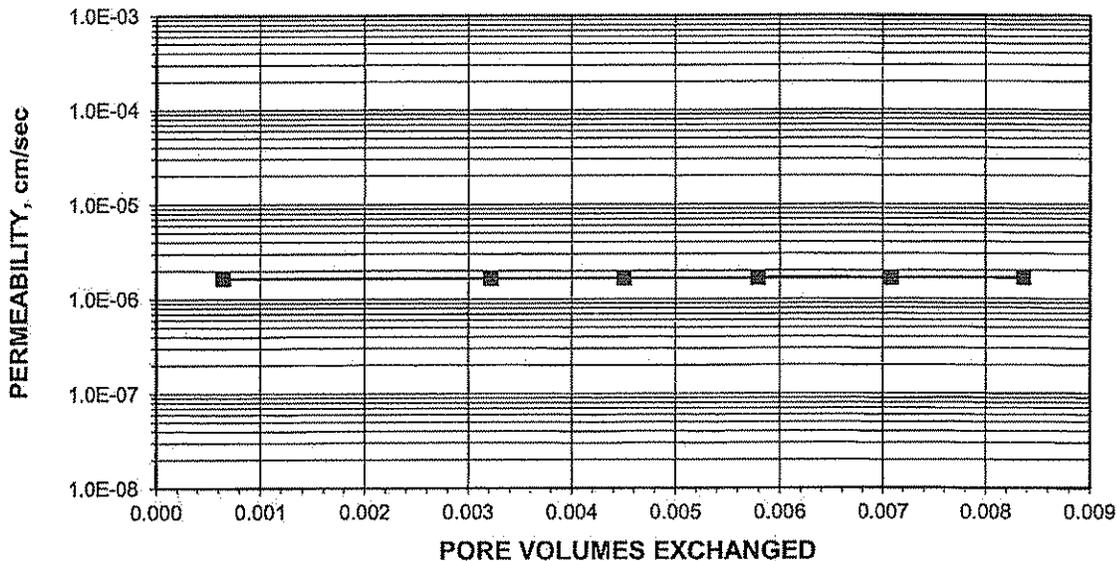
Boring No. TEST PAD / *ACR 1*  
Depth (ft.) LIFT 1  
Sample No. ST-TP-01

AVERAGE PERMEABILITY = 1.7E-06 cm/sec @ 20°C  
AVERAGE PERMEABILITY = 1.7E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW

Date: 4/16/2012 Checked By: *GEM*

Date: *4-19-12*

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client JOYCE ENGINEERING  
Client Project COBLE SR  
Project No. 2012-656-02  
Lab ID No. 2012-656-02-01

Boring No. TEST PAD / ACRE 1  
Depth (ft.) LIFT 1  
Sample No. ST-TP-01

Specific Gravity 2.70 Assumed  
Sample Condition Undisturbed

Visual Description: RED SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	8010	823
Wt. of Tare & WS (gm.)	358.88	426.98
Wt. of Tare & DS (gm.)	323.90	368.86
Wt. of Tare (gm.)	135.81	136.85
Wt. of Water (gm.)	34.98	58.12
Wt. of DS (gm.)	188.09	232.01
Moisture Content (%)	18.6	25.1

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	651.94	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	651.94	687.41
Length 1 (in.)	3.601	3.526
Length 2 (in.)	3.566	3.466
Length 3 (in.)	3.504	3.416
Top Diameter (in.)	2.835	2.830
Middle Diameter (in.)	2.835	2.840
Bottom Diameter (in.)	2.835	2.836
Average Length (in.)	3.56	3.47
Average Area (in. <sup>2</sup> )	6.31	6.31
Sample Volume (cm <sup>3</sup> )	367.94	358.96
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.77	1.92
Unit Wet Wt. (pcf)	110.6	119.5
Unit Dry Wt. (pcf)	93.3	95.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.49	1.53
Void Ratio, e	0.81	0.76
Porosity, n	0.45	0.43
Pore Volume (cm <sup>3</sup> )	164.3	155.4
Total Wgt. Of Sample After Test		685.03

Tested By: BW

Date: 4/16/2012

Checked By: GEM

Date: 4-19-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client JOYCE ENGINEERING  
 Client Project COBLE SR  
 Project No. 2012-656-02  
 Lab ID No. 2012-656-02-01

Boring No. TEST PAD / ACRE 1  
 Depth (ft.) LIFT 1  
 Sample No. ST-TP-01

**Pressure Heads (Constant)**  
 Top Cap (psi) 37.5  
 Bottom Cap (psi) 40.0  
 Cell (psi) 45.0  
 Total Pressure Head (cm) 175.8  
 Hydraulic Gradient 19.94

**Final Sample Dimensions**  
 Sample Length (cm), L 8.81  
 Sample Diameter (cm) 7.20  
 Sample Area (cm<sup>2</sup>), A 40.73  
 Inflow Burette Area (cm<sup>2</sup>), a-in 0.888  
 Outflow Burette Area (cm<sup>2</sup>), a-out 0.890  
 B Parameter (%) 95

**AVERAGE PERMEABILITY = 1.7E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.7E-08 m/sec @ 20°C**

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
4/17/2012	12	35	0.00	0.0	0.0	197.0	0	24.4	NA
4/17/2012	12	36	0.02	0.1	0.1	196.8	0	24.4	1.6E-06
4/17/2012	12	40	0.08	0.5	0.5	195.9	0	24.4	1.7E-06
4/17/2012	12	42	0.12	0.7	0.7	195.4	0	24.4	1.7E-06
4/17/2012	12	44	0.15	0.9	0.9	195.0	0	24.4	1.7E-06
4/17/2012	12	46	0.18	1.1	1.1	194.5	0	24.4	1.7E-06
4/17/2012	12	48	0.22	1.3	1.3	194.1	1	24.4	1.7E-06

Tested By: BW

Date: 4/16/2012

Checked By: *GAM*

Date: *4-17-12*

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

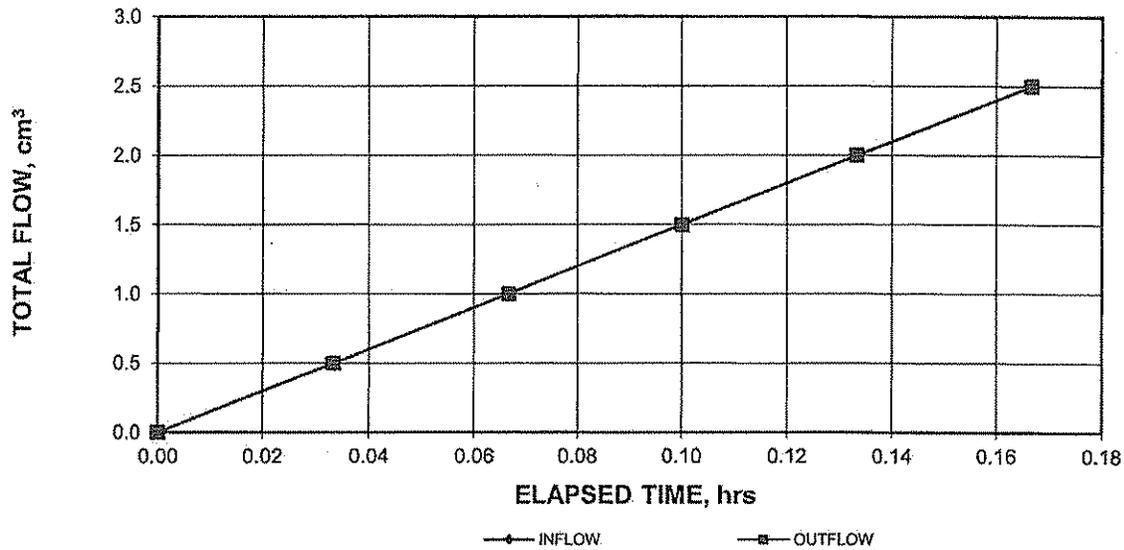
Client  
Client Project  
Project No.  
Lab ID No.

JOYCE ENGINEERING  
COBLE SR  
2012-656-03  
2012-656-03-01

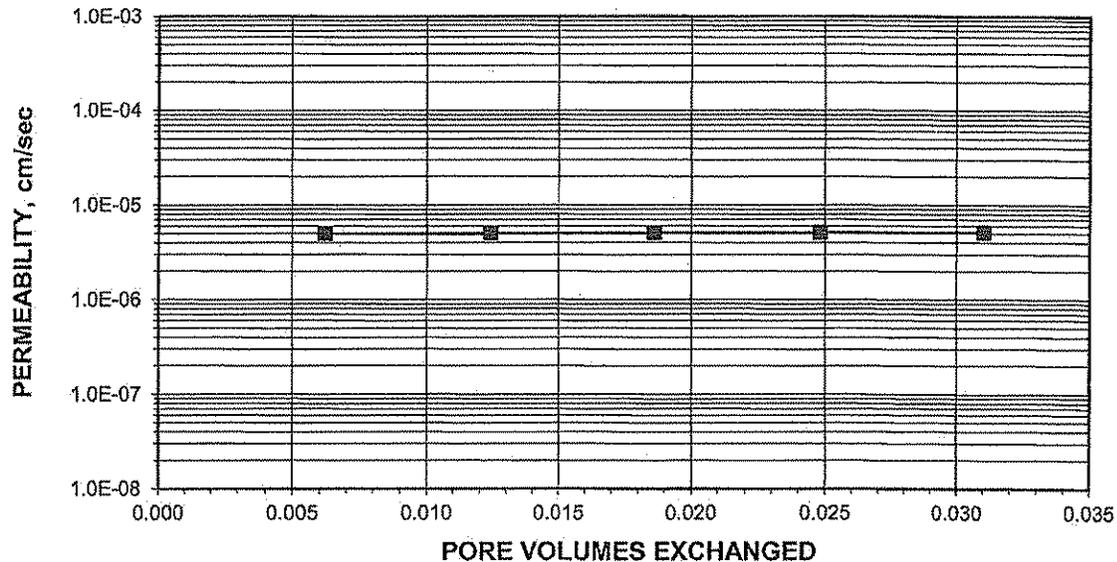
Boring No. ND-4  
Depth (ft.) LIFT 2  
Sample No. A1 / TP

AVERAGE PERMEABILITY = 5.0E-06 cm/sec @ 20°C  
AVERAGE PERMEABILITY = 5.0E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW

Date: 5/4/2012

Checked By: *BW*

Date: 5/8/12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client            JOYCE ENGINEERING  
Client Project    COBLE SR  
Project No.       2012-656-03  
Lab ID No.       2012-656-03-01

Boring No.    ND-4  
Depth (ft.)    LIFT 2  
Sample No.    A1

Specific Gravity            2.70 Assumed  
Sample Condition            Undisturbed

Visual Description:        BROWN SANDY-CLY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	B-4	810
Wt. of Tare & WS (gm.)	436.93	311.94
Wt. of Tare & DS (gm.)	396.43	290.55
Wt. of Tare (gm.)	98.40	114.64
Wt. of Water (gm.)	40.50	21.39
Wt. of DS (gm.)	298.03	175.91
Moisture Content (%)	<b>13.6</b>	<b>12.2</b>

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	584.50	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	584.50	577.14
Length 1 (in.)	2.932	2.659
Length 2 (in.)	2.932	2.584
Length 3 (in.)	2.932	2.715
Top Diameter (in.)	2.840	2.808
Middle Diameter (in.)	2.840	2.818
Bottom Diameter (in.)	2.840	2.828
Average Length (in.)	2.93	2.65
Average Area (in. <sup>2</sup> )	6.33	6.24
Sample Volume (cm <sup>3</sup> )	304.36	271.12
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.92	2.13
Unit Wet Wt. (pcf)	119.9	132.9
Unit Dry Wt. (pcf)	105.5	118.5
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.69	1.90
Void Ratio, e	0.60	0.42
Porosity, n	0.37	0.30
Pore Volume (cm <sup>3</sup> )	113.8	80.5
Total Wgt. Of Sample After Test		581.71

Tested By:    BW                      Date:    5/4/2012    Checked By:    *BW*                      Date:    5/8/12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ND-4
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A1
Lab ID No.	2012-656-03-01		
	121044		

41

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	6.74
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.16
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.24
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.977
Hydraulic Gradient	15.65	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.868
		B Parameter (%)	99

**AVERAGE PERMEABILITY = 5.0E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 5.0E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW (0 flow) (1 stop)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
5/7/2012	2	1	0.00	0.0	0.0	126.7	0	24.4	NA
5/7/2012	2	3	0.03	0.5	0.5	125.6	0	24.4	5.0E-06
5/7/2012	2	5	0.07	1.0	1.0	124.5	0	24.4	5.0E-06
5/7/2012	2	7	0.10	1.5	1.5	123.5	0	24.4	5.1E-06
5/7/2012	2	9	0.13	2.0	2.0	122.4	0	24.4	5.1E-06
5/7/2012	2	11	0.17	2.5	2.5	121.3	1	24.4	5.2E-06

Tested By: BW

Date: 5/4/2012

Checked By: *BW*

Date: *5/8/12*



# FLEXIBLE WALL PERMEABILITY TEST

## PERMOMETER METHOD

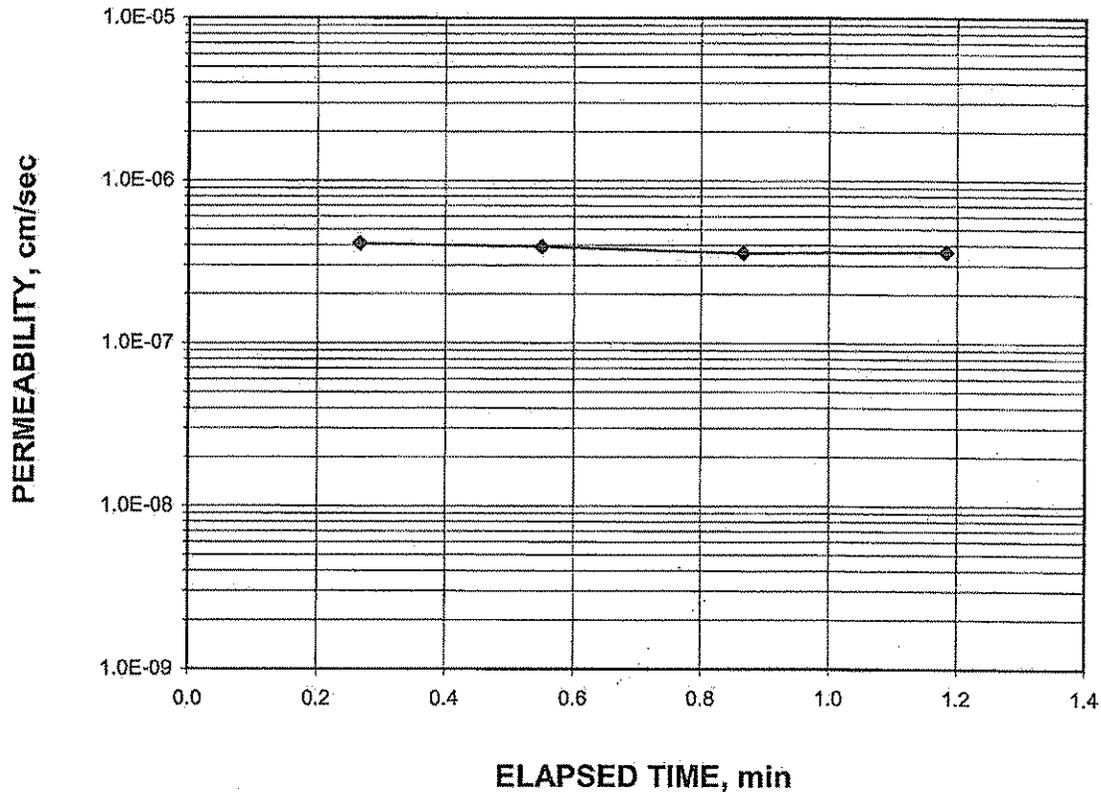
ASTM D 5084-03  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 1/TEST PAD
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A1/TP-03
Lab ID No.	2012-656-04-01		

Visual Description: REDDISH BROWN SANDY SILT

AVERAGE PERMEABILITY =  $3.8E-07$  cm/sec @ 20°C  
AVERAGE PERMEABILITY =  $3.8E-09$  m/sec @ 20°C

### PERMEABILITY vs. TIME



Tested By: BW Date: 5/22/2012 Checked By: *[Signature]* Date: 5/24



**FLEXIBLE WALL PERMEABILITY TEST**

**PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 1/TEST PAD
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A1/TP-03
Lab ID No.	2012-656-04-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: REDDISH BROWN SANDY SILT

**MOISTURE CONTENT:**

**BEFORE TEST**

**AFTER TEST**

Tare Number	SS-1	820
Wt. of Tare & WS (gm.)	261.06	334.30
Wt. of Tare & DS (gm.)	240.04	308.35
Wt. of Tare (gm.)	93.01	136.14
Wt. of Water (gm.)	21.02	25.95
Wt. of DS (gm.)	147.03	172.21
Moisture Content (%)	<b>14.3</b>	<b>15.1</b>

**SPECIMEN:**

**BEFORE TEST**

**AFTER TEST**

Wt. of Tube & WS (gm.)	535.65	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	535.65	539.27
Length 1 (in.)	2.491	2.448
Length 2 (in.)	2.513	2.461
Length 3 (in.)	2.513	2.470
Top Diameter (in.)	2.852	2.849
Middle Diameter (in.)	2.832	2.847
Bottom Diameter (in.)	2.838	2.805
Average Length (in.)	2.51	2.46
Average Area (in. <sup>2</sup> )	6.34	6.31
Sample Volume (cm <sup>3</sup> )	260.23	254.19
Unit Wet Wt. (gm./cm <sup>3</sup> )	2.058	2.121
Unit Wet Wt. (pcf)	128.5	132.4
Unit Dry Wt. (pcf)	112.4	115.1
Unit Dry Wt. (gm./cm <sup>3</sup> )	1.801	1.844
Void Ratio, e	0.499	0.464
Porosity, n	0.333	0.317
Pore Volume (cm <sup>3</sup> )	86.7	80.6
Total Wt. Of Sample After Test		543.58

Tested By: BW

Date: 5/22/2012

Checked By: *MPS*

Date: *5/24*



**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 1/TEST PAD
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A1/TP-03
Lab ID No.	2012-656-04-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	6.25
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.69
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	98	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 3.8E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 3.8E-09 m/sec @ 20°C**

DATE	TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C	
	(mm/dd/yy)	(hr)	(min)						(sec)
5/23/2012	10	54	58	54.97	0.000	6.1	10.7	24.8	NA
5/23/2012	10	55	14	55.23	0.267	6.0	10.5	24.8	4.1E-07
5/23/2012	10	55	31	55.52	0.550	5.9	10.2	24.8	3.9E-07
5/23/2012	10	55	50	55.83	0.867	5.8	10.0	24.8	3.6E-07
5/23/2012	10	56	9	56.15	1.183	5.7	9.8	24.8	3.7E-07

Tested By: BW Date: 5/22/2012 Checked By: *ADD* Date: 5/24

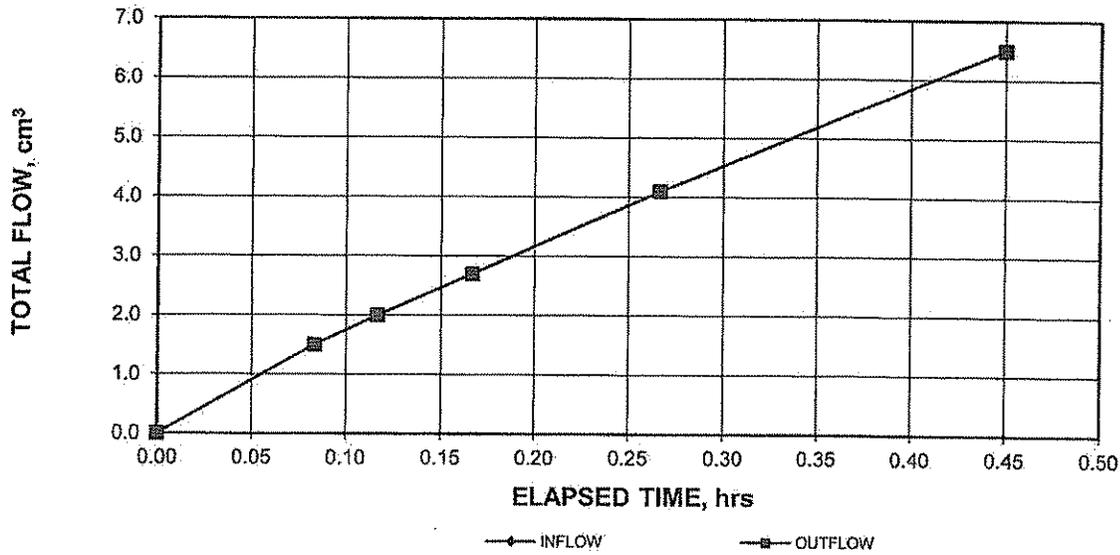
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

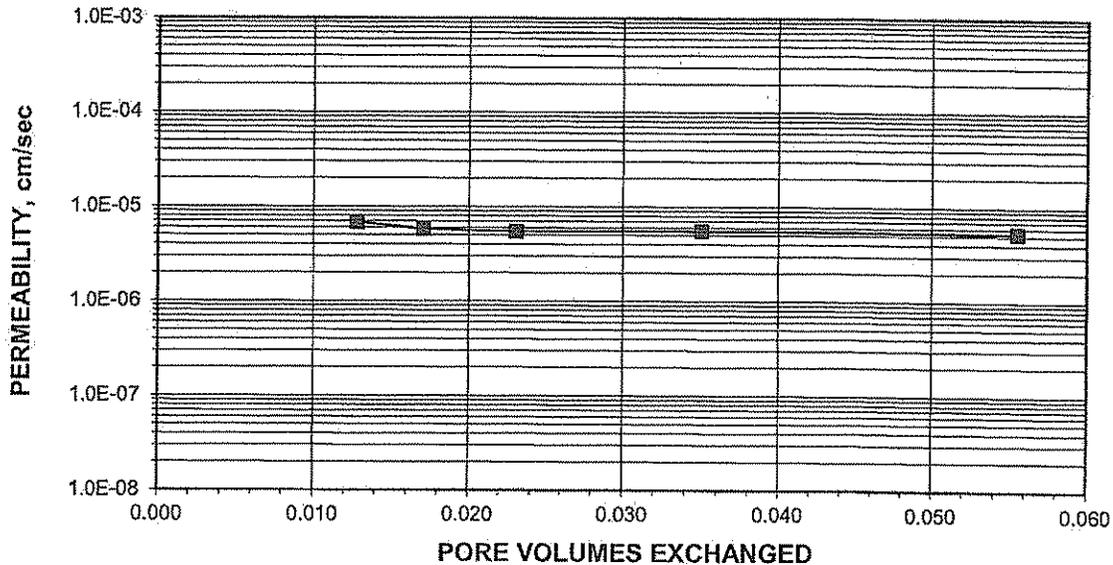
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2 / 1
Project No.	2012-656-08	Sample No.	ST-A10-L1
Lab ID No.	2012-656-08-01		

AVERAGE PERMEABILITY = 5.6E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 5.6E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 8/20/2012 Checked By: GJM Date: 8-22-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client: JOYCE ENGINEERING, INC.  
 Client Project: COBLE SR  
 Project No.: 2012-656-08  
 Lab ID No.: 2012-656-08-01

Boring No.: ACRE 10  
 Depth (ft.): LIFT 2 L  
 Sample No.: ST-A10-L1

Specific Gravity: 2.70 Assumed  
 Sample Condition: Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	813	811
Wt. of Tare & WS (gm.)	339.24	357.93
Wt. of Tare & DS (gm.)	312.62	315.48
Wt. of Tare (gm.)	111.96	106.12
Wt. of Water (gm.)	26.62	42.45
Wt. of DS (gm.)	200.66	209.36
Moisture Content (%)	13.3	20.3

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	583.72	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	583.72	619.85
Length 1 (in.)	3.030	2.967
Length 2 (in.)	3.036	3.022
Length 3 (in.)	3.034	3.034
Top Diameter (in.)	2.809	2.824
Middle Diameter (in.)	2.807	2.821
Bottom Diameter (in.)	2.814	2.816
Average Length (in.)	3.03	3.01
Average Area (in. <sup>2</sup> )	6.20	6.25
Sample Volume (cm <sup>3</sup> )	308.26	307.91
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.89	2.01
Unit Wet Wt. (pcf)	118.2	125.7
Unit Dry Wt. (pcf)	104.4	104.5
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.67	1.67
Void Ratio, e	0.62	0.61
Porosity, n	0.38	0.38
Pore Volume (cm <sup>3</sup> )	117.4	117.0
Total Wgt. Of Sample After Test		621.57

Tested By: BW

Date: 8/20/2012

Checked By: *Cam*

Date: 8-22-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2 / 1
Project No.	2012-656-08	Sample No.	ST-A10-L1
Lab ID No.	2012-656-08-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.64
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.16
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.30
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	13.80	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 5.6E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 5.6E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
8/21/2012	10	13	0.00	0.0	0.0	127.4	0	23.8	NA
8/21/2012	10	18	0.08	1.5	1.5	124.1	0	23.8	6.9E-06
8/21/2012	10	20	0.12	2.0	2.0	123.0	0	23.9	5.8E-06
8/21/2012	10	23	0.17	2.7	2.7	121.5	0	23.9	5.5E-06
8/21/2012	10	29	0.27	4.1	4.1	118.4	0	24.0	5.6E-06
8/21/2012	10	40	0.45	6.5	6.5	113.1	1	24.1	5.4E-06

Tested By: BW      Date: 8/20/2012      Checked By: *GEM*      Date: 8-22-12



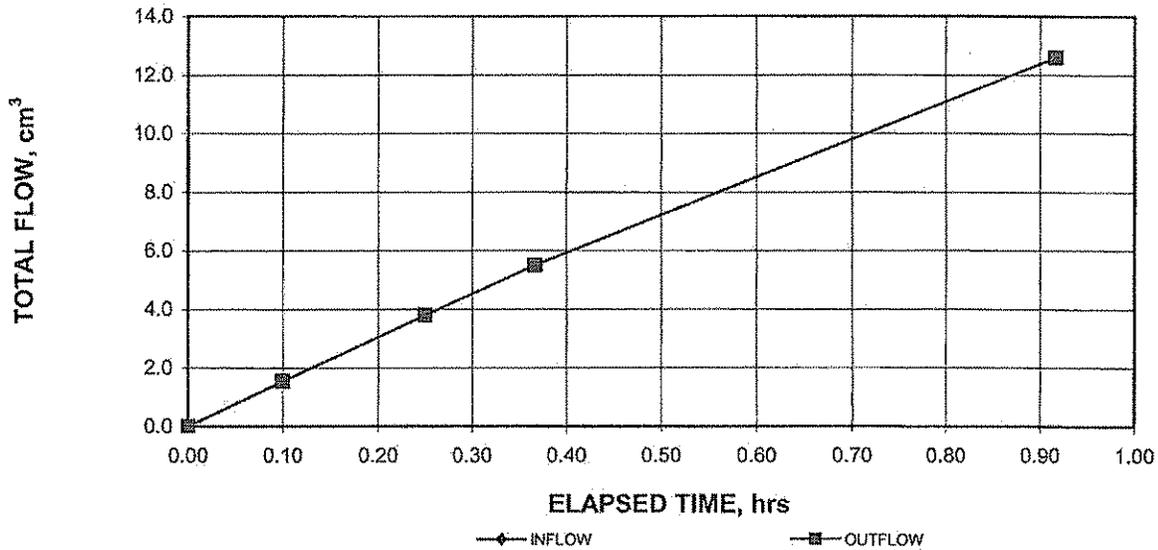
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

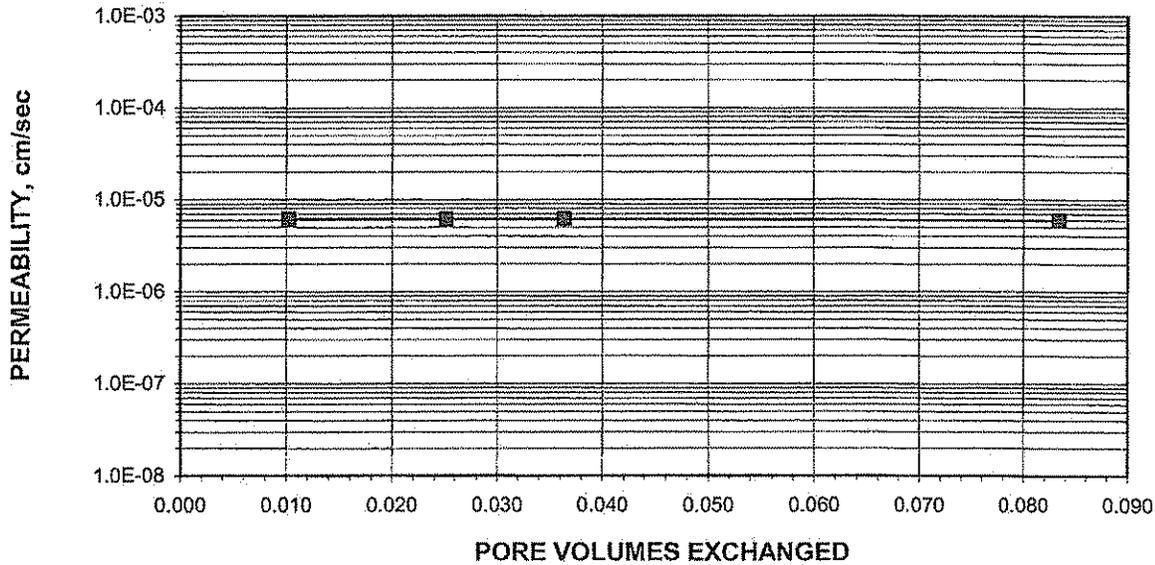
Client	JOYCE ENGINEERING	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-09	Sample No.	ST-A10-L2
Lab ID No.	2012-656-09-02		

AVERAGE PERMEABILITY = 6.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 6.1E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 8/28/2012 Checked By: *[Signature]* Date: 8/31



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-09	Sample No.	ST-A10-L2
Lab ID No.	2012-656-09-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: REDDISH BROWN SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	802	802
Wt. of Tare & WS (gm.)	372.65	366.78
Wt. of Tare & DS (gm.)	324.30	316.92
Wt. of Tare (gm.)	103.58	103.77
Wt. of Water (gm.)	48.35	49.86
Wt. of DS (gm.)	220.72	213.15
Moisture Content (%)	21.9	23.4

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	634.86	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	634.86	642.60
Length 1 (in.)	3.279	3.272
Length 2 (in.)	3.311	3.290
Length 3 (in.)	3.273	3.270
Top Diameter (in.)	2.872	2.858
Middle Diameter (in.)	2.845	2.851
Bottom Diameter (in.)	2.846	2.856
Average Length (in.)	3.29	3.28
Average Area (in. <sup>2</sup> )	6.40	6.40
Sample Volume (cm <sup>3</sup> )	344.74	343.81
Unit Wet Wt. (gm./cm <sup>3</sup> )	1.84	1.87
Unit Wet Wt. (pcf)	115.0	116.7
Unit Dry Wt. (pcf)	94.3	94.6
Unit Dry Wt. (gm./cm <sup>3</sup> )	1.51	1.51
Void Ratio, e	0.79	0.78
Porosity, n	0.44	0.44
Pore Volume (cm <sup>3</sup> )	151.9	150.9
Total Wgt. Of Sample After Test		658.69

Tested By: BW

Date: 8/28/2012 Checked By: *MUS*

Date: *8/21*

# PERMEABILITY TEST



ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-09	Sample No.	ST-A10-L2
Lab ID No.	2012-656-09-02		
	121044		

41

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	8.32
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.25
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.30
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	12.67	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	98

**AVERAGE PERMEABILITY = 6.1E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 6.1E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
8/29/2012	11	35	0.00	0.0	0.0	128.6	0	24.6	NA
8/29/2012	11	41	0.10	1.6	1.6	125.2	0	24.6	6.1E-06
8/29/2012	11	50	0.25	3.8	3.8	120.2	0	24.6	6.1E-06
8/29/2012	11	57	0.37	5.5	5.5	116.5	0	24.6	6.2E-06
8/29/2012	12	30	0.92	12.6	12.6	100.9	0	24.6	5.9E-06

Tested By: BW      Date: 8/28/2012      Checked By: *[Signature]*      Date: 8/29

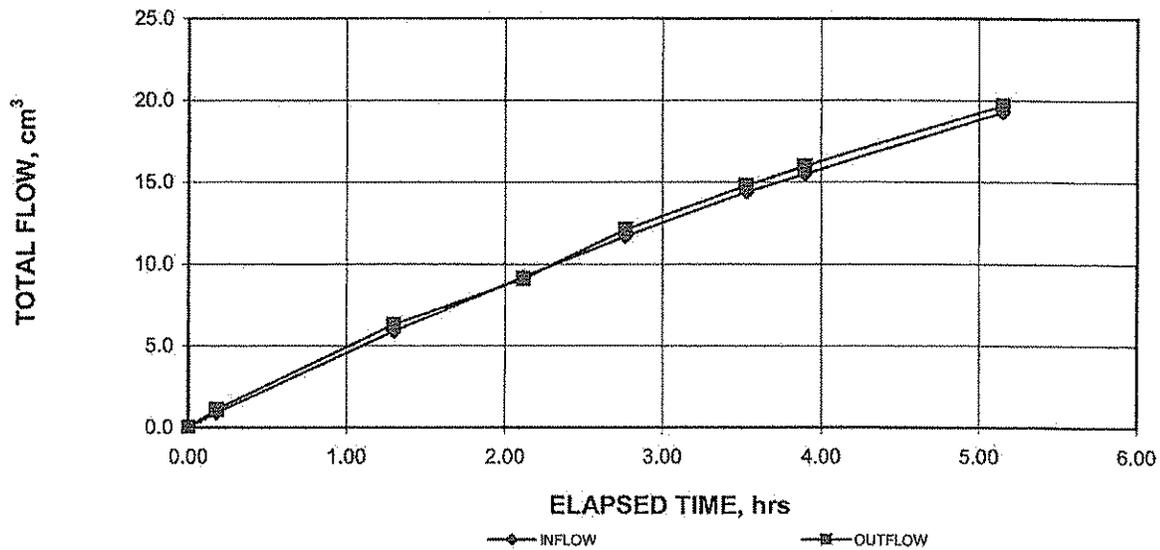
# PERMEABILITY TEST

ASTM D 5084-03

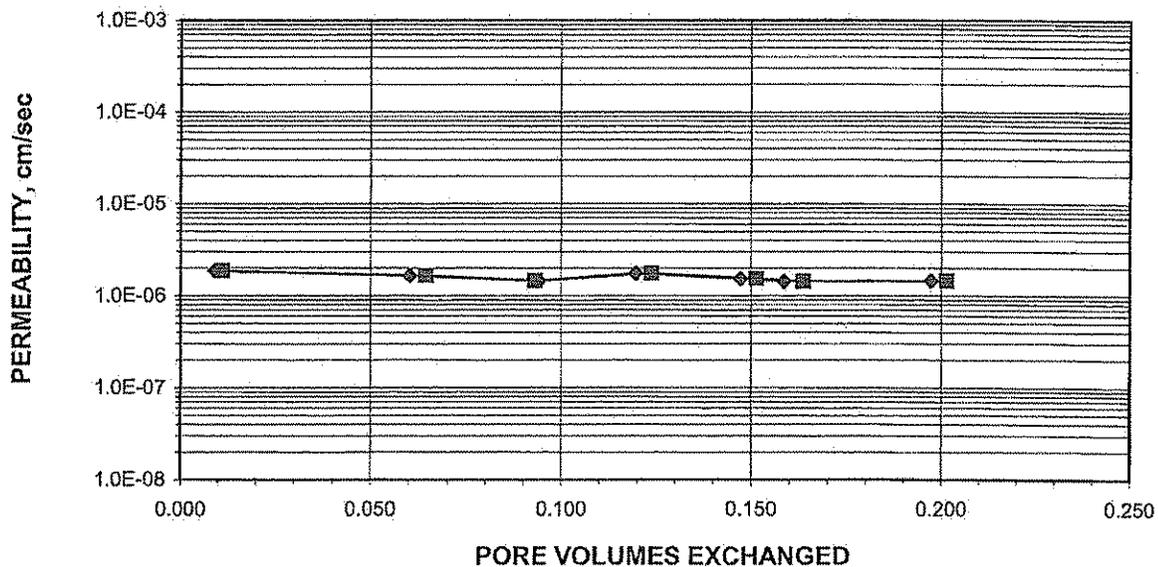
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-10	Sample No.	ST-A10-L3
Lab ID No.	2012-656-10-01		

AVERAGE PERMEABILITY = 1.5E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.5E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS

Date: 9/6/2012 Checked By: *AMS*

Date: *9/7*



# PERMEABILITY TEST

ASTM D 5084-10

Client JOYCE ENGINEERING, INC. Boring No. ACRE 10  
 Client Project COBLE SR Depth (ft.) LIFT 3  
 Project No. 2012-656-10 Sample No. ST-A10-L3  
 Lab ID No. 2012-656-10-01

Specific Gravity 2.70 Assumed  
 Sample Condition Undisturbed

Visual Description: ORANGE YELLOW SANDY CLAY WITH ROCKS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	804	806
Wt. of Tare & WS (gm.)	322.82	398.92
Wt. of Tare & DS (gm.)	300.11	350.18
Wt. of Tare (gm.)	105.22	102.05
Wt. of Water (gm.)	22.71	48.74
Wt. of DS (gm.)	194.89	248.13
Moisture Content (%)	11.7	19.6

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	614.27	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	614.27	658.23
Length 1 (in.)	2.988	2.962
Length 2 (in.)	3.001	2.956
Length 3 (in.)	2.938	2.922
Top Diameter (in.)	2.849	2.825
Middle Diameter (in.)	2.844	2.859
Bottom Diameter (in.)	2.817	2.775
Average Length (in.)	2.98	2.95
Average Area (in. <sup>2</sup> )	6.32	6.24
Sample Volume (cm <sup>3</sup> )	308.17	301.52
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.99	2.18
Unit Wet Wt. (pcf)	124.4	136.3
Unit Dry Wt. (pcf)	111.4	113.9
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.79	1.82
Void Ratio, e	0.51	0.48
Porosity, n	0.34	0.32
Pore Volume (cm <sup>3</sup> )	104.4	97.8
Total Wgt. Of Sample After Test		639.05

Tested By: SFS

Date: 9/6/2012 Checked By: *AMM*

Date: *9/7*

# PERMEABILITY TEST

ASTM D 5084-03



Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-10	Sample No.	ST-A10-L3
Lab ID No.	2012-656-10-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.48
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.16
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.29
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.865
Hydraulic Gradient	14.09	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.865
		B Parameter (%)	97

AVERAGE PERMEABILITY = 1.5E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.5E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
9/6/2012	12	37	0.00	0.0	0.0	133.0	0	25.5	NA
9/6/2012	12	48	0.18	0.9	1.1	130.7	0	25.5	1.9E-06
9/6/2012	13	55	1.30	5.9	6.3	119.0	0	25.5	1.6E-06
9/6/2012	14	44	2.12	9.2	9.1	112.0	0	25.5	1.5E-06
9/6/2012	15	23	2.77	11.7	12.1	105.7	0	25.5	1.7E-06
9/6/2012	16	9	3.53	14.4	14.8	99.5	0	25.5	1.5E-06
9/6/2012	16	31	3.90	15.5	16.0	96.9	0	25.5	1.4E-06
9/6/2012	17	46	5.15	19.3	19.7	88.3	1	25.5	1.5E-06

Tested By: SFS Date: 9/6/2012 Checked By: *AMS* Date: 9/7

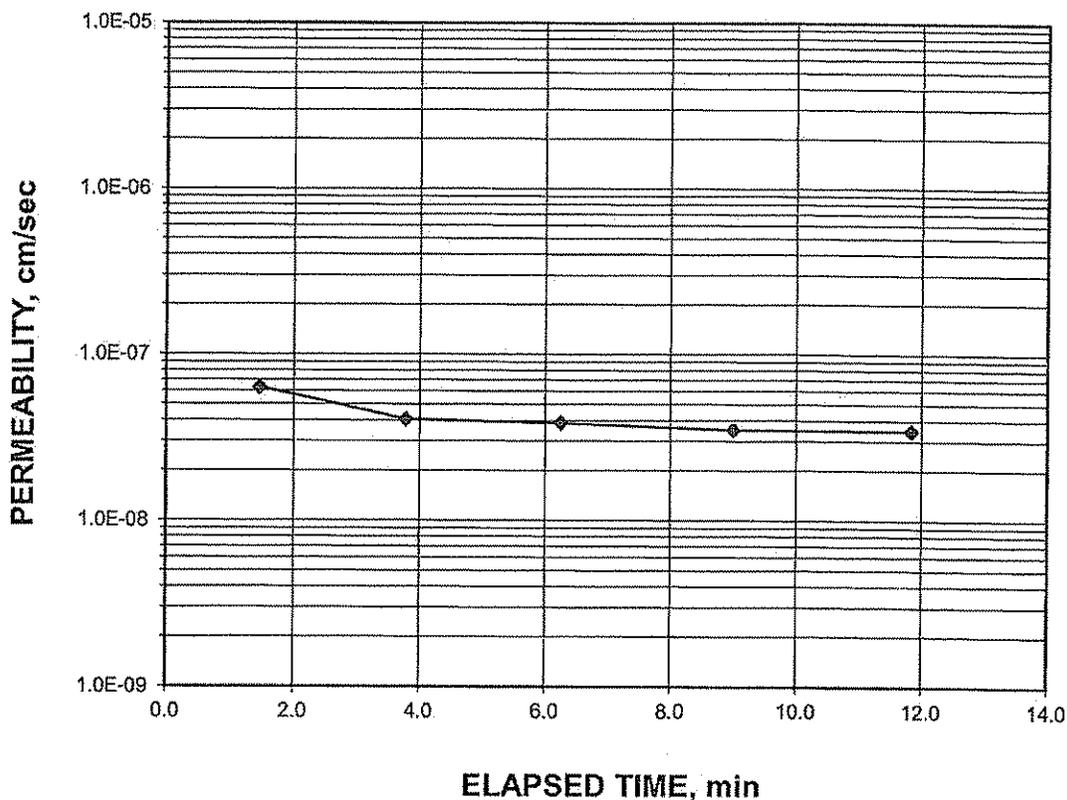
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-03  
 (SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ND-9
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-03	Sample No.	A2
Lab ID No.	2012-656-03-02		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 3.7E-08 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 3.7E-10 m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: BW Date: 5/4/2012 Checked By: *GEM* Date: 5-10-12

**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-10  
 (SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ND-9
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-03	Sample No.	A2
Lab ID No.	2012-656-03-02		
	Specific Gravity	2.70	Assumed
	Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

<b>MOISTURE CONTENT:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Tare Number	SS-5	809
Wt. of Tare & WS (gm.)	362.28	389.82
Wt. of Tare & DS (gm.)	316.09	332.92
Wt. of Tare (gm.)	97.36	114.88
Wt. of Water (gm.)	46.19	56.90
Wt. of DS (gm.)	218.73	218.04
Moisture Content (%)	<b>21.1</b>	<b>26.1</b>

<b>SPECIMEN:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Wt. of Tube & WS (gm.)	570.89	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	570.89	594.36
Length 1 (in.)	2.819	2.850
Length 2 (in.)	2.872	2.879
Length 3 (in.)	2.883	2.879
Top Diameter (in.)	2.842	2.804
Middle Diameter (in.)	2.837	2.827
Bottom Diameter (in.)	2.851	2.863
Average Length (in.)	2.86	2.87
Average Area (in. <sup>2</sup> )	6.35	6.30
Sample Volume (cm <sup>3</sup> )	297.38	296.04
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.920	2.008
Unit Wet Wt. (pcf)	119.8	125.3
Unit Dry Wt. (pcf)	98.9	99.4
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.585	1.592
Void Ratio, e	0.703	0.696
Porosity, n	0.413	0.410
Pore Volume (cm <sup>3</sup> )	122.8	121.5
Total Wt. Of Sample After Test		593.87

Tested By: BW

Date: 5/4/2012

Checked By: *GAN* Date: 5-10-12

**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ND-9
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-03	Sample No.	A2
Lab ID No.	2012-656-03-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	7.29
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.62
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	99	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 3.7E-08 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 3.7E-10 m/sec @ 20°C**

DATE	TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C	
(mm/dd/yy)	(hr)	(min)	(sec)	t (min)	R <sub>p</sub> (cm)	i (cm/cm)	(°C)	(cm/sec)	
5/7/2012	4	51	0	51.00	0.000	8.0	12.5	24.7	NA
5/7/2012	4	52	28	52.47	1.467	7.9	12.4	24.7	6.3E-08
5/7/2012	4	54	47	54.78	3.783	7.8	12.2	24.7	4.1E-08
5/7/2012	4	57	15	57.25	6.250	7.7	12.0	24.7	3.9E-08
5/7/2012	5	0	0	0.00	9.000	7.6	11.8	24.7	3.5E-08
5/7/2012	5	2	50	2.83	11.833	7.5	11.6	24.7	3.5E-08

Tested By: BW

Date: 5/4/2012

Checked By: *gem* Date: 5-10-12

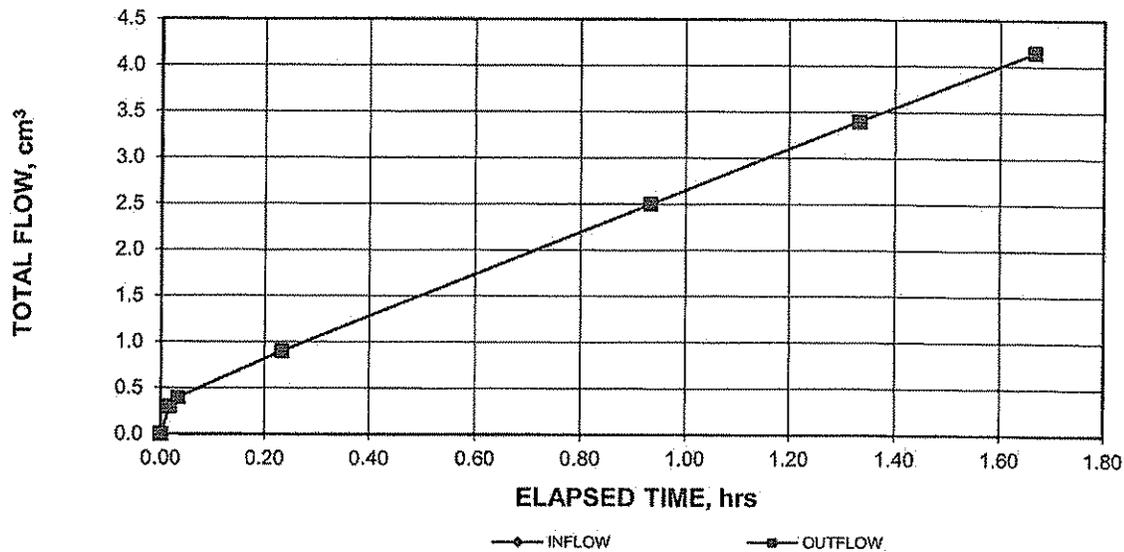
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

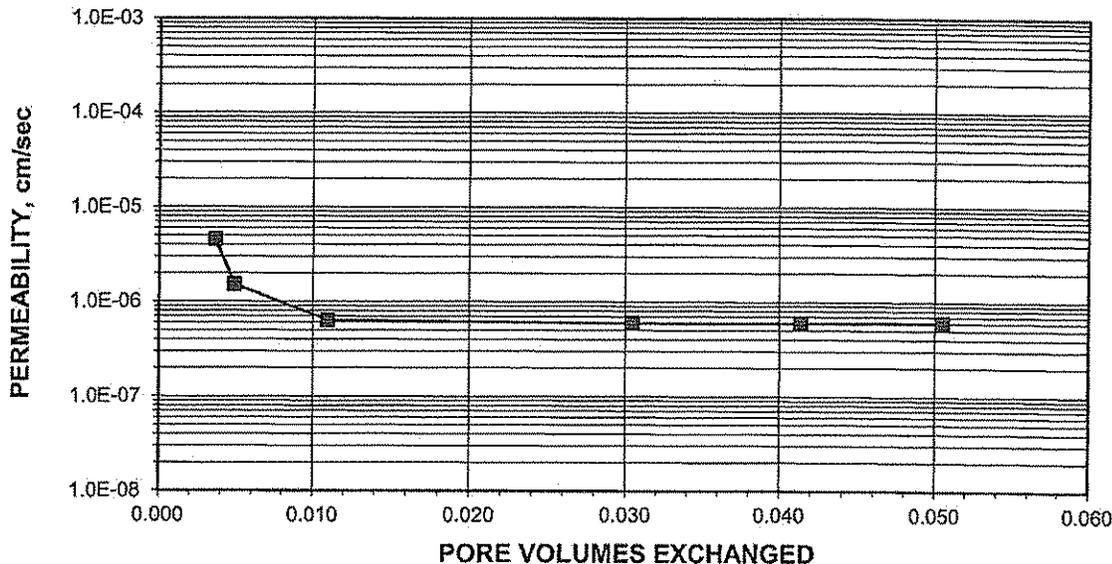
Client	JOYCE ENGINEERING	Boring No.	ND-21
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A2
Lab ID No.	2012-656-03-05		

AVERAGE PERMEABILITY = 6.1E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 6.1E-09 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 5/13/2012 Checked By: GEM Date: 5-15-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ND-21
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A2
Lab ID No.	2012-656-03-05		
		Specific Gravity	2.70 Assumed
		Sample Condition	Remolded

Visual Description: TAN SANDY SILT

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	816	804
Wt. of Tare & WS (gm.)	306.95	494.61
Wt. of Tare & DS (gm.)	288.91	414.02
Wt. of Tare (gm.)	135.93	105.08
Wt. of Water (gm.)	18.04	80.59
Wt. of DS (gm.)	152.98	308.94
Moisture Content (%)	11.8	26.1

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	367.33	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	367.33	414.30
Length 1 (in.)	2.004	2.012
Length 2 (in.)	2.001	1.996
Length 3 (in.)	2.006	1.996
Top Diameter (in.)	2.835	2.794
Middle Diameter (in.)	2.835	2.814
Bottom Diameter (in.)	2.835	2.831
Average Length (in.)	2.00	2.00
Average Area (in. <sup>2</sup> )	6.31	6.21
Sample Volume (cm <sup>3</sup> )	207.26	203.82
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.77	2.03
Unit Wet Wt. (pcf)	110.6	126.9
Unit Dry Wt. (pcf)	99.0	100.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.59	1.61
Void Ratio, e	0.70	0.67
Porosity, n	0.41	0.40
Pore Volume (cm <sup>3</sup> )	85.6	82.1
Total Wgt. Of Sample After Test		391.39

Tested By: BW      Date: 5/13/2012      Checked By: *GEM*      Date: *5-15-12*

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ND-21
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A2
Lab ID No.	2012-656-03-05		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	5.08
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.15
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.10
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	20.74	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	95

**AVERAGE PERMEABILITY = 6.1E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 6.1E-09 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW (0 flow) (1 stop)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
5/14/2012	2	30	0.00	0.0	0.0	126.3	0	24.2	NA
5/14/2012	2	31	0.02	0.3	0.3	125.7	0	24.2	4.6E-06
5/14/2012	2	32	0.03	0.4	0.4	125.5	0	24.2	1.5E-06
5/14/2012	2	44	0.23	0.9	0.9	124.5	0	24.2	6.4E-07
5/14/2012	3	26	0.93	2.5	2.5	121.2	0	24.2	5.9E-07
5/14/2012	3	50	1.33	3.4	3.4	119.3	0	24.2	6.0E-07
5/14/2012	4	10	1.67	4.2	4.2	117.8	1	24.2	6.0E-07

Tested By: BW      Date: 5/13/2012      Checked By: *GM*      Date: 5-15-12

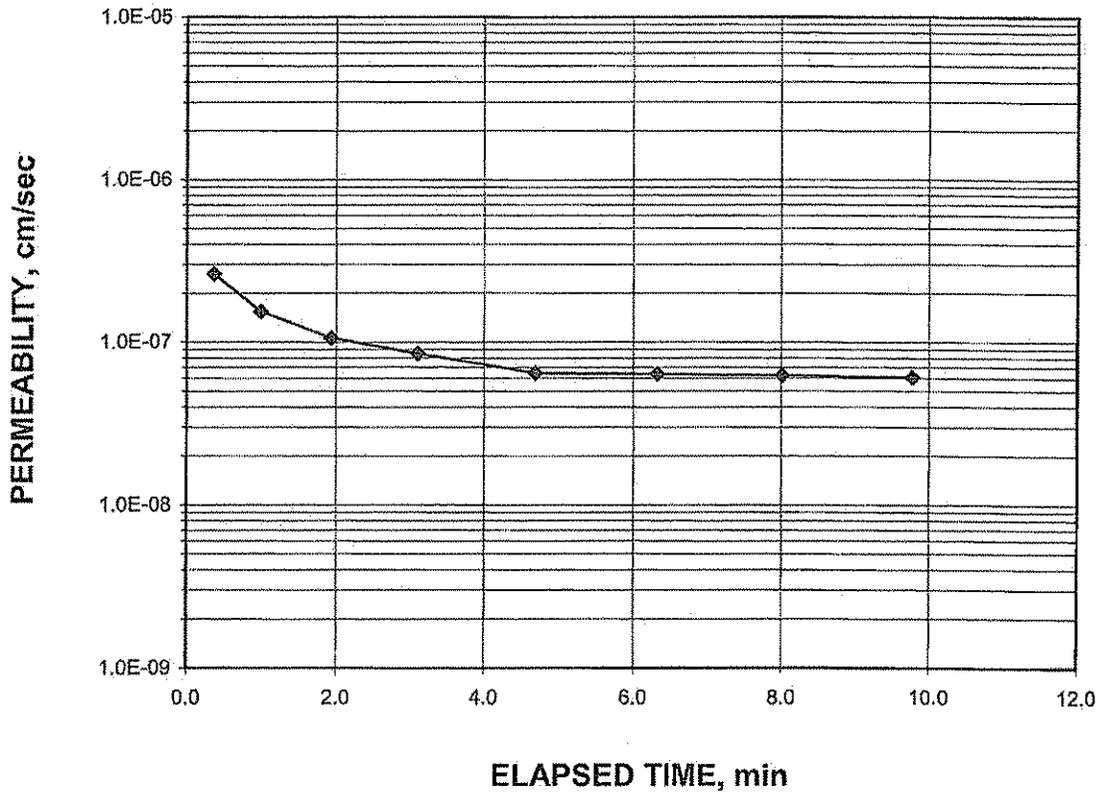
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
ASTM D 5084-03  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 2
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A2-03
Lab ID No.	2012-656-04-02		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY =  $6.3E-08$  cm/sec @ 20°C  
 AVERAGE PERMEABILITY =  $6.3E-10$  m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: BW Date: 5/22/2012 Checked By: *MDP* Date: 5/24



## FLEXIBLE WALL PERMEABILITY TEST

### PERMOMETER METHOD

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 2
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A2-03
Lab ID No.	2012-656-04-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	Z-12	813
Wt. of Tare & WS (gm.)	338.42	364.77
Wt. of Tare & DS (gm.)	292.83	319.12
Wt. of Tare (gm.)	94.66	112.2
Wt. of Water (gm.)	45.59	45.65
Wt. of DS (gm.)	198.17	206.92
Moisture Content (%)	<b>23.0</b>	<b>22.1</b>

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	639.29	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	639.29	634.38
Length 1 (in.)	3.014	2.998
Length 2 (in.)	2.993	2.995
Length 3 (in.)	3.004	3.002
Top Diameter (in.)	2.832	2.831
Middle Diameter (in.)	2.832	2.835
Bottom Diameter (in.)	2.826	2.837
Average Length (in.)	3.00	3.00
Average Area (in. <sup>2</sup> )	6.29	6.31
Sample Volume (cm <sup>3</sup> )	309.61	310.01
Unit Wet Wt. (gm./ cm <sup>3</sup> )	2.065	2.046
Unit Wet Wt. (pcf)	128.9	127.7
Unit Dry Wt. (pcf)	104.8	104.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.679	1.676
Void Ratio, e	0.608	0.611
Porosity, n	0.378	0.379
Pore Volume (cm <sup>3</sup> )	117.1	117.5
Total Wt. Of Sample After Test		646.00

Tested By: BW

Date: 5/22/2012

Checked By: *MPS* Date: *5/24*



**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 2
Client Project	COBLE SR.	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A2-03
Lab ID No.	2012-656-04-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	7.62
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.71
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	97	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 6.3E-08 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 6.3E-10 m/sec @ 20°C**

DATE	TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C	
	(mm/dd/yy)	(hr)	(min)						(sec)
5/23/2012	10	33	8	33.13	0.000	8.0	12.0	24.8	NA
5/23/2012	10	33	30	33.50	0.367	7.9	11.8	24.8	2.6E-07
5/23/2012	10	34	8	34.13	1.000	7.8	11.7	24.8	1.5E-07
5/23/2012	10	35	4	35.07	1.933	7.7	11.5	24.8	1.1E-07
5/23/2012	10	36	15	36.25	3.117	7.6	11.3	24.8	8.5E-08
5/23/2012	10	37	50	37.83	4.700	7.5	11.1	24.8	6.5E-08
5/23/2012	10	39	28	39.47	6.333	7.4	11.0	24.8	6.4E-08
5/23/2012	10	41	9	41.15	8.017	7.3	10.8	24.8	6.3E-08
5/23/2012	10	42	55	42.92	9.783	7.2	10.6	24.8	6.1E-08

Tested By: BW Date: 5/22/2012 Checked By: *MAT* Date: 5/24

# PERMEABILITY TEST

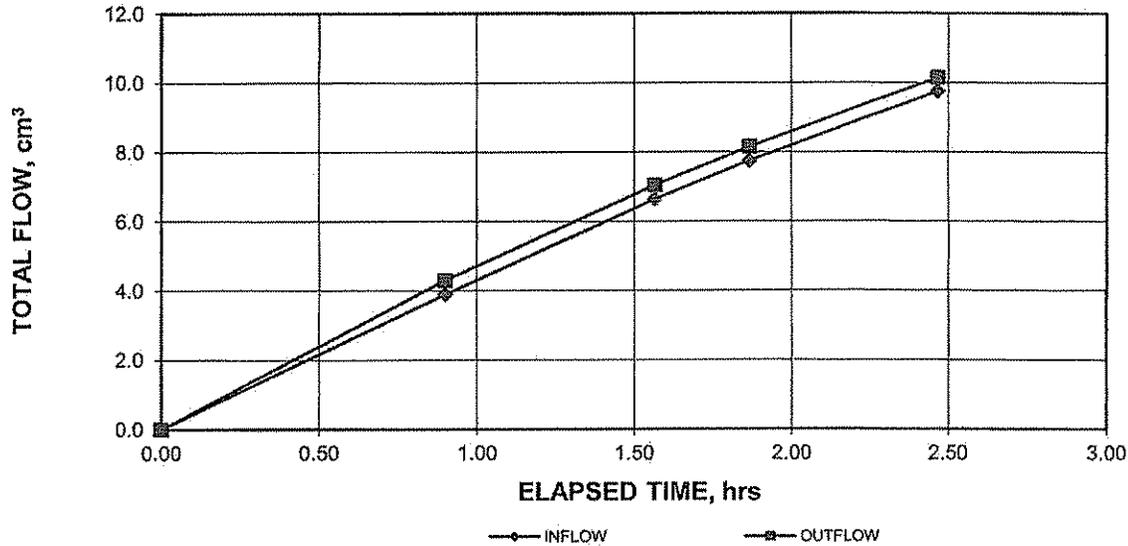
ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 3
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-02	Sample No.	ST-03-01
Lab ID No.	2012-656-02-03		

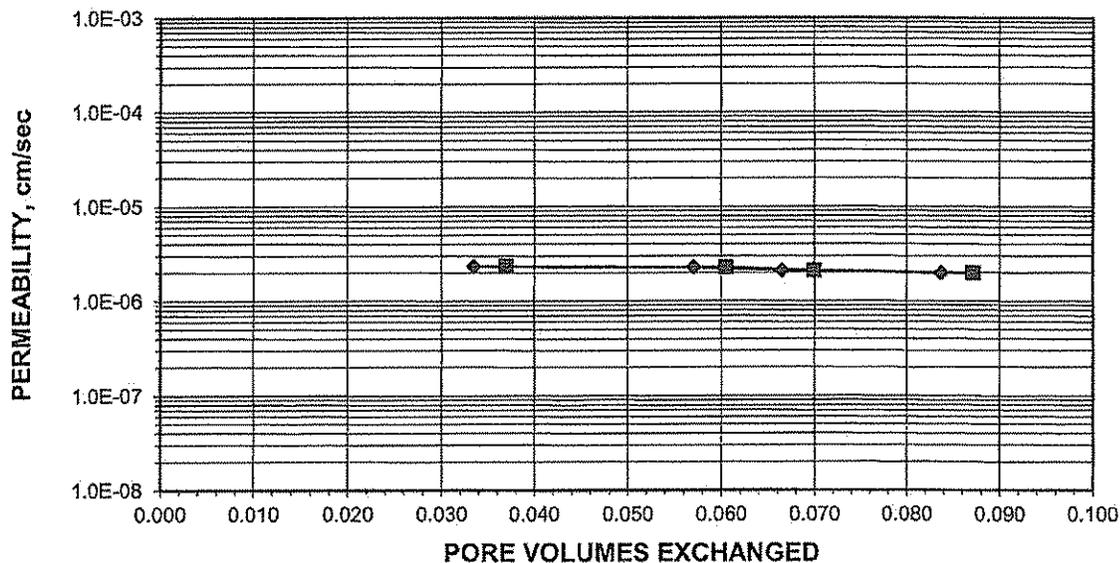
AVERAGE PERMEABILITY = 2.2E-06 cm/sec @ 20°C

AVERAGE PERMEABILITY = 2.2E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 4/20/2012 Checked By: GEM Date: 4-24-12



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client: JOYCE ENGINEERING  
 Client Project: COBLE SR  
 Project No.: 2012-656-02  
 Lab ID No.: 2012-656-02-03

Boring No.: ACRE 3  
 Depth (ft.): LIFT 1  
 Sample No.: ST-03-01

Specific Gravity: 2.70 Assumed  
 Sample Condition: Undisturbed

Visual Description: BROWN SANDY SILT

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	804	801
Wt. of Tare & WS (gm.)	351.82	326.51
Wt. of Tare & DS (gm.)	325.59	288.10
Wt. of Tare (gm.)	105.07	107.25
Wt. of Water (gm.)	26.23	38.41
Wt. of DS (gm.)	220.52	180.85
Moisture Content (%)	11.9	21.2

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	629.25	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	629.25	681.80
Length 1 (in.)	3.466	3.265
Length 2 (in.)	3.328	3.230
Length 3 (in.)	3.355	3.228
Top Diameter (in.)	2.835	2.783
Middle Diameter (in.)	2.835	2.803
Bottom Diameter (in.)	2.835	2.785
Average Length (in.)	3.38	3.24
Average Area (in. <sup>2</sup> )	6.31	6.12
Sample Volume (cm <sup>3</sup> )	349.94	324.77
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.80	2.10
Unit Wet Wt. (pcf)	112.2	131.0
Unit Dry Wt. (pcf)	100.3	108.1
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.61	1.73
Void Ratio, e	0.68	0.56
Porosity, n	0.40	0.36
Pore Volume (cm <sup>3</sup> )	141.7	116.5
Total Wgt. Of Sample After Test		660.70

Tested By: BW

Date: 4/20/2012 Checked By: *BAM*

Date: *4-24-12*

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 3
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-02	Sample No.	ST-03-01
Lab ID No.	2012-656-02-03		
	121044		

41

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	8.23
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.09
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	39.45
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	12.81	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	95

**AVERAGE PERMEABILITY = 2.2E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 2.2E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
4/21/2012	12	34	0.00	0.0	0.0	106.9	0	24.0	NA
4/21/2012	13	28	0.90	3.9	4.3	98.5	0	23.9	2.3E-06
4/21/2012	14	8	1.57	6.7	7.1	92.8	0	24.0	2.3E-06
4/21/2012	14	26	1.87	7.8	8.2	90.6	0	24.0	2.1E-06
4/21/2012	15	2	2.47	9.8	10.2	86.5	1	24.0	2.0E-06

Tested By: BW      Date: 4/20/2012      Checked By: *GAM*      Date: 4-24-12

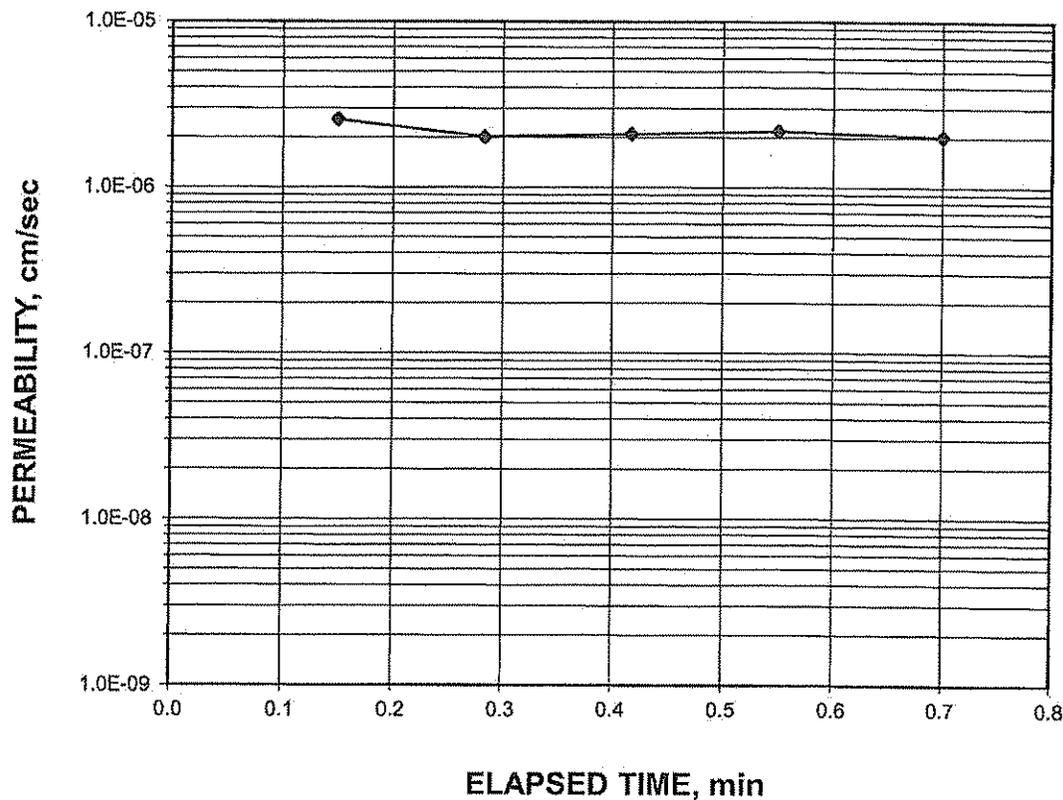
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
ASTM D 5084-03  
(SOP-S22C)

Client	JOYCE ENGINEERING	Boring No.	ND-13
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A3
Lab ID No.	2012-656-03-03		

Visual Description: ORANGE SANDY SILT

AVERAGE PERMEABILITY = 2.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 2.1E-08 m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: BW Date: 5/10/2012 Checked By: *com* Date: 5-14-12

**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-10  
 (SOP-S22C)

Client	JOYCE ENGINEERING	Boring No.	ND-13
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A3
Lab ID No.	2012-656-03-03		
	Specific Gravity	2.70	Assumed
	Sample Condition		Undisturbed

Visual Description: ORANGE SANDY SILT

<b>MOISTURE CONTENT:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Tare Number	802	Z-14
Wt. of Tare & WS (gm.)	371.35	307.85
Wt. of Tare & DS (gm.)	330.36	266.6
Wt. of Tare (gm.)	103.61	98.15
Wt. of Water (gm.)	40.99	41.25
Wt. of DS (gm.)	226.75	168.45
Moisture Content (%)	18.1	24.5

<b>SPECIMEN:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Wt. of Tube & WS (gm.)	587.61	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	587.61	619.51
Length 1 (in.)	3.006	3.004
Length 2 (in.)	3.009	3.045
Length 3 (in.)	3.029	3.050
Top Diameter (in.)	2.841	2.842
Middle Diameter (in.)	2.828	2.840
Bottom Diameter (in.)	2.820	2.835
Average Length (in.)	3.01	3.03
Average Area (in. <sup>2</sup> )	6.29	6.33
Sample Volume (cm <sup>3</sup> )	310.67	314.63
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.891	1.969
Unit Wet Wt. (pcf)	118.1	122.9
Unit Dry Wt. (pcf)	100.0	98.7
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.602	1.582
Void Ratio, e	0.686	0.707
Porosity, n	0.407	0.414
Pore Volume (cm <sup>3</sup> )	126.4	130.3
Total Wt. Of Sample After Test		620.00

Tested By: BW Date: 5/10/2012 Checked By: Date:

**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING	Boring No.	ND-13
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A3
Lab ID No.	2012-656-03-03		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	7.70
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.84
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	98	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 2.1E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 2.1E-08 m/sec @ 20°C**

DATE	TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C	
(mm/dd/yy)	(hr)	(min)	(sec)	t (min)	R <sub>p</sub> (cm)	i (cm/cm)	(°C)	(cm/sec)	
5/13/2012	1	27	1	27.02	0.000	6.5	9.3	24.2	NA
5/13/2012	1	27	10	27.17	0.150	6.2	8.8	24.2	2.6E-06
5/13/2012	1	27	18	27.30	0.283	6.0	8.5	24.2	2.0E-06
5/13/2012	1	27	26	27.43	0.417	5.8	8.1	24.2	2.1E-06
5/13/2012	1	27	34	27.57	0.550	5.6	7.8	24.2	2.2E-06
5/13/2012	1	27	43	27.72	0.700	5.4	7.5	24.2	2.0E-06

Tested By: BW Date: 5/10/2012 Checked By: Date:

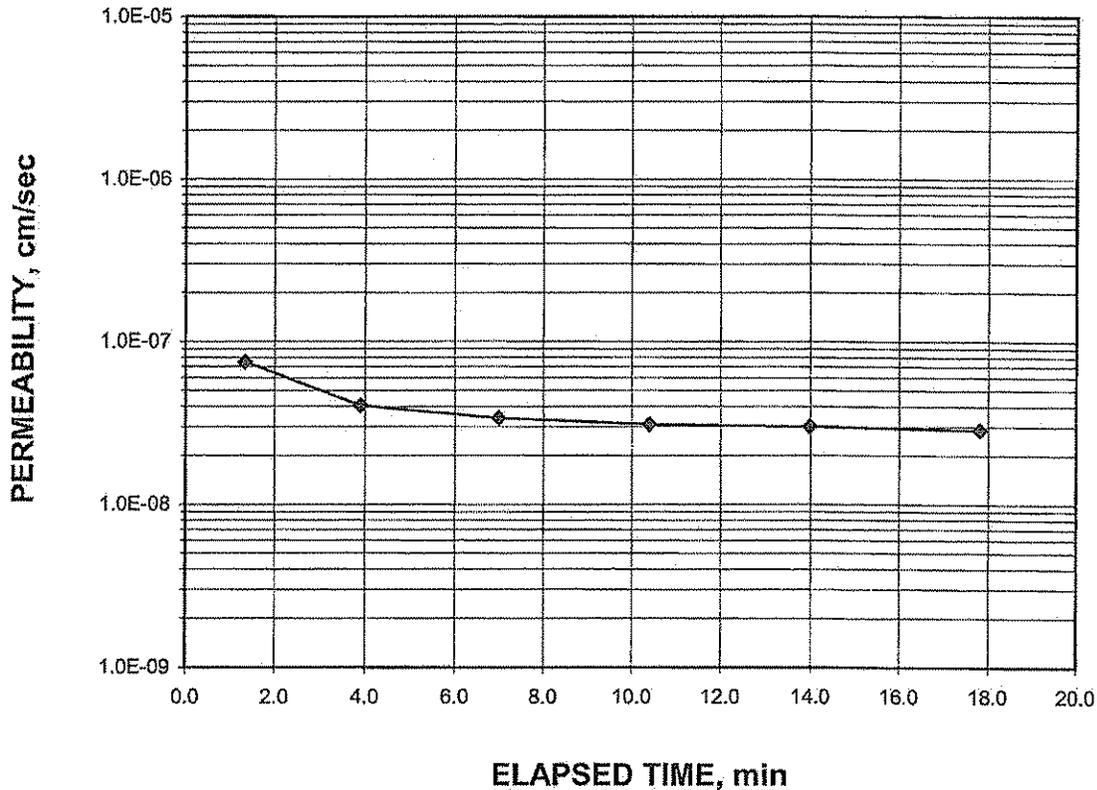
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
ASTM D 5084-03  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 3
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A3-03
Lab ID No.	2012-656-04-03		

Visual Description: REDDISH BROWN SANDY SILT

AVERAGE PERMEABILITY =  $3.1E-08$  cm/sec @ 20°C  
AVERAGE PERMEABILITY =  $3.1E-10$  m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: BW Date: 5/22/2012 Checked By: *MDS* Date: 5/24



**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-10  
 (SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 3
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A3-03
Lab ID No.	2012-656-04-03		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: REDDISH BROWN SANDY SILT

**MOISTURE CONTENT:**

**BEFORE TEST**

**AFTER TEST**

Tare Number	Y-11	809
Wt. of Tare & WS (gm.)	344.85	382.28
Wt. of Tare & DS (gm.)	300.22	334.33
Wt. of Tare (gm.)	96.58	115.03
Wt. of Water (gm.)	44.63	47.95
Wt. of DS (gm.)	203.64	219.30
Moisture Content (%)	<b>21.9</b>	<b>21.9</b>

**SPECIMEN:**

**BEFORE TEST**

**AFTER TEST**

Wt. of Tube & WS (gm.)	651.43	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	651.43	651.16
Length 1 (in.)	3.125	3.144
Length 2 (in.)	3.136	3.182
Length 3 (in.)	3.138	3.164
Top Diameter (in.)	2.842	2.841
Middle Diameter (in.)	2.837	2.836
Bottom Diameter (in.)	2.856	2.841
Average Length (in.)	3.13	3.16
Average Area (in. <sup>2</sup> )	6.36	6.33
Sample Volume (cm <sup>3</sup> )	326.37	328.22
Unit Wet Wt. (gm./cm <sup>3</sup> )	1.996	1.984
Unit Wet Wt. (pcf)	124.6	123.8
Unit Dry Wt. (pcf)	102.2	101.6
Unit Dry Wt. (gm./cm <sup>3</sup> )	1.637	1.628
Void Ratio, e	0.649	0.659
Porosity, n	0.394	0.397
Pore Volume (cm <sup>3</sup> )	128.5	130.3
Total Wt. Of Sample After Test		671.02

Tested By: BW Date: 5/22/2012 Checked By: *MMIS* Date: 5/24



**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 3
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A3-03
Lab ID No.	2012-656-04-03		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	8.03
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.85
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	95	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 3.1E-08 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 3.1E-10 m/sec @ 20°C**

DATE	TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C	
	(mm/dd/yy)	(hr)	(min)						
			(sec)	(min)	t	R <sub>p</sub>	i	(°C)	
					(min)	(cm)	(cm/cm)		
5/23/2012	11	22	56	22.93	0.000	8.0	11.4	24.7	NA
5/23/2012	11	24	17	24.28	1.350	7.9	11.2	24.7	7.5E-08
5/23/2012	11	26	50	26.83	3.900	7.8	11.1	24.7	4.0E-08
5/23/2012	11	29	55	29.92	6.983	7.7	10.9	24.7	3.4E-08
5/23/2012	11	33	20	33.33	10.400	7.6	10.7	24.7	3.1E-08
5/23/2012	11	36	55	36.92	13.983	7.5	10.6	24.7	3.0E-08
5/23/2012	11	40	45	40.75	17.817	7.4	10.4	24.7	2.9E-08

Tested By: BW Date: 5/22/2012 Checked By: *WMS* Date: 5/24

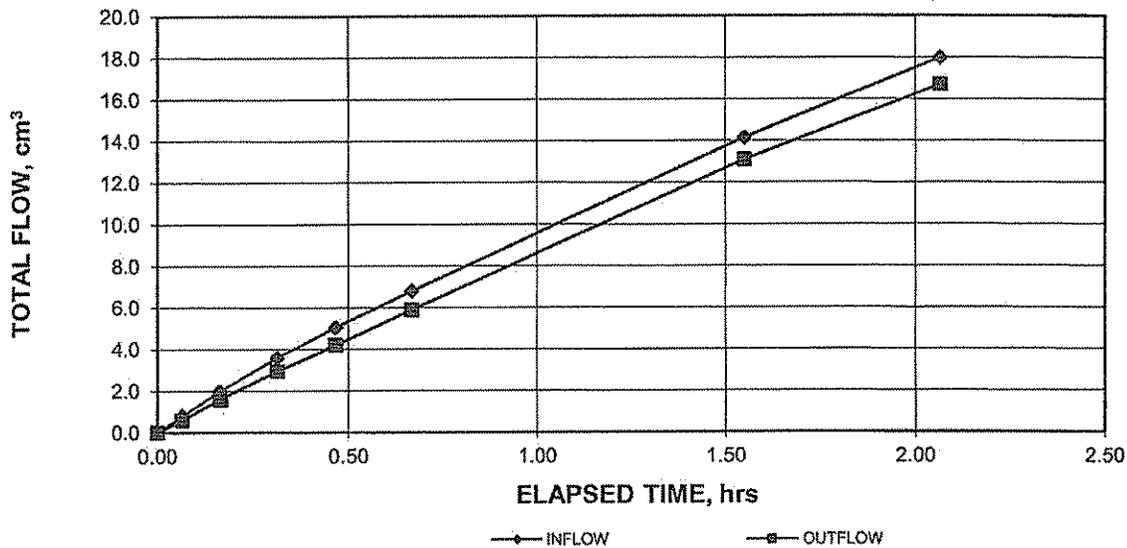
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

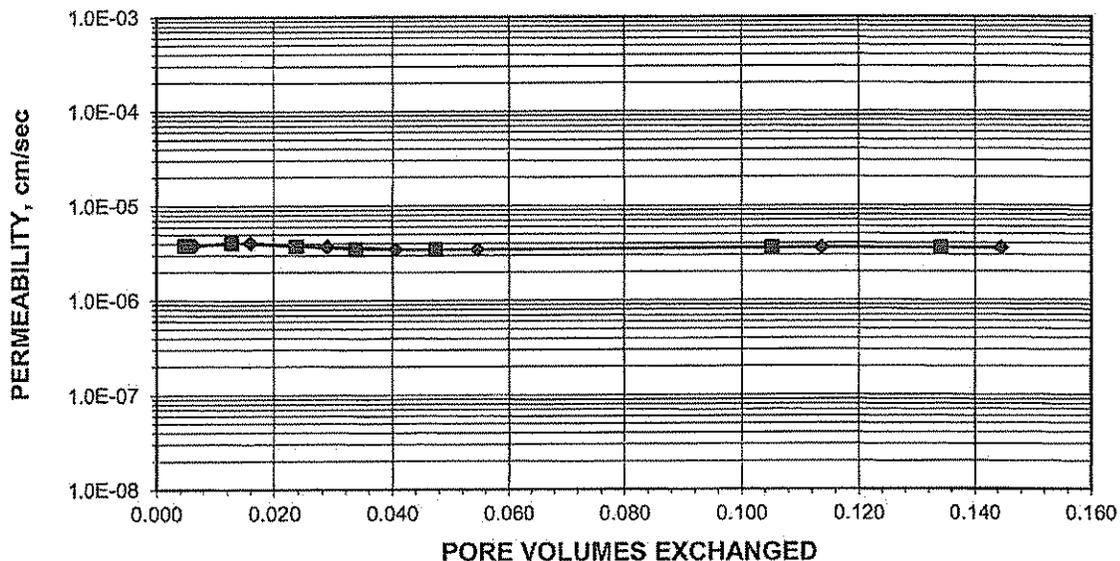
Client	JOYCE ENGINEERING	Boring No.	ACRE 4
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-02	Sample No.	ST-04-01
Lab ID No.	2012-656-02-04		

AVERAGE PERMEABILITY = 3.5E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 3.5E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 4/20/2012 Checked By: Date:

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 4
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-02	Sample No.	ST-04-01
Lab ID No.	2012-656-02-04		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	801	809
Wt. of Tare & WS (gm.)	384.19	371.21
Wt. of Tare & DS (gm.)	349.63	317.65
Wt. of Tare (gm.)	107.31	114.90
Wt. of Water (gm.)	34.56	53.56
Wt. of DS (gm.)	242.32	202.75
Moisture Content (%)	14.3	26.4

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	603.80	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	603.80	668.03
Length 1 (in.)	3.040	3.031
Length 2 (in.)	3.023	3.058
Length 3 (in.)	3.019	3.010
Top Diameter (in.)	2.844	2.863
Middle Diameter (in.)	2.849	2.862
Bottom Diameter (in.)	2.845	2.867
Average Length (in.)	3.03	3.03
Average Area (in. <sup>2</sup> )	6.36	6.44
Sample Volume (cm <sup>3</sup> )	315.59	320.19
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.91	2.09
Unit Wet Wt. (pcf)	119.4	130.2
Unit Dry Wt. (pcf)	104.5	103.0
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.67	1.65
Void Ratio, e	0.61	0.64
Porosity, n	0.38	0.39
Pore Volume (cm <sup>3</sup> )	119.9	124.5
Total Wgt. Of Sample After Test		623.07

Tested By: BW Date: 4/20/2012 Checked By: *GAN* Date: 4-23-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 4
Client Project:	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-02	Sample No.	ST-04-01
Lab ID No.	2012-656-02-04		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.70
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.27
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.56
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.888
Hydraulic Gradient	13.69	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.890
		B Parameter (%)	99

**AVERAGE PERMEABILITY = 3.5E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 3.5E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW (0 flow) (1 stop)	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
4/21/2012	10	30	0.00	0.0	0.0	129.7	0	23.7	NA
4/21/2012	10	34	0.07	0.8	0.6	128.2	0	23.7	3.8E-06
4/21/2012	10	40	0.17	2.0	1.6	125.7	0	23.7	4.1E-06
4/21/2012	10	49	0.32	3.6	3.0	122.4	0	23.7	3.7E-06
4/21/2012	10	58	0.47	5.1	4.2	119.4	0	23.8	3.5E-06
4/21/2012	11	10	0.67	6.8	5.9	115.5	0	23.8	3.5E-06
4/21/2012	12	3	1.55	14.2	13.1	99.1	0	23.9	3.6E-06
4/21/2012	12	34	2.07	18.0	16.7	90.8	1	24.0	3.6E-06

Tested By: BW                      Date: 4/20/2012    Checked By:                      Date:

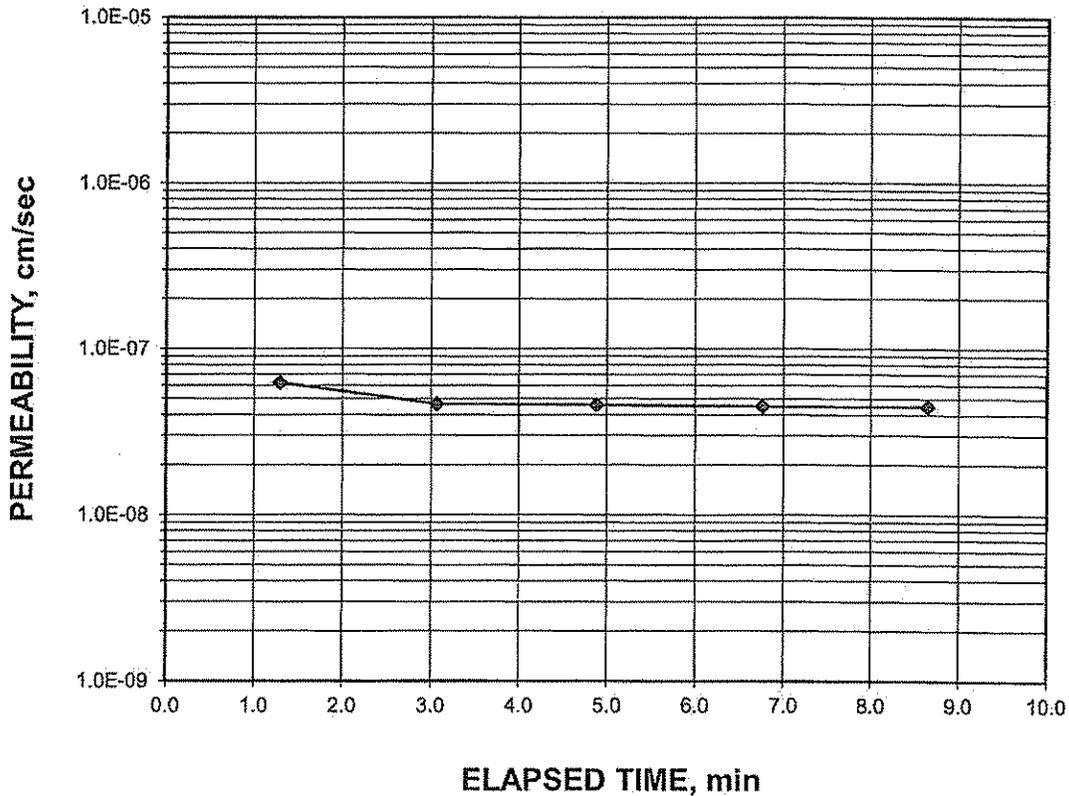
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-03  
 (SOP-S22C)

Client	JOYCE ENGINEERING	Boring No.	ND-18
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A4
Lab ID No.	2012-656-03-04		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 4.6E-08 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 4.6E-10 m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: BW Date: 5/8/2012 Checked By: GEM Date: 5-10-12

**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-10  
 (SOP-S22C)

Client	JOYCE ENGINEERING	Boring No.	ND-18
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A4
Lab ID No.	2012-656-03-04		
	Specific Gravity	2.70	Assumed
	Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

<b>MOISTURE CONTENT:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Tare Number	818	806
Wt. of Tare & WS (gm.)	390.61	337.89
Wt. of Tare & DS (gm.)	351.98	297.72
Wt. of Tare (gm.)	137.51	102.05
Wt. of Water (gm.)	38.63	40.17
Wt. of DS (gm.)	214.47	195.67
Moisture Content (%)	<b>18.0</b>	<b>20.5</b>

<b>SPECIMEN:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Wt. of Tube & WS (gm.)	499.63	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	499.63	510.29
Length 1 (in.)	2.413	2.347
Length 2 (in.)	2.469	2.341
Length 3 (in.)	2.492	2.314
Top Diameter (in.)	2.839	2.829
Middle Diameter (in.)	2.843	2.822
Bottom Diameter (in.)	2.836	2.810
Average Length (in.)	2.46	2.33
Average Area (in. <sup>2</sup> )	6.33	6.25
Sample Volume (cm <sup>3</sup> )	255.04	238.94
Unit Wet Wt. (gm./cm <sup>3</sup> )	1.959	2.136
Unit Wet Wt. (pcf)	122.3	133.3
Unit Dry Wt. (pcf)	103.6	110.6
Unit Dry Wt. (gm./cm <sup>3</sup> )	1.660	1.772
Void Ratio, e	0.626	0.524
Porosity, n	0.385	0.344
Pore Volume (cm <sup>3</sup> )	98.2	82.1
Total Wt. Of Sample After Test		505.41

Tested By: BW Date: 5/8/2012 Checked By: *GEM* Date: *5/10/12*

**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING	Boring No.	ND-18
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-03	Sample No.	A4
Lab ID No.	2012-656-03-04		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	50.0	Sample Length (cm), L	5.93
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.30
Eff. Cons. Pressure(psi)	10.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	96	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 4.6E-08 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 4.6E-10 m/sec @ 20°C**

DATE		TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	t	R <sub>p</sub>	i	(°C)	(cm/sec)
5/8/2012	8	20	29	20.48	0.000	7.7	14.8	23.8	NA
5/8/2012	8	21	47	21.78	1.300	7.6	14.5	23.8	6.2E-08
5/8/2012	8	23	33	23.55	3.067	7.5	14.3	23.8	4.7E-08
5/8/2012	8	25	22	25.37	4.883	7.4	14.1	23.8	4.6E-08
5/8/2012	8	27	15	27.25	6.767	7.3	13.9	23.8	4.5E-08
5/8/2012	8	29	8	29.13	8.650	7.2	13.7	24.7	4.5E-08

Tested By: **BW** Date: **5/8/2012** Checked By: **GEM** Date: **5-10-12**



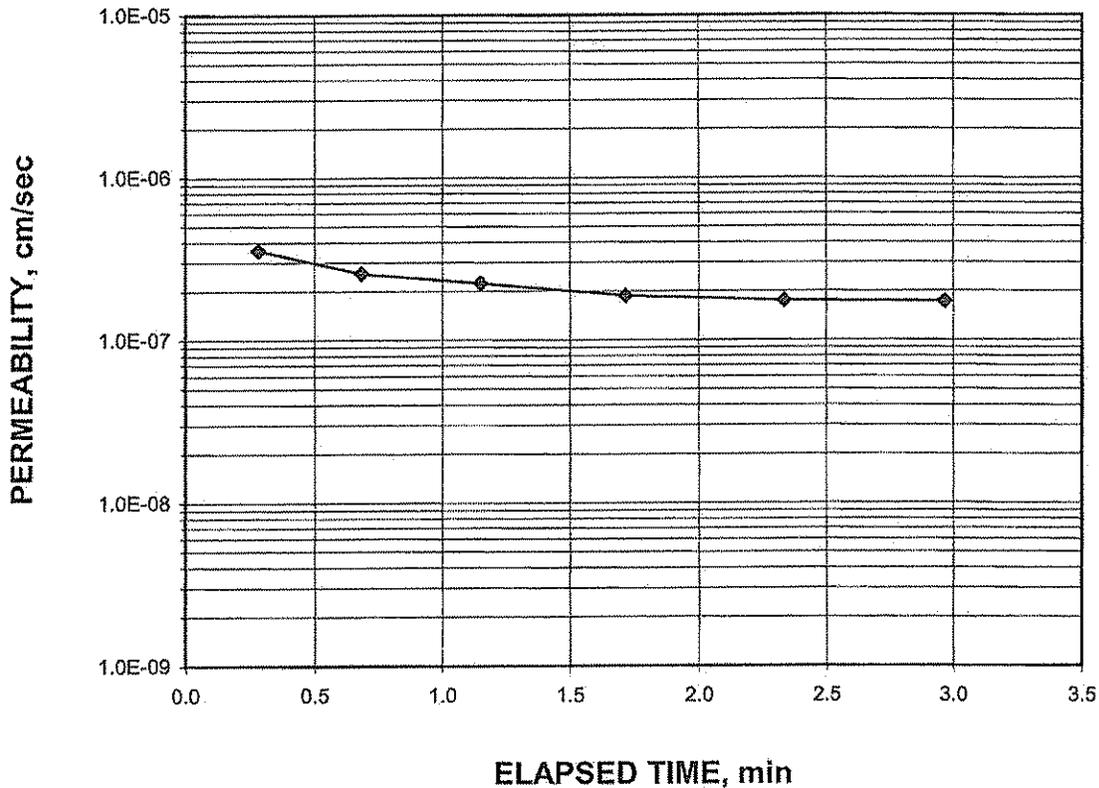
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-03  
 (SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 4
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A4-03
Lab ID No.	2012-656-04-04		

Visual Description: BROWN SANDY CLAY

AVERAGE PERMEABILITY = 1.9E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.9E-09 m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: BW Date: 5/22/2012 Checked By: *MM* Date: 5/24

## FLEXIBLE WALL PERMEABILITY TEST

### PERMOMETER METHOD

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 4
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A4-03
Lab ID No.	2012-656-04-04		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	802	807
Wt. of Tare & WS (gm.)	300.28	341.92
Wt. of Tare & DS (gm.)	272.52	301.05
Wt. of Tare (gm.)	103.73	104.81
Wt. of Water (gm.)	27.76	40.87
Wt. of DS (gm.)	168.79	196.24
Moisture Content (%)	16.4	20.8

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	663.45	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	663.45	688.41
Length 1 (in.)	3.182	3.128
Length 2 (in.)	3.142	3.184
Length 3 (in.)	3.179	3.169
Top Diameter (in.)	2.880	2.841
Middle Diameter (in.)	2.856	2.827
Bottom Diameter (in.)	2.864	2.853
Average Length (in.)	3.17	3.16
Average Area (in. <sup>2</sup> )	6.45	6.34
Sample Volume (cm <sup>3</sup> )	335.03	328.14
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.980	2.098
Unit Wet Wt. (pcf)	123.6	131.0
Unit Dry Wt. (pcf)	106.2	108.4
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.701	1.736
Void Ratio, e	0.588	0.555
Porosity, n	0.370	0.357
Pore Volume (cm <sup>3</sup> )	124.0	117.1
Total Wt. Of Sample After Test		677.47

Tested By: BW

Date: 5/22/2012

Checked By: *MB* Date: 5/24



**FLEXIBLE WALL PERMEABILITY TEST  
PERMOMETER METHOD**

ASTM D 5084-10  
(SOP-S22C)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 4
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-04	Sample No.	ST-A4-03
Lab ID No.	2012-656-04-04		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	8.03
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	40.88
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	95	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1

**AVERAGE PERMEABILITY = 1.9E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.9E-09 m/sec @ 20°C**

DATE	TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C	
	(mm/dd/yy)	(hr)	(min)						(min)
5/23/2012	11	5	57	5.95	0.000	8.0	11.4	24.7	NA
5/23/2012	11	6	14	6.23	0.283	7.9	11.2	24.7	3.6E-07
5/23/2012	11	6	38	6.63	0.683	7.8	11.1	24.7	2.6E-07
5/23/2012	11	7	6	7.10	1.150	7.7	10.9	24.7	2.2E-07
5/23/2012	11	7	40	7.67	1.717	7.6	10.7	24.7	1.9E-07
5/23/2012	11	8	17	8.28	2.333	7.5	10.6	24.7	1.7E-07
5/23/2012	11	8	55	8.92	2.967	7.4	10.4	24.7	1.7E-07

Tested By: BW Date: 5/22/2012 Checked By: *MMS* Date: *5/24*

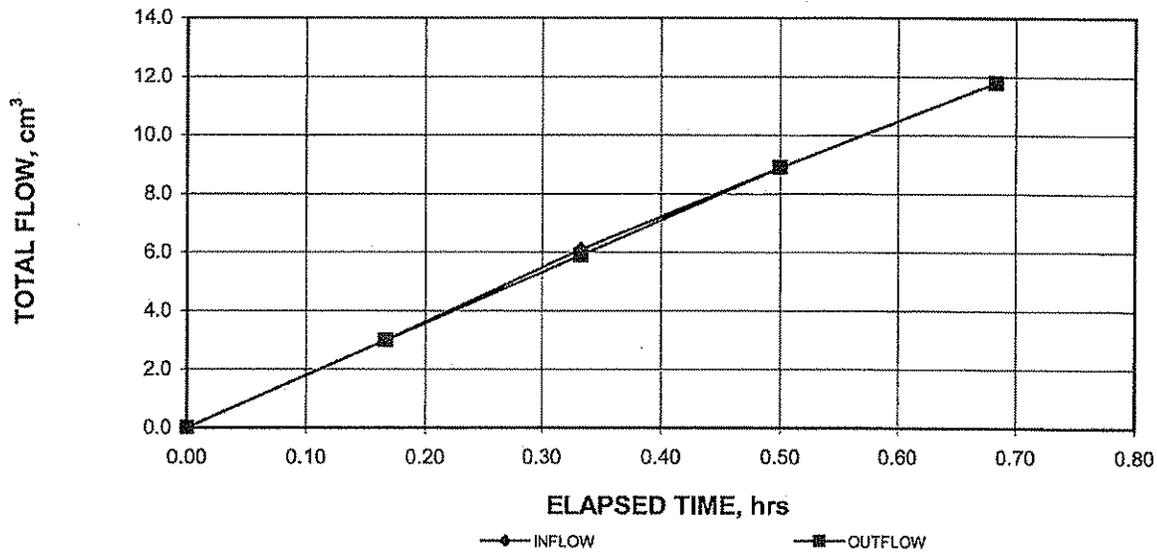
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

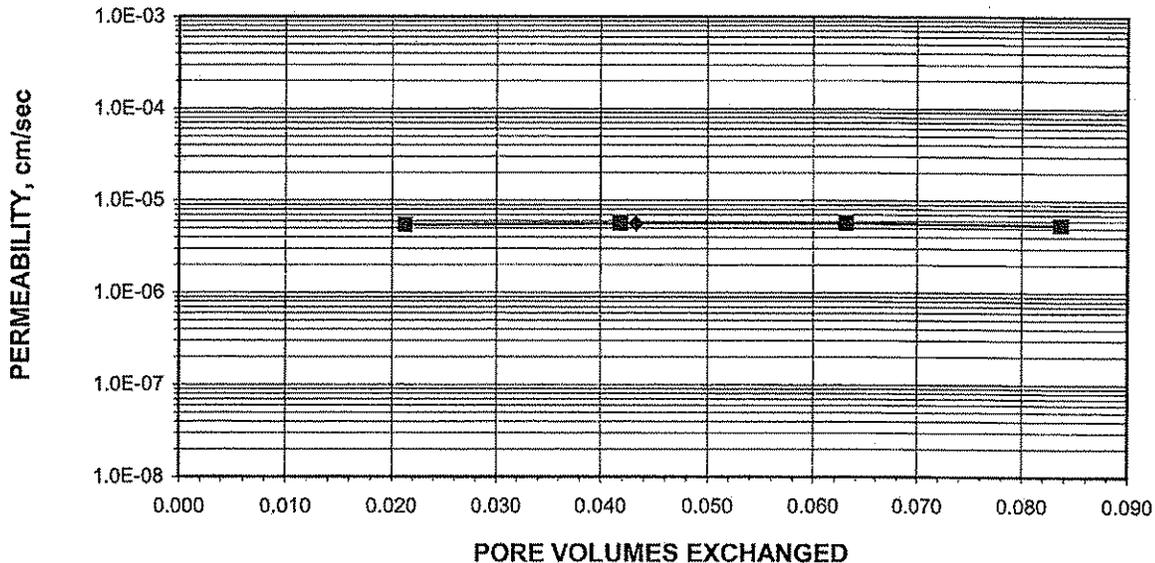
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-05	Sample No.	ST-A5-01
Lab ID No.	2012-656-05-01		

AVERAGE PERMEABILITY = 5.5E-06 cm/sec @ 20°C  
AVERAGE PERMEABILITY = 5.5E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 7/9/2012 Checked By: *[Signature]* Date: 7/23



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-05	Sample No.	ST-A5-01
Lab ID No.	2012-656-05-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: TAN SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	814	810
Wt. of Tare & WS (gm.)	370.05	417.16
Wt. of Tare & DS (gm.)	345.88	355.69
Wt. of Tare (gm.)	112.14	114.97
Wt. of Water (gm.)	24.17	61.47
Wt. of DS (gm.)	233.74	240.72
Moisture Content (%)	10.3	25.5

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	590.73	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	590.73	672.08
Length 1 (in.)	3.224	3.227
Length 2 (in.)	3.232	3.208
Length 3 (in.)	3.284	3.23
Top Diameter (in.)	2.910	2.873
Middle Diameter (in.)	2.896	2.863
Bottom Diameter (in.)	2.884	2.845
Average Length (in.)	3.25	3.22
Average Area (in. <sup>2</sup> )	6.59	6.43
Sample Volume (cm <sup>3</sup> )	350.61	339.24
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.68	1.98
Unit Wet Wt. (pcf)	105.2	123.7
Unit Dry Wt. (pcf)	95.3	98.5
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.53	1.58
Void Ratio, e	0.77	0.71
Porosity, n	0.43	0.42
Pore Volume (cm <sup>3</sup> )	152.3	141.0
Total Wgt. Of Sample After Test		661.91

Tested By: BW Date: 7/9/2012 Checked By: *MRS* Date: 7/23

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)



Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-05	Sample No.	ST-A5-01
Lab ID No.	2012-656-05-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.0	Sample Length (cm), L	8.18
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.27
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.46
Total Pressure Head (cm)	140.6	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	17.18	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	99

AVERAGE PERMEABILITY = 5.5E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 5.5E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
7/11/2012	4	27	0.00	0.0	0.0	164.9	0	25.0	NA
7/11/2012	4	37	0.17	3.0	3.0	158.3	0	25.0	5.4E-06
7/11/2012	4	47	0.33	6.1	5.9	151.7	0	25.0	5.6E-06
7/11/2012	4	57	0.50	8.9	8.9	145.4	0	25.0	5.7E-06
7/11/2012	5	8	0.68	11.8	11.8	139.0	1	25.0	5.4E-06

Tested By: BW Date: 7/9/2012 Checked By: *MB* Date: 7/23

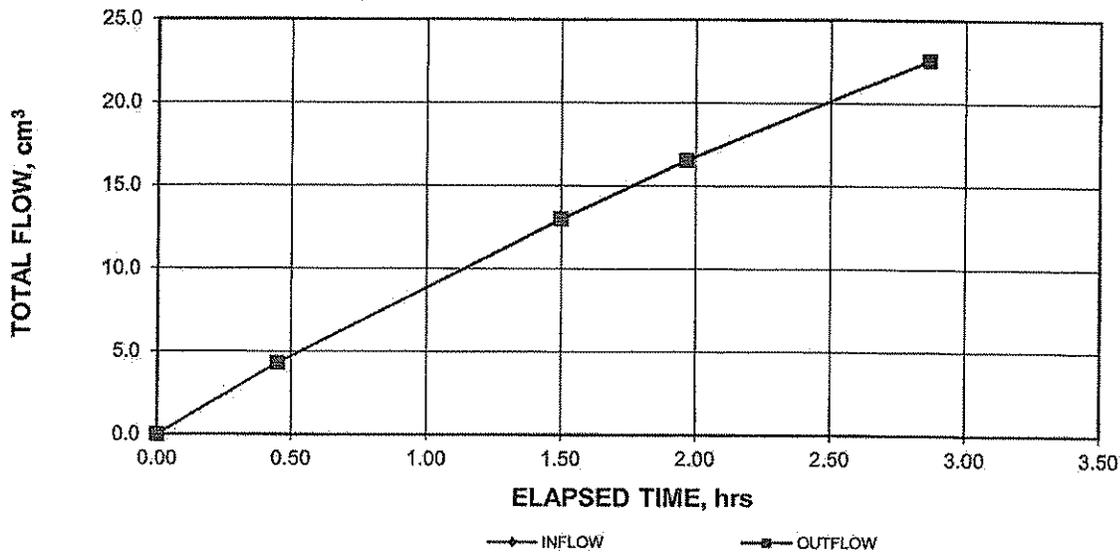
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

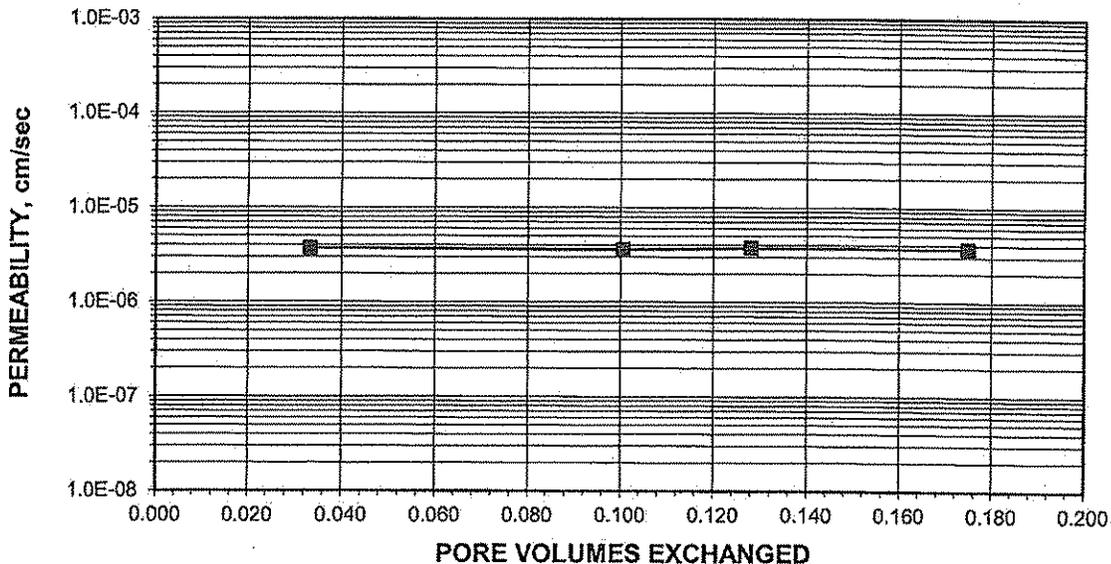
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR.	Depth (ft.)	LIFT 2
Project No.	2012-656-06	Sample No.	ST-A5-02
Lab ID No.	2012-656-06-01		

AVERAGE PERMEABILITY = 3.7E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 3.7E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 7/23/2012 Checked By: GEM Date: 7-26-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-06	Sample No.	ST-A5-02
Lab ID No.	2012-656-06-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: LIGHT BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	811	818
Wt. of Tare & WS (gm.)	355.83	318.96
Wt. of Tare & DS (gm.)	320.84	283.85
Wt. of Tare (gm.)	106.14	137.35
Wt. of Water (gm.)	34.99	35.11
Wt. of DS (gm.)	214.70	146.50
Moisture Content (%)	16.3	24.0

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	604.48	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	604.48	644.34
Length 1 (in.)	3.140	3.157
Length 2 (in.)	3.130	3.125
Length 3 (in.)	3.105	3.082
Top Diameter (in.)	2.858	2.83
Middle Diameter (in.)	2.856	2.84
Bottom Diameter (in.)	2.854	2.82
Average Length (in.)	3.13	3.12
Average Area (in. <sup>2</sup> )	6.41	6.29
Sample Volume (cm <sup>3</sup> )	328.06	321.74
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.84	2.00
Unit Wet Wt. (pcf)	115.0	125.0
Unit Dry Wt. (pcf)	98.9	100.8
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.58	1.62
Void Ratio, e	0.70	0.67
Porosity, n	0.41	0.40
Pore Volume (cm <sup>3</sup> )	135.6	129.2
Total Wgt. Of Sample After Test		636.83

Tested By: BW

Date: 7/23/2012

Checked By: *GEM*

Date: 7-26-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-06	Sample No.	ST-A5-02
Lab ID No.	2012-656-06-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.93
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.19
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.58
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	13.30	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 3.7E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 3.7E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
7/25/2012	13	52	0.00	0.0	0.0	126.3	0	25.9	NA
7/25/2012	14	19	0.45	4.3	4.3	117.5	0	25.9	3.7E-06
7/25/2012	15	22	1.50	13.0	13.0	99.6	0	25.9	3.6E-06
7/25/2012	15	50	1.97	16.6	16.6	92.2	0	25.9	3.7E-06
7/25/2012	16	44	2.87	22.6	22.6	79.8	1	25.9	3.7E-06

Tested By: BW      Date: 7/23/2012      Checked By: *GEM*      Date: 7-26-12

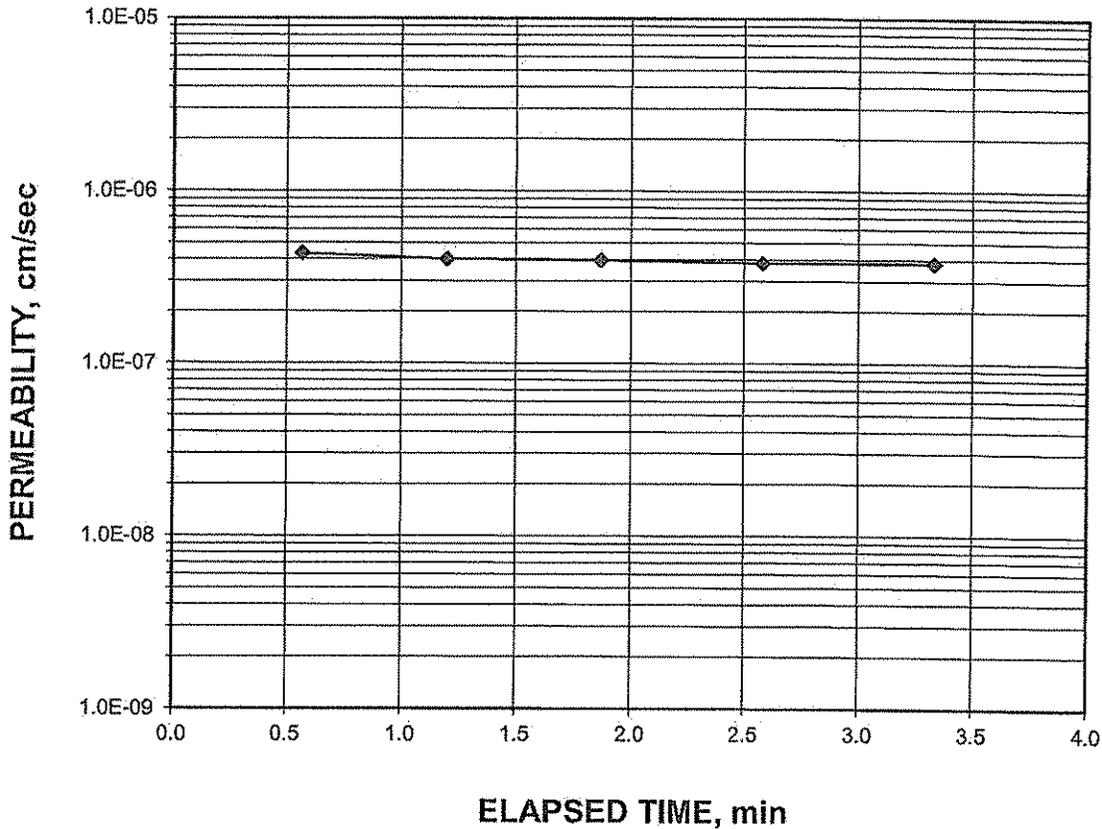
**FLEXIBLE WALL PERMEABILITY TEST  
 PERMOMETER METHOD  
 ASTM D 5084-03**

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-07	Sample No.	ST-05-03
Lab ID No.	2012-656-07-01		

Visual Description: YELLOW ORANGE SANDY CLAY

AVERAGE PERMEABILITY = 3.9E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 3.9E-09 m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: SFS      Date: 7/31/2012      Checked By: *GM*      Date: 8-3-12

**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-07	Sample No.	ST-05-03
Lab ID No.	2012-656-07-01		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: YELLOW ORANGE SANDY CLAY

<b>MOISTURE CONTENT:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Tare Number	820	804
Wt. of Tare & WS (gm.)	305.72	346.1
Wt. of Tare & DS (gm.)	271.21	292.32
Wt. of Tare (gm.)	136.22	105.1
Wt. of Water (gm.)	34.51	53.78
Wt. of DS (gm.)	134.99	187.22
Moisture Content (%)	<b>25.6</b>	<b>28.7</b>

<b>SPECIMEN:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Wt. of Tube & WS (gm.)	611.98	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	611.98	627.38
Length 1 (in.)	3.210	3.219
Length 2 (in.)	3.194	3.209
Length 3 (in.)	3.210	3.221
Top Diameter (in.)	2.837	2.866
Middle Diameter (in.)	2.837	2.867
Bottom Diameter (in.)	2.838	2.874
Average Length (in.)	3.20	3.22
Average Area (in. <sup>2</sup> )	6.32	6.46
Sample Volume (cm <sup>3</sup> )	332.04	340.73
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.843	1.841
Unit Wet Wt. (pcf)	115.0	114.9
Unit Dry Wt. (pcf)	91.6	89.3
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.468	1.430
Void Ratio, e	0.839	0.888
Porosity, n	0.456	0.470
Pore Volume (cm <sup>3</sup> )	151.5	160.2
Total Wt. Of Sample After Test		644.74

Tested By: SFS Date: 7/31/2012 Checked By: Gam Date: 8-3-12

## FLEXIBLE WALL PERMEABILITY TEST PERMOMETER METHOD

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 5
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-07	Sample No.	ST-05-03
Lab ID No.	2012-656-07-01		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	8.17
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	41.71
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	97	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1.3

AVERAGE PERMEABILITY = 3.9E-07 cm/sec @ 20°C

AVERAGE PERMEABILITY = 3.9E-09 m/sec @ 20°C

DATE		TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	t (min)	R <sub>p</sub> (cm)	i (cm/cm)	(°C)	(cm/sec)
8/2/2012	15	32	2	32.03	0.000	7.0	9.1	25.7	NA
8/2/2012	15	32	36	32.60	0.567	6.8	8.8	25.7	4.3E-07
8/2/2012	15	33	14	33.23	1.200	6.6	8.5	25.7	4.0E-07
8/2/2012	15	33	54	33.90	1.867	6.4	8.2	25.7	4.0E-07
8/2/2012	15	34	37	34.62	2.583	6.2	7.8	25.7	3.8E-07
8/2/2012	15	35	22	35.37	3.333	6.0	7.5	25.7	3.8E-07

Tested By: SFS

Date: 7/31/2012

Checked By: *GAM* Date: 8-3-12

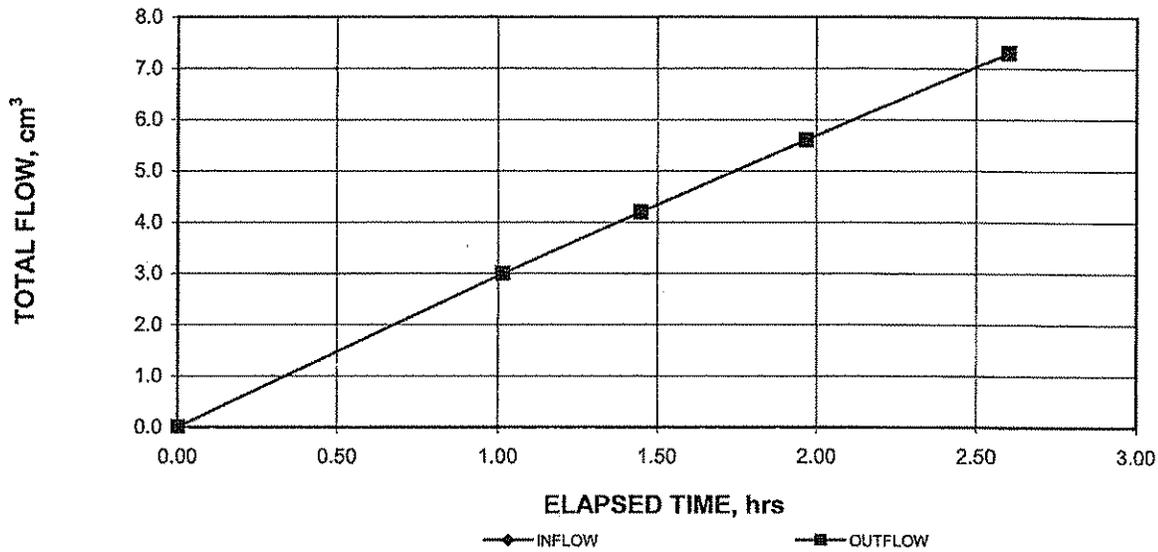
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

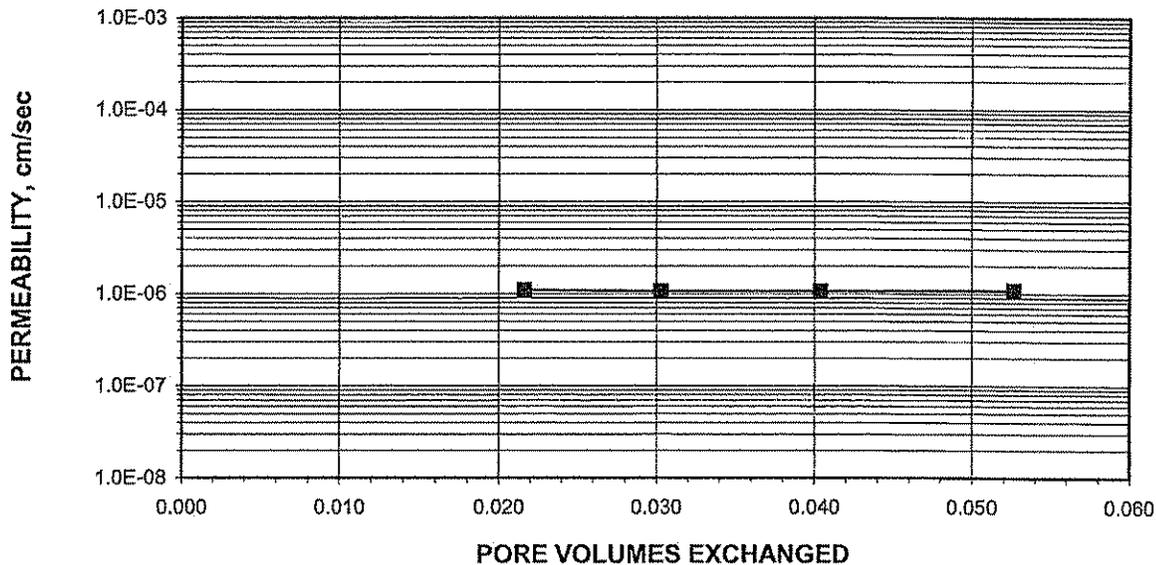
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE-6
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-05	Sample No.	ST-A6-01
Lab ID No.	2012-656-05-02		

AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW

Date: 7/9/2012 Checked By: *[Signature]*

Date: 7/23



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE-6
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-05	Sample No.	ST-A6-01
Lab ID No.	2012-656-05-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: TAN SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	813	811
Wt. of Tare & WS (gm.)	364.26	354.6
Wt. of Tare & DS (gm.)	325.21	296.56
Wt. of Tare (gm.)	112.97	106.64
Wt. of Water (gm.)	39.05	58.04
Wt. of DS (gm.)	212.24	189.92
Moisture Content (%)	18.4	30.6

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	588.61	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	588.61	649.07
Length 1 (in.)	3.031	3.058
Length 2 (in.)	3.033	3.047
Length 3 (in.)	3.034	3.045
Top Diameter (in.)	2.854	2.874
Middle Diameter (in.)	2.852	2.868
Bottom Diameter (in.)	2.849	2.86
Average Length (in.)	3.03	3.05
Average Area (in. <sup>2</sup> )	6.39	6.46
Sample Volume (cm <sup>3</sup> )	317.40	322.74
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.85	2.01
Unit Wet Wt. (pcf)	115.8	125.5
Unit Dry Wt. (pcf)	97.8	96.2
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.57	1.54
Void Ratio, e	0.72	0.75
Porosity, n	0.42	0.43
Pore Volume (cm <sup>3</sup> )	133.3	138.6
Total Wgt. Of Sample After Test		639.60

Tested By: BW Date: 7/9/2012 Checked By: *[Signature]* Date: 7/23

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)



Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE-6
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-05	Sample No.	ST-A6-01
Lab ID No.	2012-656-05-02		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.75
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.28
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.66
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	13.61	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	97

**AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C**

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
7/11/2012	1	36	0.00	0.0	0.0	127.3	0	24.9	NA
7/11/2012	2	37	1.02	3.0	3.0	121.2	0	24.9	1.1E-06
7/11/2012	3	3	1.45	4.2	4.2	118.7	0	24.9	1.1E-06
7/11/2012	3	34	1.97	5.6	5.6	115.8	0	24.9	1.1E-06
7/11/2012	4	12	2.60	7.3	7.3	112.3	1	24.9	1.1E-06

Tested By: BW Date: 7/9/2012 Checked By: *MM* Date: 7/23



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 6
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-06	Sample No.	ST-A6-02
Lab ID No.	2012-656-06-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description:     LIGHT TAN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	801	828
Wt. of Tare & WS (gm.)	347.70	321.12
Wt. of Tare & DS (gm.)	319.35	288.54
Wt. of Tare (gm.)	107.11	136.07
Wt. of Water (gm.)	28.35	32.58
Wt. of DS (gm.)	212.24	152.47
Moisture Content (%)	<b>13.4</b>	<b>21.4</b>

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	589.91	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	589.91	631.60
Length 1 (in.)	3.095	3.054
Length 2 (in.)	3.052	3.07
Length 3 (in.)	3.089	3.048
Top Diameter (in.)	2.858	2.845
Middle Diameter (in.)	2.850	2.852
Bottom Diameter (in.)	2.842	2.842
Average Length (in.)	3.08	3.06
Average Area (in. <sup>2</sup> )	6.38	6.36
Sample Volume (cm <sup>3</sup> )	321.84	318.79
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.83	1.98
Unit Wet Wt. (pcf)	114.4	123.7
Unit Dry Wt. (pcf)	100.9	101.9
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.62	1.63
Void Ratio, e	0.67	0.65
Porosity, n	0.40	0.40
Pore Volume (cm <sup>3</sup> )	129.1	126.1
Total Wgt. Of Sample After Test		637.81

Tested By:    BW                      Date: 7/23/2012    Checked By:    *GM*                      Date: 7-27-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 6
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-06	Sample No.	ST-A6-02
Lab ID No.	2012-656-06-02		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.6	Sample Length (cm), L	7.77
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.23
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.05
Total Pressure Head (cm)	98.4	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	12.67	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	97

**AVERAGE PERMEABILITY = 1.5E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.5E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
7/25/2012	8	7	0.00	0.0	0.0	121.3	0	25.3	NA
7/25/2012	8	44	0.62	2.3	2.3	116.6	0	25.3	1.5E-06
7/25/2012	9	28	1.35	4.7	4.8	111.6	0	25.3	1.4E-06
7/25/2012	9	46	1.65	5.8	5.8	109.4	0	25.3	1.5E-06
7/25/2012	10	1	1.90	6.7	6.8	107.4	1	25.3	1.6E-06

Tested By: **BW**      Date: **7/23/2012**      Checked By: **GEM**      Date: **7-27-12**

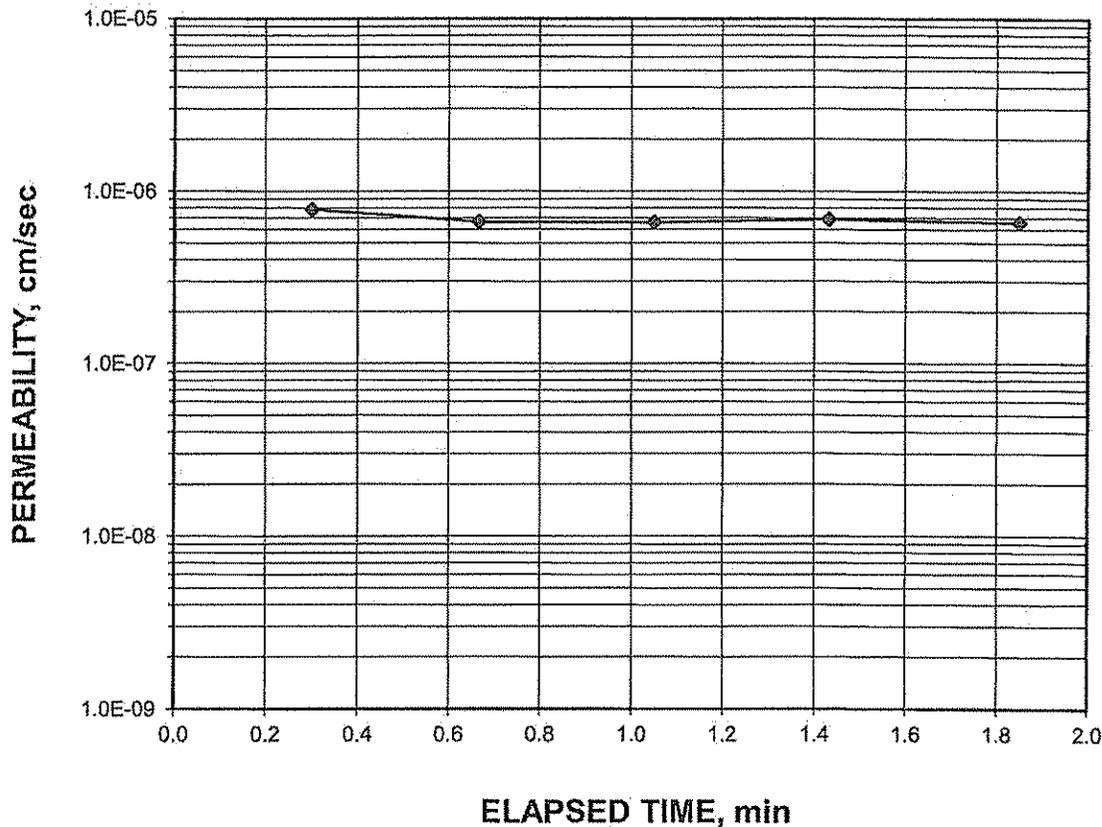
**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 6
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-07	Sample No.	ST-06-03
Lab ID No.	2012-656-07-02		

Visual Description: YELLOW ORANGE SANDY CLAY

AVERAGE PERMEABILITY = 6.7E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 6.7E-09 m/sec @ 20°C

**PERMEABILITY vs. TIME**



Tested By: SFS Date: 7/31/2012 Checked By: GEM Date: 8-3-12

**FLEXIBLE WALL PERMEABILITY TEST**  
**PERMOMETER METHOD**  
 ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 6
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-07	Sample No.	ST-06-03
Lab ID No.	2012-656-07-02		

Specific Gravity	2.70	Assumed
Sample Condition		Undisturbed

Visual Description: YELLOW ORANGE SANDY CLAY

<b>MOISTURE CONTENT:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Tare Number	825	807
Wt. of Tare & WS (gm.)	344.48	348.47
Wt. of Tare & DS (gm.)	307.50	298.76
Wt. of Tare (gm.)	136.96	104.72
Wt. of Water (gm.)	36.98	49.71
Wt. of DS (gm.)	170.54	194.04
Moisture Content (%)	<b>21.7</b>	<b>25.6</b>

<b>SPECIMEN:</b>	<b>BEFORE TEST</b>	<b>AFTER TEST</b>
Wt. of Tube & WS (gm.)	608.55	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.) (gm.)	608.55	628.23
Length 1 (in.)	3.044	3.069
Length 2 (in.)	3.064	3.048
Length 3 (in.)	3.064	3.039
Top Diameter (in.)	2.842	2.851
Middle Diameter (in.)	2.838	2.852
Bottom Diameter (in.)	2.839	2.856
Average Length (in.)	3.06	3.05
Average Area (in. <sup>2</sup> )	6.33	6.39
Sample Volume (cm <sup>3</sup> )	317.30	319.73
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.918	1.965
Unit Wet Wt. (pcf)	119.7	122.7
Unit Dry Wt. (pcf)	98.4	97.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.576	1.564
Void Ratio, e	0.713	0.726
Porosity, n	0.416	0.421
Pore Volume (cm <sup>3</sup> )	132.1	134.5
Total Wt. Of Sample After Test		631.76

Tested By: SFS      Date: 7/31/2012      Checked By: *cam*      Date: *8-3-12*

## FLEXIBLE WALL PERMEABILITY TEST PERMOMETER METHOD

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 6
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-07	Sample No.	ST-06-03
Lab ID No.	2012-656-07-02		

Test Pressures		Final Sample Dimensions	
Cell Pressure(psi)	45.0	Sample Length (cm), L	7.75
Back Pressure(psi)	40.0	Sample Area (cm <sup>2</sup> ), A	41.24
Eff. Cons. Pressure(psi)	5.0	Pipette Area (cm <sup>2</sup> ), a <sub>p</sub>	0.03142
Response (%)	95	Annulus Area (cm <sup>2</sup> ), a <sub>a</sub>	0.76712
		Equilibrium Level (cm), R <sub>eq</sub>	1.3

**AVERAGE PERMEABILITY = 6.7E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 6.7E-09 m/sec @ 20°C**

DATE		TIME			ELAPSED TIME	PIPETTE READING	INCREMENT GRADIENT	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(sec)	(min)	t (min)	R <sub>p</sub> (cm)	i (cm/cm)	(°C)	(cm/sec)
8/2/2012	15	4	42	4.70	0.000	7.0	9.6	25.8	NA
8/2/2012	15	5	0	5.00	0.300	6.8	9.3	25.8	7.8E-07
8/2/2012	15	5	22	5.37	0.667	6.6	8.9	25.8	6.6E-07
8/2/2012	15	5	45	5.75	1.050	6.4	8.6	25.8	6.6E-07
8/2/2012	15	6	8	6.13	1.433	6.2	8.3	25.8	6.9E-07
8/2/2012	15	6	33	6.55	1.850	6.0	7.9	25.8	6.6E-07

Tested By: SFS      Date: 7/31/2012      Checked By: *GEN*      Date: 8-3-12

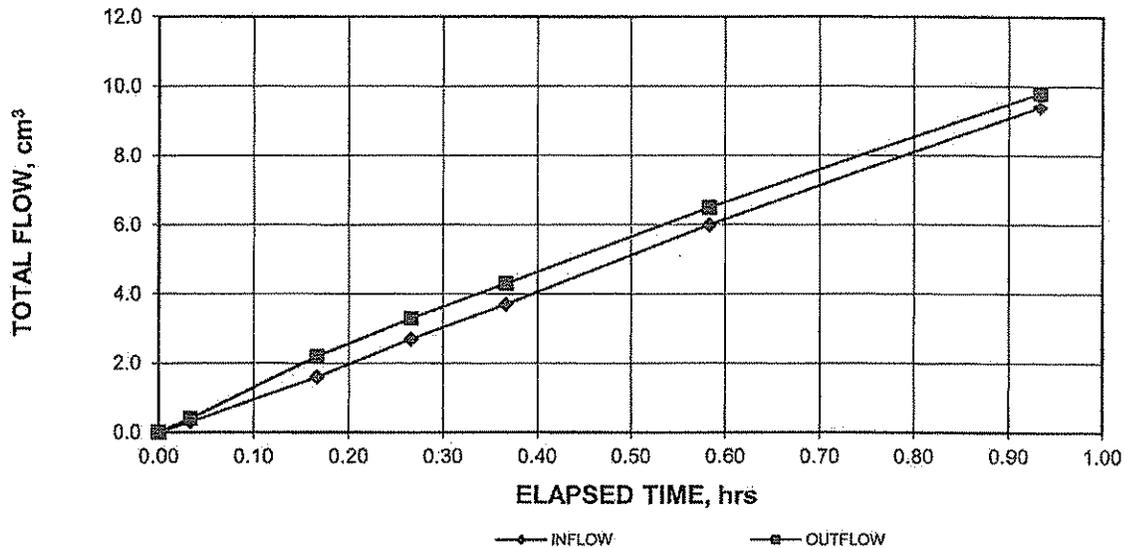
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

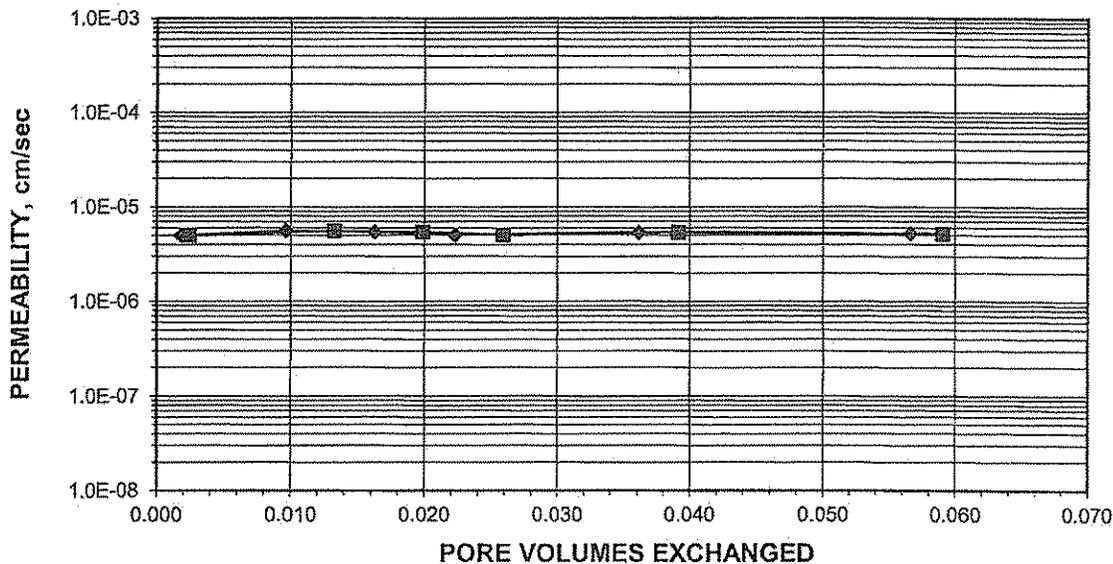
Client	JOYCE ENGINEERING, INC.	Boring No.	ST-A7-L1
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-11	Sample No.	ST-02
Lab ID No.	2012-656-11-02		

AVERAGE PERMEABILITY = 5.3E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 5.3E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 9/14/2012 Checked By: *GAM* Date: 9-18-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ST-A7-L1
Client Project	COBLE SR.	Depth (ft.)	NA
Project No.	2012-656-11	Sample No.	ST-02
Lab ID No.	2012-656-11-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: RED / LIGHT BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	820	8010
Wt. of Tare & WS (gm.)	404.82	641.88
Wt. of Tare & DS (gm.)	370.72	543.43
Wt. of Tare (gm.)	136.17	135.84
Wt. of Water (gm.)	34.10	98.45
Wt. of DS (gm.)	234.55	407.59
Moisture Content (%)	14.5	24.2

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	778.45	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	778.45	843.80
Length 1 (in.)	4.244	4.133
Length 2 (in.)	4.313	4.120
Length 3 (in.)	4.257	4.029
Top Diameter (in.)	2.834	2.819
Middle Diameter (in.)	2.835	2.793
Bottom Diameter (in.)	2.820	2.834
Average Length (in.)	4.27	4.09
Average Area (in. <sup>2</sup> )	6.29	6.23
Sample Volume (cm <sup>3</sup> )	440.17	417.64
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.77	2.02
Unit Wet Wt. (pcf)	110.4	126.1
Unit Dry Wt. (pcf)	96.4	101.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.54	1.63
Void Ratio, e	0.75	0.66
Porosity, n	0.43	0.40
Pore Volume (cm <sup>3</sup> )	188.5	165.9
Total Wgt. Of Sample After Test		832.74

Tested By: SFS      Date: 9/14/2012      Checked By: *GAN*      Date: *9-18-12*

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ST-A7-L1
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-11	Sample No.	ST-02
Lab ID No.	2012-656-11-02		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	10.40
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.15
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.16
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.865
Hydraulic Gradient	10.14	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.865
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 5.3E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 5.3E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
9/17/2012	15	10	0.00	0.0	0.0	133.0	0	25.3	NA
9/17/2012	15	12	0.03	0.3	0.4	132.2	0	25.3	5.0E-06
9/17/2012	15	20	0.17	1.6	2.2	128.6	0	25.3	5.6E-06
9/17/2012	15	26	0.27	2.7	3.3	126.1	0	25.3	5.4E-06
9/17/2012	15	32	0.37	3.7	4.3	123.8	0	25.3	5.0E-06
9/17/2012	15	45	0.58	6.0	6.5	118.6	0	25.4	5.4E-06
9/17/2012	16	6	0.93	9.4	9.8	111.0	1	25.4	5.2E-06

Tested By: SFS      Date: 9/14/2012      Checked By: *GEM*      Date: *9-12-12*

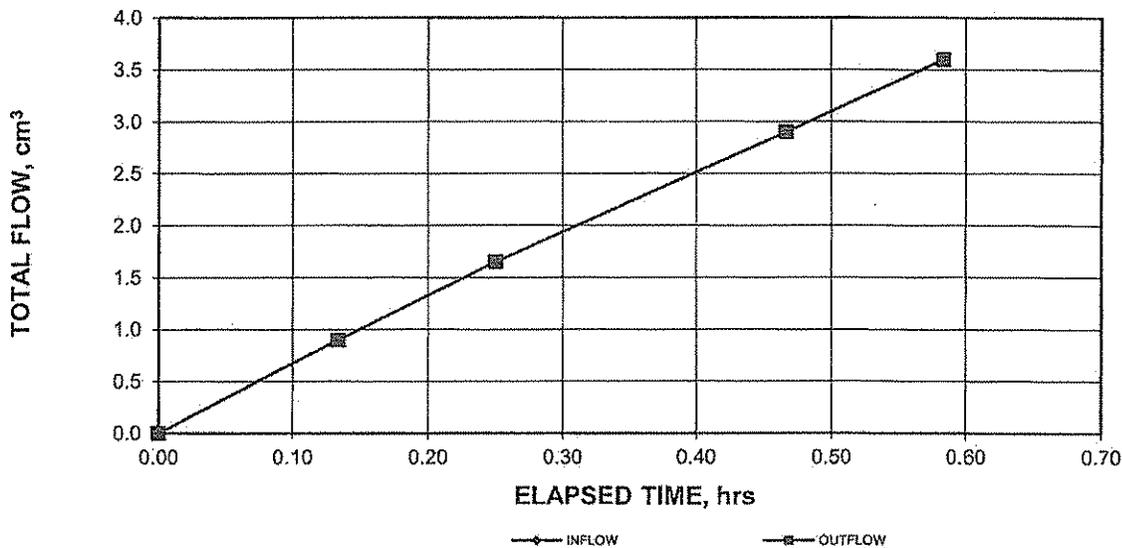
# PERMEABILITY TEST

ASTM D 5084-03

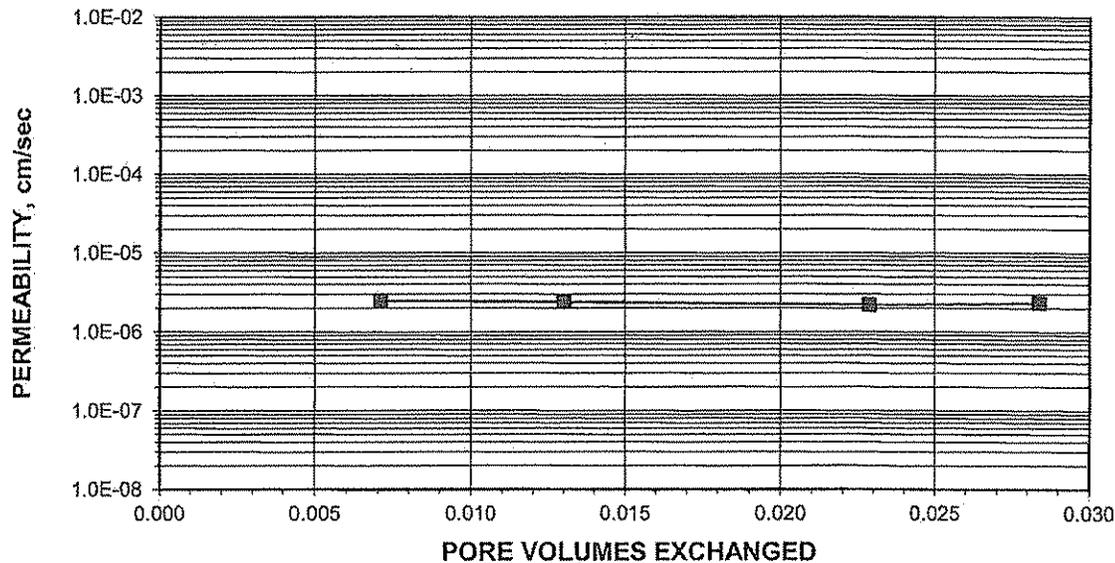
Client	JOYCE ENGINEERING	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-13	Sample No.	ST-A7-L2
Lab ID No.	2012-656-13-02		

AVERAGE PERMEABILITY = 2.4E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 2.4E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 9/27/2012 Checked By: JBD Date: 10-2-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-13	Sample No.	ST-A7-L2
Lab ID No.	2012-656-13-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description:      ORANGE SANDY CLAY WITH ROCKS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	814	808
Wt. of Tare & WS (gm.)	417.12	351.62
Wt. of Tare & DS (gm.)	367.39	304.92
Wt. of Tare (gm.)	111.39	104.45
Wt. of Water (gm.)	49.73	46.70
Wt. of DS (gm.)	256.00	200.47
Moisture Content (%)	19.4	23.3

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	615.63	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	615.63	635.58
Length 1 (in.)	3.121	3.044
Length 2 (in.)	3.084	3.081
Length 3 (in.)	3.094	3.093
Top Diameter (in.)	2.841	2.834
Middle Diameter (in.)	2.839	2.837
Bottom Diameter (in.)	2.844	2.833
Average Length (in.)	3.10	3.07
Average Area (in. <sup>2</sup> )	6.34	6.31
Sample Volume (cm <sup>3</sup> )	322.07	317.77
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.91	2.00
Unit Wet Wt. (pcf)	119.3	124.9
Unit Dry Wt. (pcf)	99.9	101.3
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.60	1.62
Void Ratio, e	0.69	0.66
Porosity, n	0.41	0.40
Pore Volume (cm <sup>3</sup> )	131.1	126.8
Total Wgt. Of Sample After Test		636.48

Tested By:    SFS                      Date: 9/27/2012    Checked By:    *JBD*                      Date: 10-2-12

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-13	Sample No.	ST-A7-L2
Lab ID No.	2012-656-13-02		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	40.5	Sample Length (cm), L	7.80
Bottom Cap (psi)	42.0	Sample Diameter (cm)	7.20
Cell (psi)	47.0	Sample Area (cm <sup>2</sup> ), A	40.72
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.877
Hydraulic Gradient	13.51	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.886
		B Parameter (%)	97

**AVERAGE PERMEABILITY = 2.4E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 2.4E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
9/28/2012	9	41	0.00	0.0	0.0	129.0	0	24.5	NA
9/28/2012	9	49	0.13	0.9	0.9	127.0	0	24.5	2.5E-06
9/28/2012	9	56	0.25	1.7	1.7	125.3	0	24.5	2.4E-06
9/28/2012	10	9	0.47	2.9	2.9	122.5	0	24.6	2.2E-06
9/28/2012	10	16	0.58	3.6	3.6	120.9	0	24.6	2.3E-06

Tested By: SFS      Date: 9/27/2012      Checked By: *JBD*      Date: 10-2-12

# PERMEABILITY TEST

ASTM D 5084-03

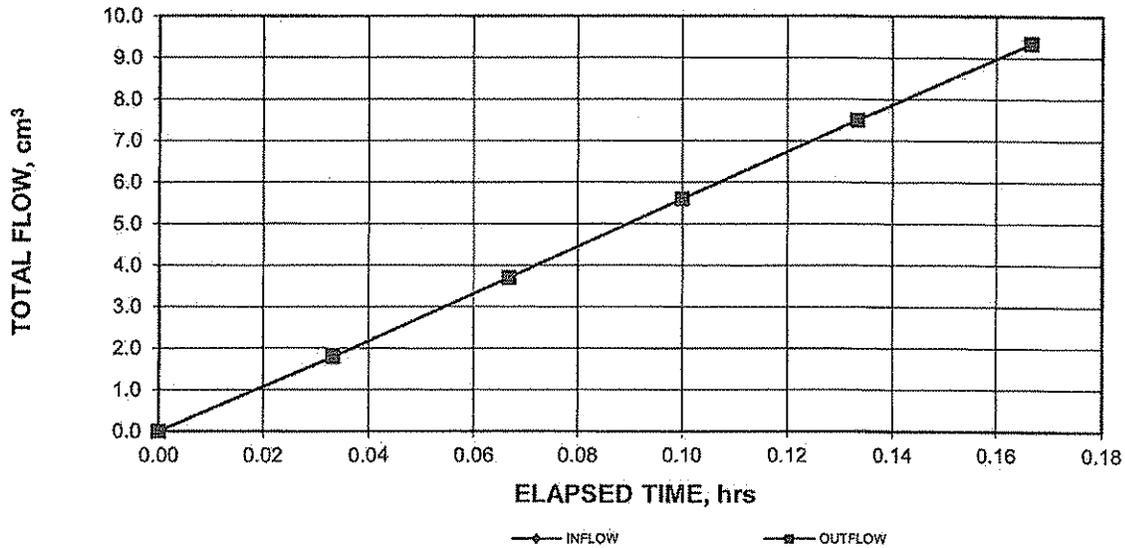
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-14	Sample No.	ST-A7-L3
Lab ID No.	2012-656-14-01		

AVERAGE PERMEABILITY = 2.4E-05 cm/sec @ 20°C

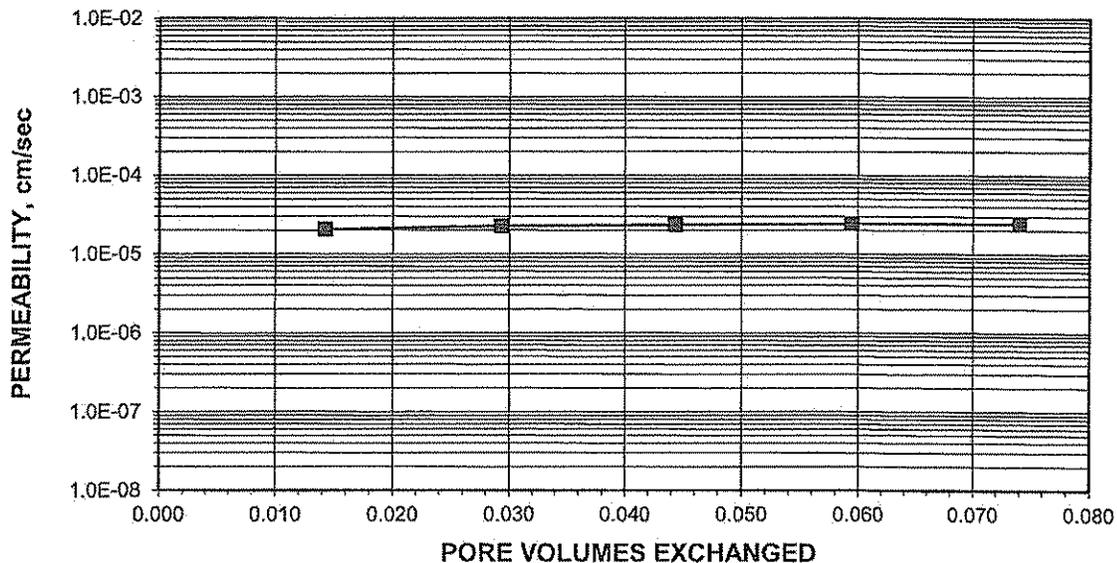
AVERAGE PERMEABILITY = 2.4E-07 m/sec @ 20°C

*fair*

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 10/18/2012 Checked By: *Cam* Date: 10-22-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-14	Sample No.	ST-A7-L3
Lab ID No.	2012-656-14-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	816	827
Wt. of Tare & WS (gm.)	336.64	329.55
Wt. of Tare & DS (gm.)	305.56	284.68
Wt. of Tare (gm.)	135.77	136.4
Wt. of Water (gm.)	31.08	44.87
Wt. of DS (gm.)	169.79	148.28
Moisture Content (%)	18.3	30.3

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	612.35	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	612.35	674.23
Length 1 (in.)	3.094	3.085
Length 2 (in.)	3.112	3.099
Length 3 (in.)	3.120	3.082
Top Diameter (in.)	2.849	2.829
Middle Diameter (in.)	2.840	2.836
Bottom Diameter (in.)	2.841	2.819
Average Length (in.)	3.11	3.09
Average Area (in. <sup>2</sup> )	6.35	6.28
Sample Volume (cm <sup>3</sup> )	323.46	317.92
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.89	2.12
Unit Wet Wt. (pcf)	118.2	132.4
Unit Dry Wt. (pcf)	99.9	101.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.60	1.63
Void Ratio, e	0.69	0.66
Porosity, n	0.41	0.40
Pore Volume (cm <sup>3</sup> )	131.8	126.2
Total Wgt. Of Sample After Test		628.79

Tested By: BW Date: 10/18/2012 Checked By: *GJM* Date: 10-21-12



# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-14	Sample No.	ST-A7-L3
Lab ID No.	2012-656-14-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.85
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.18
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.52
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.877
Hydraulic Gradient	13.44	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.886
		B Parameter (%)	96

AVERAGE PERMEABILITY = 2.4E-05 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 2.4E-07 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
10/19/2012	11	10	0.00	0.0	0.0	129.0	0	23.5	NA
10/19/2012	11	12	0.03	1.8	1.8	125.0	0	23.5	2.1E-05
10/19/2012	11	14	0.07	3.7	3.7	120.7	0	23.5	2.3E-05
10/19/2012	11	16	0.10	5.6	5.6	116.4	0	23.5	2.4E-05
10/19/2012	11	18	0.13	7.5	7.5	112.2	0	23.5	2.4E-05
10/19/2012	11	20	0.17	9.4	9.4	108.0	1	23.5	2.5E-05

Tested By: BW Date: 10/18/2012 Checked By: *GM* Date: 10-22-12

# PERMEABILITY TEST

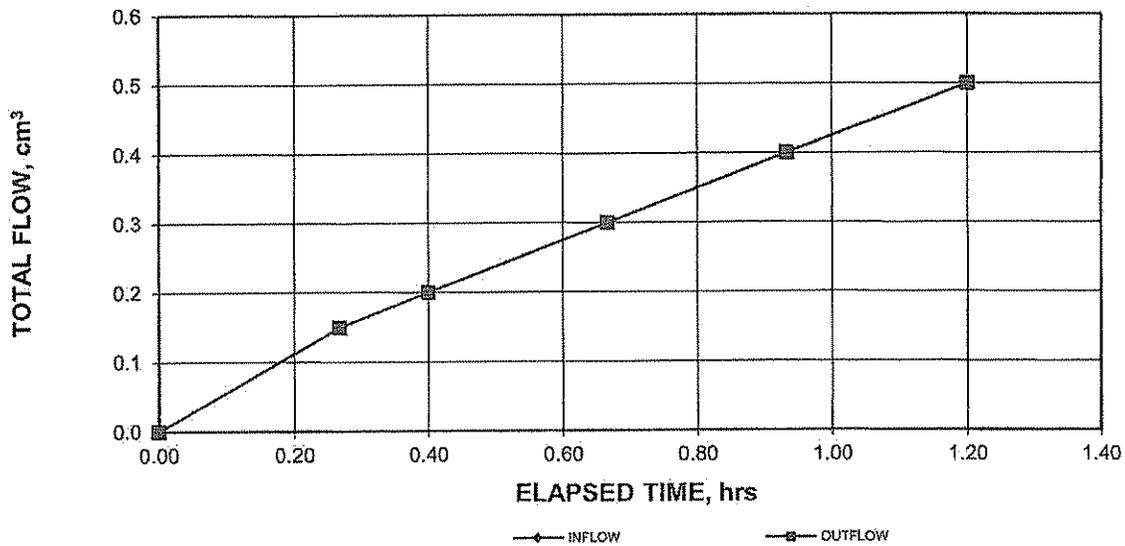
ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-15	Sample No.	ST-A7-L3 RETEST
Lab ID No.	2012-656-15-01		

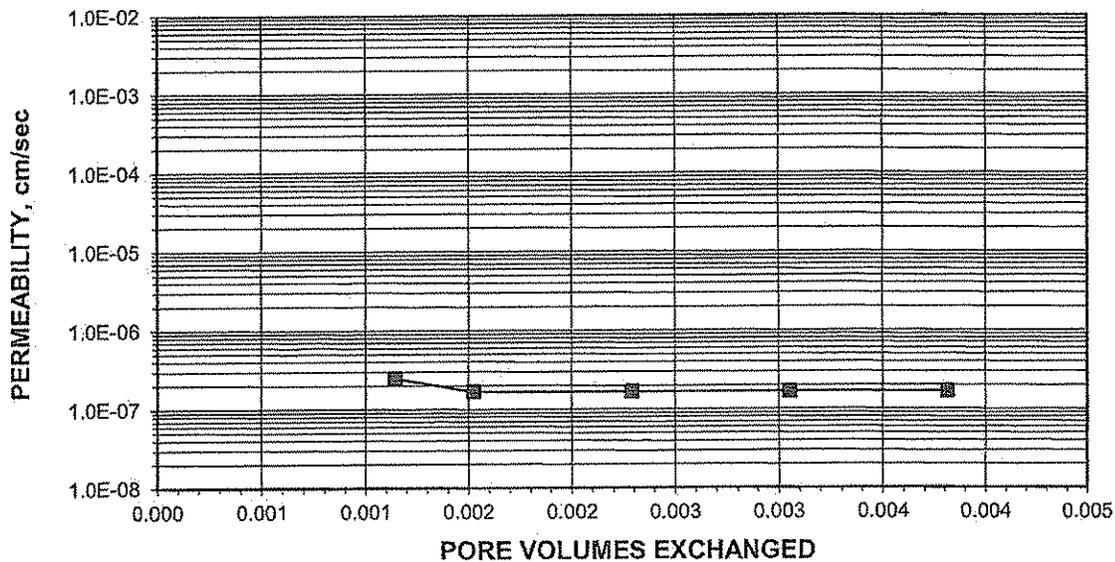
AVERAGE PERMEABILITY = 1.7E-07 cm/sec @ 20°C

AVERAGE PERMEABILITY = 1.7E-09 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 10/25/2012 Checked By: GEM Date: 10/30/12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-15	Sample No.	ST-A7-L3 RETEST
Lab ID No.	2012-656-15-01		
		Specific Gravity	2.70 Assumed
		Sample Condition	Undisturbed

Visual Description:      ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	SSR	823
Wt. of Tare & WS (gm.)	436.47	334.67
Wt. of Tare & DS (gm.)	383.32	293.91
Wt. of Tare (gm.)	99.43	136.71
Wt. of Water (gm.)	53.15	40.76
Wt. of DS (gm.)	283.89	157.20
Moisture Content (%)	<b>18.7</b>	<b>25.9</b>

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	628.34	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	628.34	666.48
Length 1 (in.)	3.093	3.112
Length 2 (in.)	3.110	3.139
Length 3 (in.)	3.106	3.123
Top Diameter (in.)	2.845	2.854
Middle Diameter (in.)	2.848	2.855
Bottom Diameter (in.)	2.849	2.846
Average Length (in.)	3.10	3.12
Average Area (in. <sup>2</sup> )	6.37	6.39
Sample Volume (cm <sup>3</sup> )	323.78	327.03
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.94	2.04
Unit Wet Wt. (pcf)	121.1	127.2
Unit Dry Wt. (pcf)	102.0	101.0
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.63	1.62
Void Ratio, e	0.65	0.67
Porosity, n	0.39	0.40
Pore Volume (cm <sup>3</sup> )	127.8	131.0
Total Wgt. Of Sample After Test		648.23

Tested By:    BW                      Date: 10/25/2012    Checked By:    *GAN*                      Date: 10-30-12

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 7
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-15	Sample No.	ST-A7-L3 RETEST
Lab ID No.	2012-656-15-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.94
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.24
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.21
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.897
Hydraulic Gradient	13.29	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.878
		B Parameter (%)	99

**AVERAGE PERMEABILITY = 1.7E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.7E-09 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
10/19/2012	9	42	0.00	0.0	0.0	114.5	0	21.9	NA
10/19/2012	9	58	0.27	0.1	0.1	114.2	0	21.9	2.5E-07
10/19/2012	10	6	0.40	0.2	0.2	114.0	0	21.9	1.7E-07
10/19/2012	10	22	0.67	0.3	0.3	113.8	0	21.9	1.7E-07
10/19/2012	10	38	0.93	0.4	0.4	113.6	0	21.9	1.7E-07
10/19/2012	10	54	1.20	0.5	0.5	113.4	1	21.9	1.7E-07

Tested By: BW      Date: 10/25/2012      Checked By: *GAN*      Date: *10-30-12*

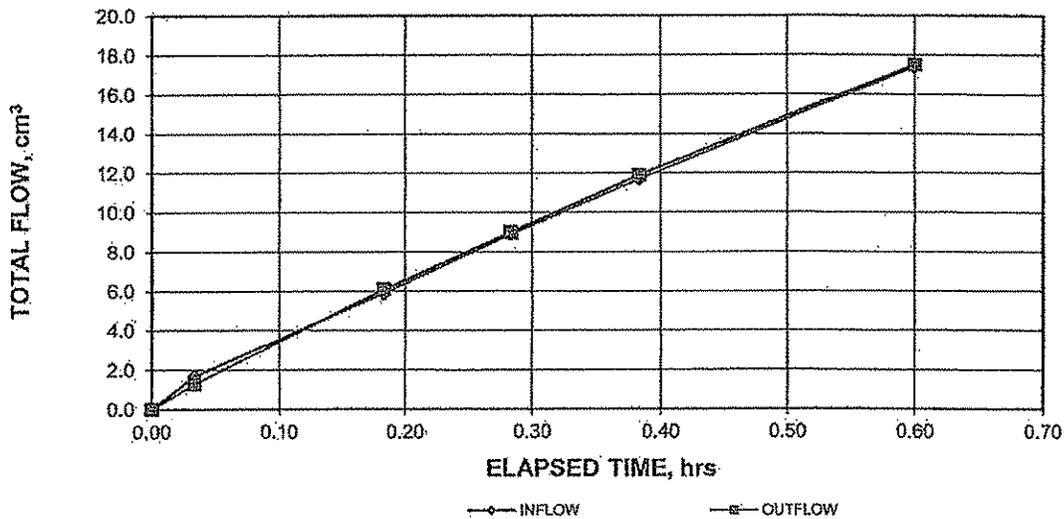
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

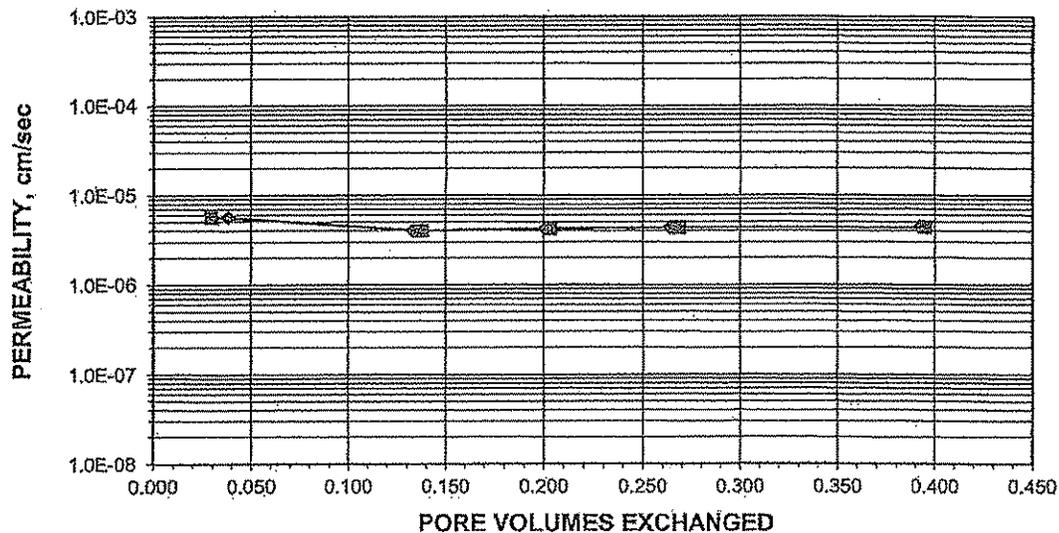
Client	JOYCE ENGINEERING, INC.	Boring No.	ST-A8-L1
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-11	Sample No.	ST-01
Lab ID No.	2012-656-11-01		

AVERAGE PERMEABILITY = 4.3E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 4.3E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 9/14/2012 Checked By: GEM Date: 9-18-12



# PERMEABILITY TEST

ASTM D.5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ST-A8-L1
Client Project	COBLE SR.	Depth (ft.)	NA
Project No.	2012-656-11	Sample No.	ST-01
Lab ID No.	2012-656-11-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: RED SANDY CLAY WITH GRAY SAND

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	818	820
Wt. of Tare & WS (gm.)	359.33	359.28
Wt. of Tare & DS (gm.)	329.58	313.47
Wt. of Tare (gm.)	137.33	136.29
Wt. of Water (gm.)	29.75	45.81
Wt. of DS (gm.)	192.25	177.18
Moisture Content (%)	15.5	25.9

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	204.82	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	204.82	223.23
Length 1 (in.)	1.200	1.089
Length 2 (in.)	1.159	1.111
Length 3 (in.)	1.161	1.045
Top Diameter (in.)	2.823	2.794
Middle Diameter (in.)	2.824	2.816
Bottom Diameter (in.)	2.791	2.823
Average Length (in.)	1.17	1.08
Average Area (in. <sup>2</sup> )	6.21	6.21
Sample Volume (cm <sup>3</sup> )	119.47	110.00
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.71	2.03
Unit Wet Wt. (pcf)	107.0	126.7
Unit Dry Wt. (pcf)	92.7	100.7
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.48	1.61
Void Ratio, e	0.82	0.67
Porosity, n	0.45	0.40
Pore Volume (cm <sup>3</sup> )	53.8	44.3
Total Wgt. Of Sample After Test		223.68

Tested By: SFS Date: 9/14/2012 Checked By: *GEM* Date: 9-18-12



# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ST-A8-L1
Client Project	COBLE SR	Depth (ft.)	NA
Project No.	2012-656-11	Sample No.	ST-01
Lab ID No.	2012-656-11-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	2.75
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.14
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.04
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.865
Hydraulic Gradient	38.38	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.865
		B Parameter (%)	100

AVERAGE PERMEABILITY = 4.3E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 4.3E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	(0 flow) (1 stop)	(°C)	@ 20°C (cm/sec)
9/17/2012	15	9	0.00	0.0	0.0	133.0	0	25.3	NA
9/17/2012	15	11	0.03	1.7	1.3	129.5	0	25.3	5.7E-06
9/17/2012	15	20	0.18	5.9	6.1	119.2	0	25.3	4.0E-06
9/17/2012	15	26	0.28	8.9	9.0	112.4	0	25.3	4.3E-06
9/17/2012	15	32	0.38	11.7	11.9	105.9	0	25.3	4.4E-06
9/17/2012	15	45	0.60	17.4	17.5	93.0	1	25.3	4.4E-06

Tested By: SFS Date: 9/14/2012 Checked By: CAM Date: 9-18-12

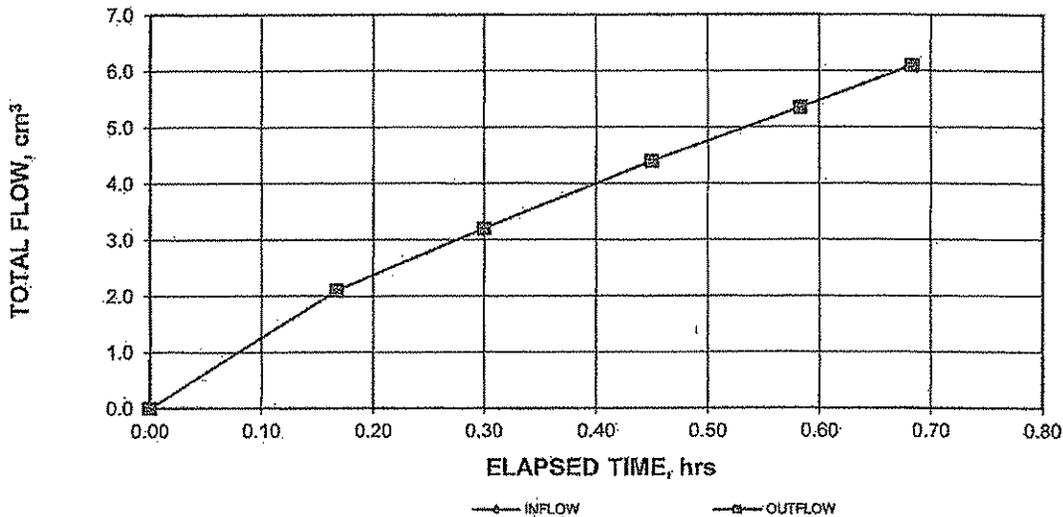
# PERMEABILITY TEST

ASTM D 5084-03

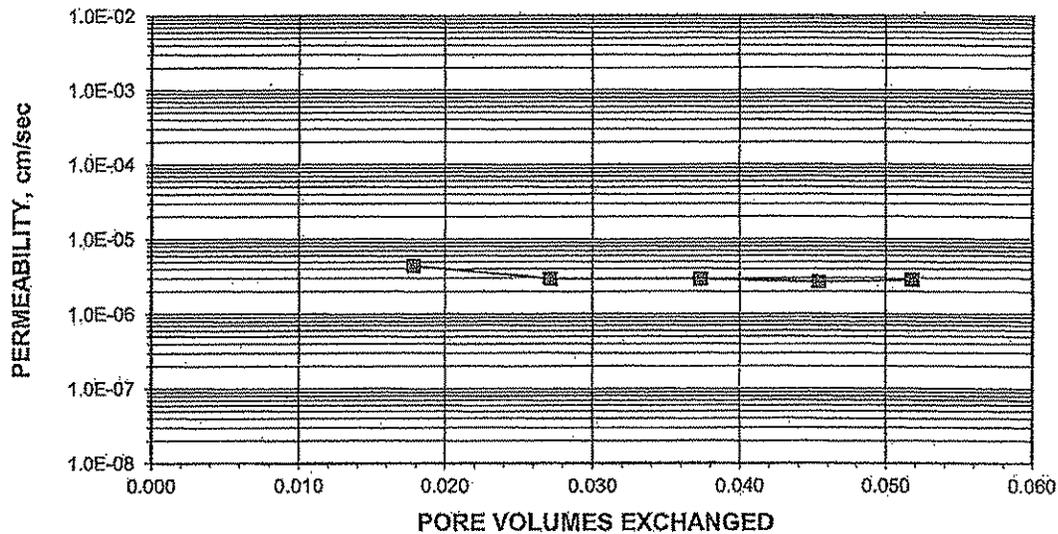
Client	JOYCE ENGINEERING	Boring No.	ACRE 8
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-13	Sample No.	ST-A8-L2
Lab ID No.	2012-656-13-01		

AVERAGE PERMEABILITY = 2.9E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 2.9E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 9/27/2012 Checked By: JED Date: 10-2-12



# PERMEABILITY TEST

ASTM D 5084-10

Client JOYCE ENGINEERING  
 Client Project COBLE SR  
 Project No. 2012-656-13  
 Lab ID No. 2012-656-13-01

Boring No. ACRE 8  
 Depth (ft.) LIFT 2  
 Sample No. ST-A8-L2

Specific Gravity 2.70 Assumed  
 Sample Condition Undisturbed

Visual Description: ORANGE SANDY CLAY WITH ROCKS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	805	810
Wt. of Tare & WS (gm.)	439.07	318.41
Wt. of Tare & DS (gm.)	385.32	278.21
Wt. of Tare (gm.)	105.84	114.46
Wt. of Water (gm.)	53.75	40.20
Wt. of DS (gm.)	279.48	163.75
Moisture Content (%)	19.2	24.5

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	584.34	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	584.34	610.40
Length 1 (in.)	2.972	2.875
Length 2 (in.)	2.973	2.889
Length 3 (in.)	2.965	2.902
Top Diameter (in.)	2.843	2.835
Middle Diameter (in.)	2.831	2.838
Bottom Diameter (in.)	2.835	2.839
Average Length (in.)	2.97	2.89
Average Area (in. <sup>2</sup> )	6.32	6.32
Sample Volume (cm <sup>3</sup> )	307.51	299.30
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.90	2.04
Unit Wet Wt. (pcf)	118.6	127.3
Unit Dry Wt. (pcf)	99.5	102.2
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.59	1.64
Void Ratio, e	0.69	0.65
Porosity, n	0.41	0.39
Pore Volume (cm <sup>3</sup> )	126.0	117.8
Total Wgt. Of Sample After Test		595.04

Tested By: SFS

Date: 9/27/2012

Checked By: JBS

Date: 10-2-12



# PERMEABILITY TEST

ASTM D 5084-03

Client JOYCE ENGINEERING  
 Client Project COBLE SR.  
 Project No. 2012-656-13  
 Lab ID No. 2012-656-13-01

Boring No. ACRE 8:  
 Depth (ft.) LIFT 2  
 Sample No. ST-A8-L2

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.34
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.21
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.79
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	14.37	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	100

AVERAGE PERMEABILITY = 2.9E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 2.9E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
9/28/2012	9	21	0.00	0.0	0.0	129.7	0	24.4	NA
9/28/2012	9	31	0.17	2.1	2.1	125.1	0	24.4	4.4E-06
9/28/2012	9	39	0.30	3.2	3.2	122.7	0	24.4	3.0E-06
9/28/2012	9	48	0.45	4.4	4.4	120.1	0	24.5	2.9E-06
9/28/2012	9	56	0.58	5.4	5.4	118.0	0	24.5	2.7E-06
9/28/2012	10	2	0.68	6.1	6.1	116.4	1	24.5	2.9E-06

Tested By: SFS

Date: 9/27/2012 Checked By: JBD

Date: 10-2-12

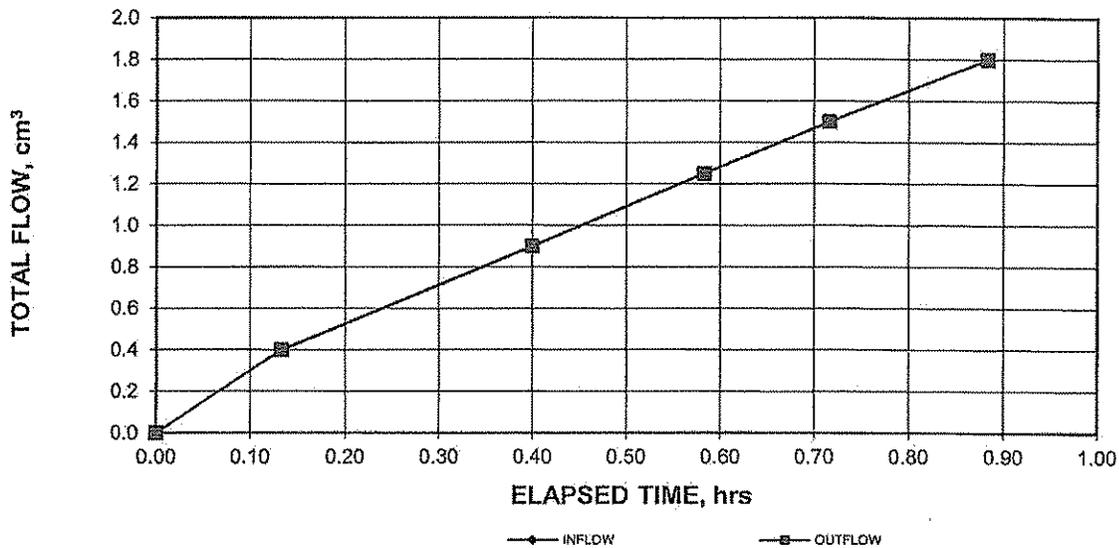
# PERMEABILITY TEST

ASTM D 5084-03

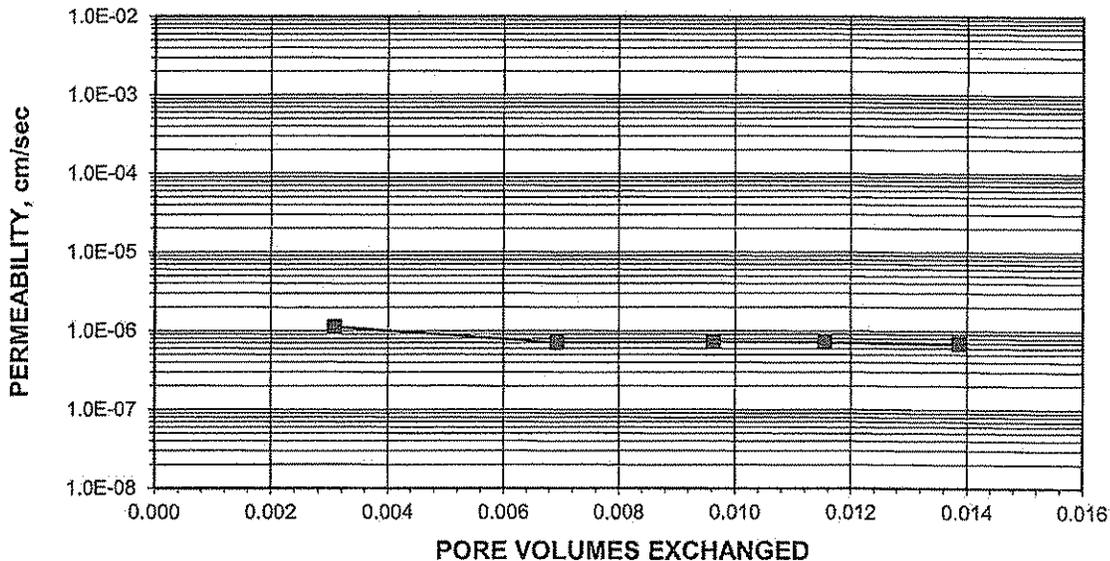
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 8
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-14	Sample No.	ST-A8-L3
Lab ID No.	2012-656-14-02		

AVERAGE PERMEABILITY = 7.1E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 7.1E-09 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW

Date: 10/18/2012 Checked By: *GM*

Date: 10-22-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 8
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-14	Sample No.	ST-A8-L3
Lab ID No.	2012-656-14-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	815	8010
Wt. of Tare & WS (gm.)	353.07	353.92
Wt. of Tare & DS (gm.)	315.49	309.22
Wt. of Tare (gm.)	135.85	135.87
Wt. of Water (gm.)	37.58	44.70
Wt. of DS (gm.)	179.64	173.35
Moisture Content (%)	20.9	25.8

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	626.60	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	626.60	651.82
Length 1 (in.)	3.080	3.078
Length 2 (in.)	3.066	3.085
Length 3 (in.)	3.084	3.073
Top Diameter (in.)	2.860	2.851
Middle Diameter (in.)	2.855	2.84
Bottom Diameter (in.)	2.861	2.858
Average Length (in.)	3.08	3.08
Average Area (in. <sup>2</sup> )	6.42	6.38
Sample Volume (cm <sup>3</sup> )	323.59	321.77
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.94	2.03
Unit Wet Wt. (pcf)	120.9	126.5
Unit Dry Wt. (pcf)	100.0	100.5
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.60	1.61
Void Ratio, e	0.69	0.68
Porosity, n	0.41	0.40
Pore Volume (cm <sup>3</sup> )	131.7	129.8
Total Wgt. Of Sample After Test		641.61

Tested By: BW Date: 10/18/2012 Checked By: *GEM* Date: 10-22-12

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 8
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-14	Sample No.	ST-A8-L3
Lab ID No.	2012-656-14-02		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.82
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.24
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.15
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.877
Hydraulic Gradient	13.49	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.886
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 7.1E-07 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 7.1E-09 m/sec @ 20°C**

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
	(mm/dd/yy)	(hr)							
			(hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	(cm)	( 1 stop )		(cm/sec)
10/18/2012	9	43	0.00	0.0	0.0	129.0	0	23.3	NA
10/18/2012	9	51	0.13	0.4	0.4	128.1	0	23.3	1.1E-06
10/18/2012	10	7	0.40	0.9	0.9	127.0	0	23.3	7.1E-07
10/18/2012	10	18	0.58	1.3	1.3	126.2	0	23.3	7.3E-07
10/18/2012	10	26	0.72	1.5	1.5	125.6	0	23.3	7.2E-07
10/18/2012	10	36	0.88	1.8	1.8	125.0	1	23.3	6.9E-07

Tested By: BW      Date: 10/18/2012      Checked By: *GEM*      Date: 10-22-12

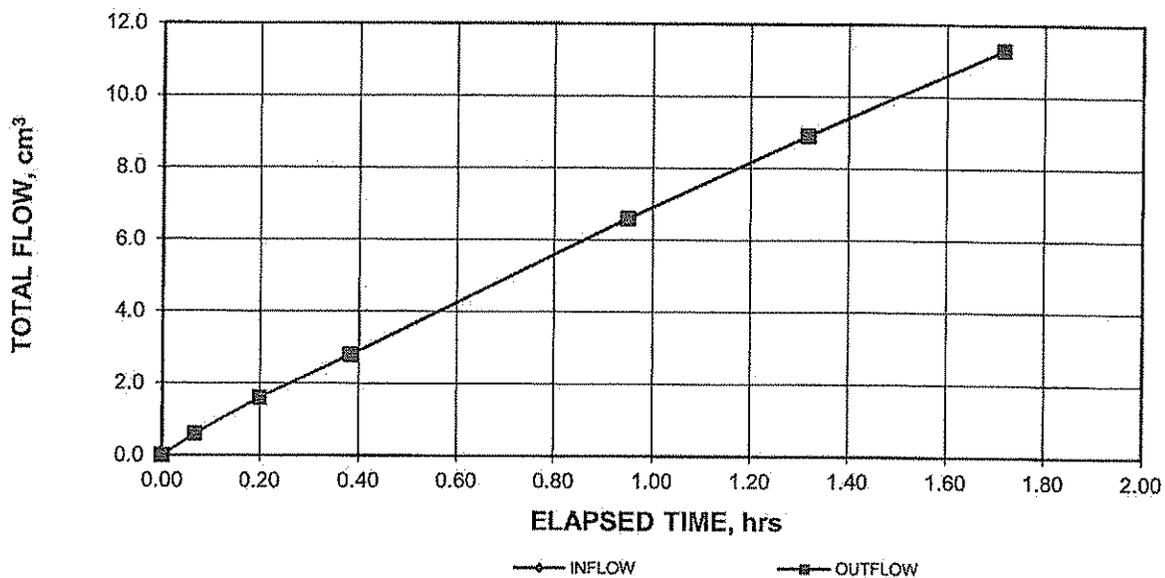
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

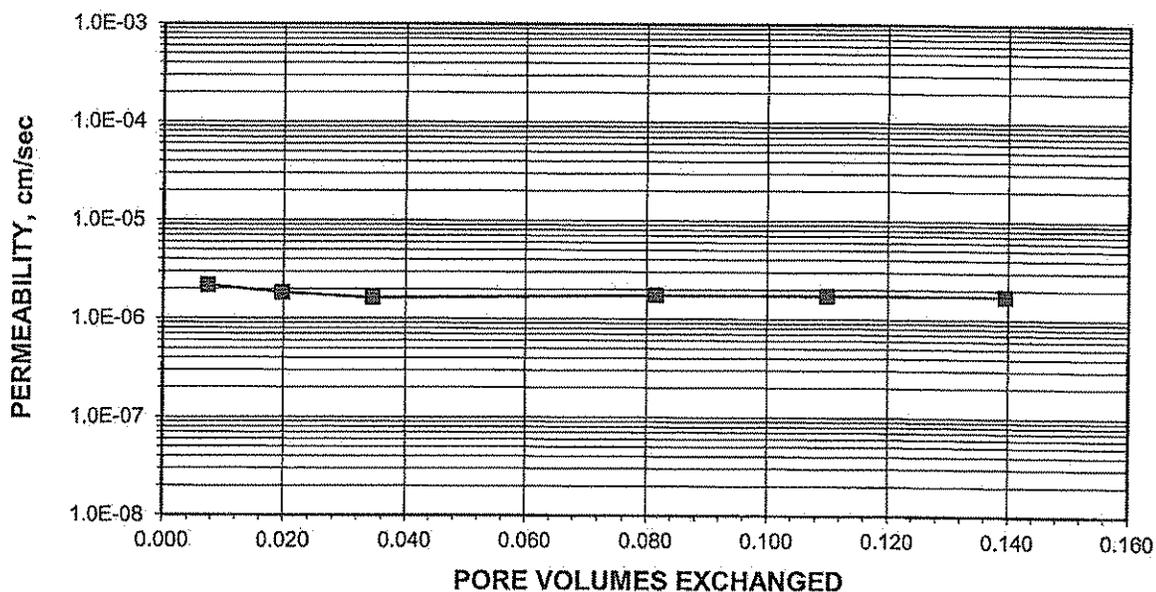
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-07	Sample No.	ST-09-01
Lab ID No.	2012-656-07-03		

AVERAGE PERMEABILITY = 1.7E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.7E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 7/31/2012 Checked By: *GM* Date: 8-2-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client JOYCE ENGINEERING, INC.  
 Client Project COBLE SR  
 Project No. 2012-656-07  
 Lab ID No. 2012-656-07-03

Boring No. ACRE 9  
 Depth (ft.) LIFT 1  
 Sample No. ST-09-01

Specific Gravity 2.70 Assumed  
 Sample Condition Undisturbed

Visual Description: ORANGE YELLOW SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	803	823
Wt. of Tare & WS (gm.)	345.58	331.32
Wt. of Tare & DS (gm.)	317.22	292.22
Wt. of Tare (gm.)	103.77	136.8
Wt. of Water (gm.)	28.36	39.10
Wt. of DS (gm.)	213.45	155.42
Moisture Content (%)	13.3	25.2

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	367.70	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	367.70	406.23
Length 1 (in.)	2.003	1.982
Length 2 (in.)	1.974	1.987
Length 3 (in.)	2.000	1.967
Top Diameter (in.)	2.844	2.81
Middle Diameter (in.)	2.840	2.803
Bottom Diameter (in.)	2.829	2.82
Average Length (in.)	1.99	1.98
Average Area (in. <sup>2</sup> )	6.32	6.21
Sample Volume (cm <sup>3</sup> )	206.48	201.23
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.78	2.02
Unit Wet Wt. (pcf)	111.2	126.0
Unit Dry Wt. (pcf)	98.1	100.7
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.57	1.61
Void Ratio, e	0.72	0.67
Porosity, n	0.42	0.40
Pore Volume (cm <sup>3</sup> )	86.3	81.0
Total Wgt. Of Sample After Test		403.94

Tested By: BW Date: 7/31/2012 Checked By: *gam* Date: *8-2-12*

# PERMEABILITY TEST

ASTM D 5084-03.  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-07	Sample No.	ST-09-01
Lab ID No.	2012-656-07-03		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	5.03
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.14
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.04
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.959
Hydraulic Gradient	20.98	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.983
		B Parameter (%)	95

AVERAGE PERMEABILITY = 1.7E-06 cm/sec @ 20°C  
AVERAGE PERMEABILITY = 1.7E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
8/1/2012	15	44	0.00	0.0	0.0	127.3	0	25.5	NA
8/1/2012	15	48	0.07	0.6	0.6	126.1	0	25.5	2.2E-06
8/1/2012	15	56	0.20	1.6	1.6	124.0	0	25.5	1.8E-06
8/1/2012	16	7	0.38	2.8	2.8	121.6	0	25.5	1.6E-06
8/1/2012	16	41	0.95	6.6	6.6	113.7	0	25.5	1.7E-06
8/1/2012	17	3	1.32	8.9	8.9	109.0	0	25.5	1.7E-06
8/1/2012	17	27	1.72	11.3	11.3	104.1	1	25.5	1.7E-06

Tested By: BW Date: 7/31/2012 Checked By: *GJM* Date: 8-2-12

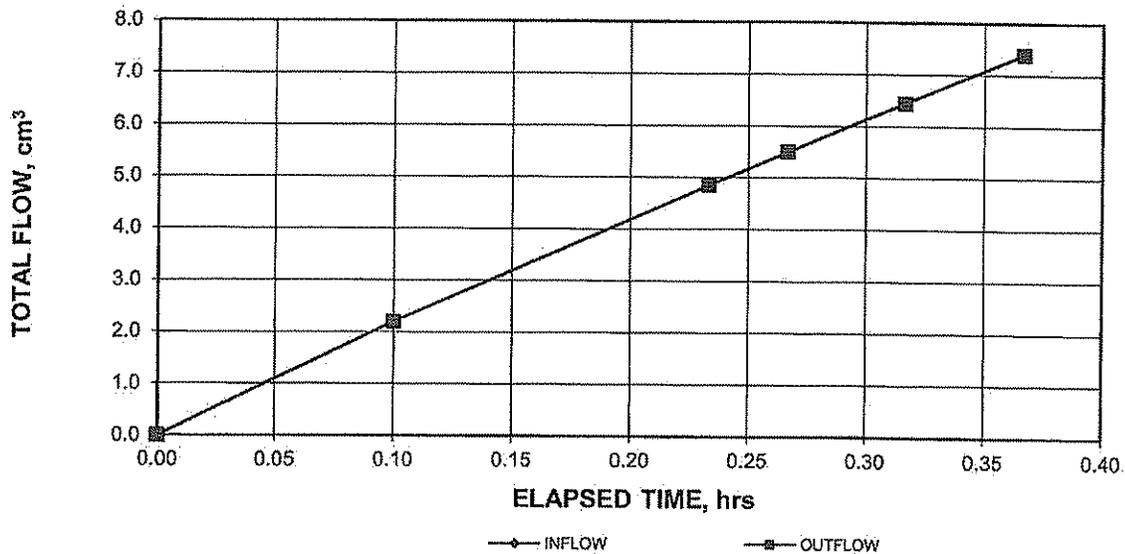
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

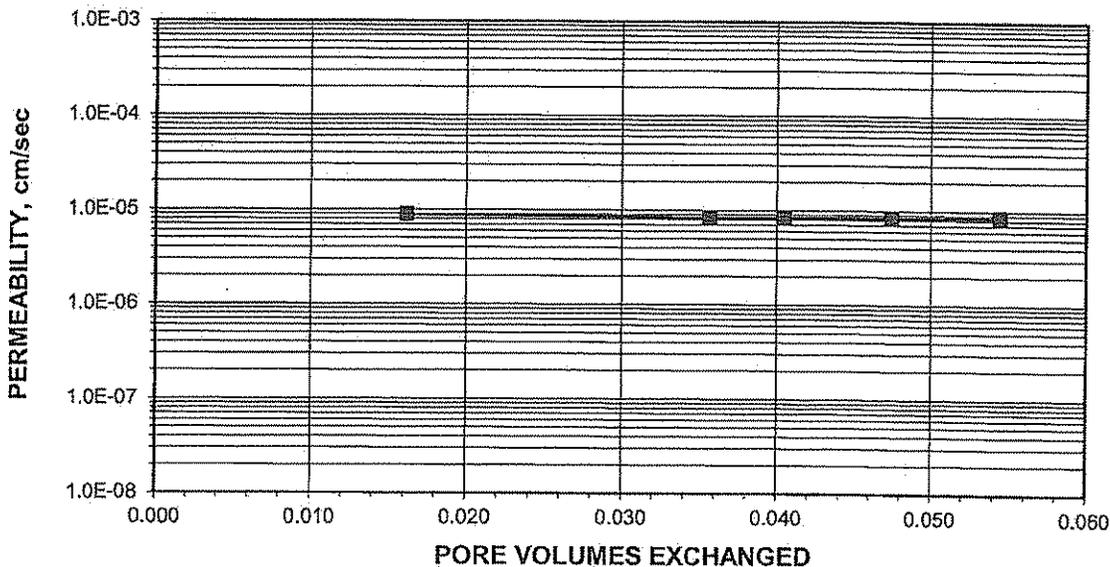
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-08	Sample No.	ST-A9-L2
Lab ID No.	2012-656-08-02		

AVERAGE PERMEABILITY = 8.4E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 8.4E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 8/20/2012 Checked By: Gem Date: 8-22-12

# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-08	Sample No.	ST-A9-L2
Lab ID No.	2012-656-08-02		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: LIGHT BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	809	810
Wt. of Tare & WS (gm.)	405.64	351.67
Wt. of Tare & DS (gm.)	360.97	307.27
Wt. of Tare (gm.)	115.18	114.55
Wt. of Water (gm.)	44.67	44.40
Wt. of DS (gm.)	245.79	192.72
Moisture Content (%)	18.2	23.0

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	583.01	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	583.01	607.01
Length 1 (in.)	3.196	3.086
Length 2 (in.)	3.218	3.140
Length 3 (in.)	3.178	3.150
Top Diameter (in.)	2.828	2.805
Middle Diameter (in.)	2.834	2.816
Bottom Diameter (in.)	2.829	2.823
Average Length (in.)	3.20	3.13
Average Area (in. <sup>2</sup> )	6.29	6.22
Sample Volume (cm <sup>3</sup> )	329.65	318.67
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.77	1.90
Unit Wet Wt. (pcf)	110.4	118.9
Unit Dry Wt. (pcf)	93.4	96.6
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.50	1.55
Void Ratio, e	0.80	0.74
Porosity, n	0.45	0.43
Pore Volume (cm <sup>3</sup> )	146.9	135.9
Total Wgt. Of Sample After Test		612.59

Tested By: BW

Date: 8/20/2012 Checked By: *GEM*

Date: 8-22-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-08	Sample No.	ST-A9-L2
Lab ID No.	2012-656-08-02		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.94
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.15
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.14
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.977
Hydraulic Gradient	13.28	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.868
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 8.4E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 8.4E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)					( 0 flow ) ( 1 stop )		
8/21/2012	10	54	0.00	0.0	0.0	126.6	0	23.9	NA
8/21/2012	11	0	0.10	2.2	2.2	121.8	0	23.9	8.9E-06
8/21/2012	11	8	0.23	4.9	4.9	116.0	0	23.9	8.4E-06
8/21/2012	11	10	0.27	5.5	5.5	114.6	0	23.9	8.5E-06
8/21/2012	11	13	0.32	6.5	6.5	112.6	0	23.9	8.4E-06
8/21/2012	11	16	0.37	7.4	7.4	110.5	1	23.9	8.5E-06

Tested By: BW      Date: 8/20/2012      Checked By: *GM*      Date: 8-22-12

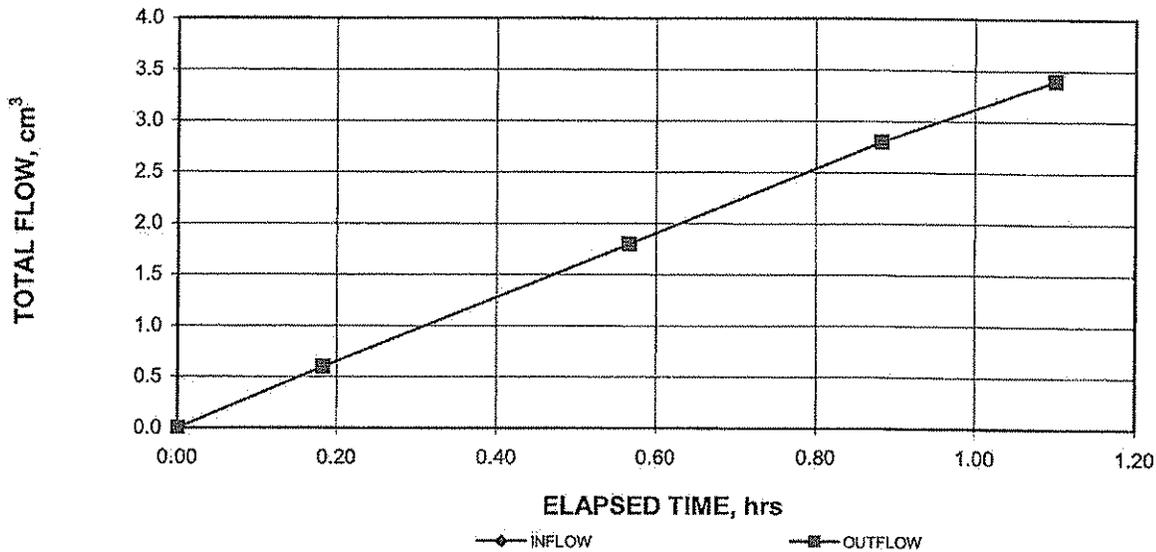
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

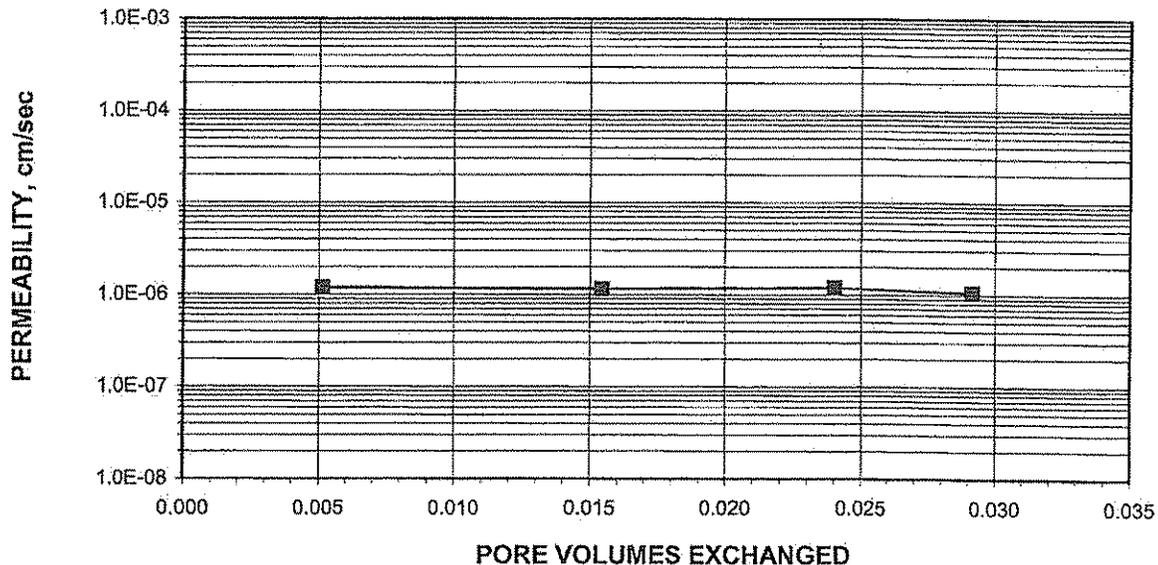
Client	JOYCE ENGINEERING	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-09	Sample No.	ST-A9-L3
Lab ID No.	2012-656-09-01		

AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW

Date: 8/28/2012 Checked By: *MMS*

Date: 8/31



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-09	Sample No.	ST-A9-L3
Lab ID No.	2012-656-09-01		

Specific Gravity                      2.70 Assumed  
Sample Condition                      Undisturbed

Visual Description:      BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	800	804
Wt. of Tare & WS (gm.)	391.40	360.03
Wt. of Tare & DS (gm.)	353.29	318.49
Wt. of Tare (gm.)	103.91	105.28
Wt. of Water (gm.)	38.11	41.54
Wt. of DS (gm.)	249.38	213.21
Moisture Content (%)	15.3	19.5

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	636.06	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	636.06	659.24
Length 1 (in.)	3.109	3.116
Length 2 (in.)	3.067	3.097
Length 3 (in.)	3.046	2.965
Top Diameter (in.)	2.848	2.851
Middle Diameter (in.)	2.852	2.867
Bottom Diameter (in.)	2.851	2.846
Average Length (in.)	3.07	3.06
Average Area (in. <sup>2</sup> )	6.38	6.40
Sample Volume (cm <sup>3</sup> )	321.43	320.87
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.98	2.05
Unit Wet Wt. (pcf)	123.5	128.2
Unit Dry Wt. (pcf)	107.1	107.3
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.72	1.72
Void Ratio, e	0.57	0.57
Porosity, n	0.36	0.36
Pore Volume (cm <sup>3</sup> )	117.1	116.5
Total Wgt. Of Sample After Test		657.10

Tested By:      BW

Date: 8/28/2012      Checked By: *[Signature]*

Date: 8/31

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)



Client	JOYCE ENGINEERING	Boring No.	ACRE 9
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-09	Sample No.	ST-A9-L3
Lab ID No.	2012-656-09-01		
	121044		

41

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.77
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.25
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.29
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	13.57	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	95

AVERAGE PERMEABILITY = 1.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.1E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
8/29/2012	10	16	0.00	0.0	0.0	129.7	0	24.4	NA
8/29/2012	10	27	0.18	0.6	0.6	128.4	0	24.4	1.2E-06
8/29/2012	10	50	0.57	1.8	1.8	125.8	0	24.4	1.2E-06
8/29/2012	11	9	0.88	2.8	2.8	123.6	0	24.4	1.2E-06
8/29/2012	11	22	1.10	3.4	3.4	122.3	0	24.4	1.1E-06

Tested By: BW

Date: 8/28/2012 Checked By: *[Signature]*

Date: 8/31

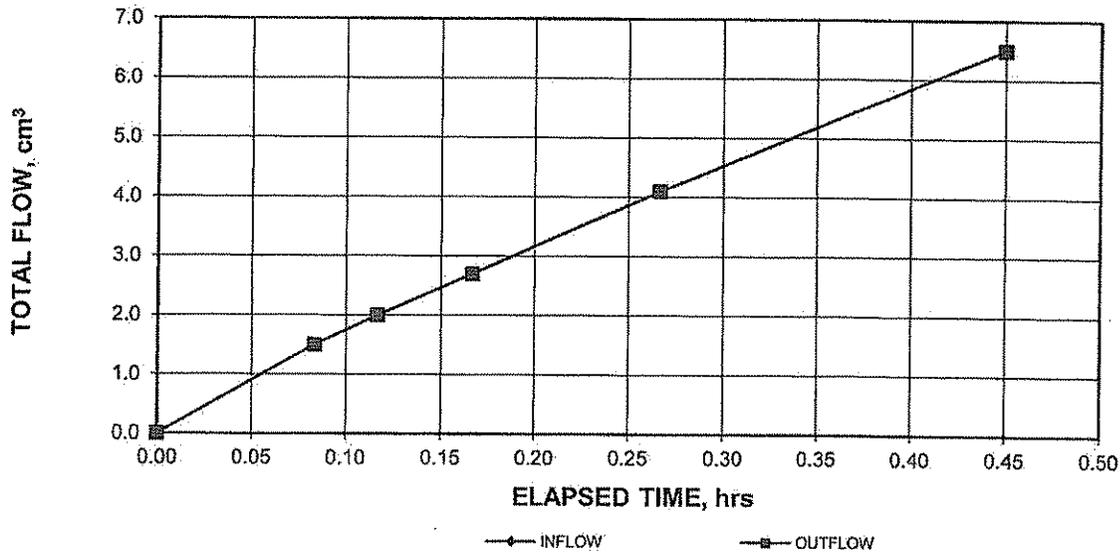
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

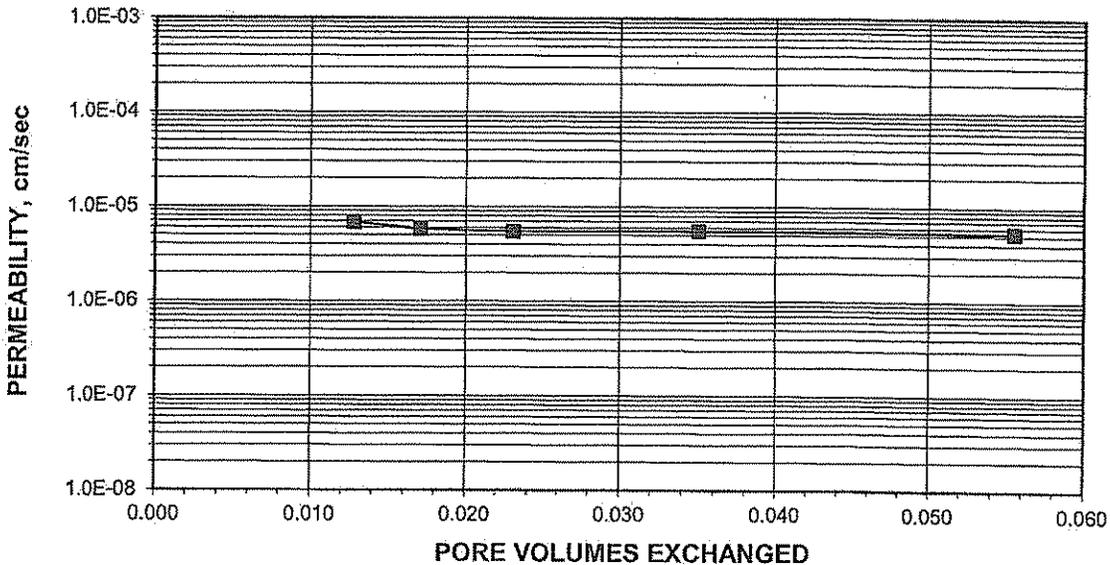
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2 / 1
Project No.	2012-656-08	Sample No.	ST-A10-L1
Lab ID No.	2012-656-08-01		

AVERAGE PERMEABILITY = 5.6E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 5.6E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 8/20/2012 Checked By: GJM Date: 8-22-12



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client: JOYCE ENGINEERING, INC.  
 Client Project: COBLE SR  
 Project No.: 2012-656-08  
 Lab ID No.: 2012-656-08-01

Boring No.: ACRE 10  
 Depth (ft.): LIFT 2 L  
 Sample No.: ST-A10-L1

Specific Gravity: 2.70 Assumed  
 Sample Condition: Undisturbed

Visual Description: BROWN SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	813	811
Wt. of Tare & WS (gm.)	339.24	357.93
Wt. of Tare & DS (gm.)	312.62	315.48
Wt. of Tare (gm.)	111.96	106.12
Wt. of Water (gm.)	26.62	42.45
Wt. of DS (gm.)	200.66	209.36
Moisture Content (%)	13.3	20.3

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	583.72	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	583.72	619.85
Length 1 (in.)	3.030	2.967
Length 2 (in.)	3.036	3.022
Length 3 (in.)	3.034	3.034
Top Diameter (in.)	2.809	2.824
Middle Diameter (in.)	2.807	2.821
Bottom Diameter (in.)	2.814	2.816
Average Length (in.)	3.03	3.01
Average Area (in. <sup>2</sup> )	6.20	6.25
Sample Volume (cm <sup>3</sup> )	308.26	307.91
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.89	2.01
Unit Wet Wt. (pcf)	118.2	125.7
Unit Dry Wt. (pcf)	104.4	104.5
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.67	1.67
Void Ratio, e	0.62	0.61
Porosity, n	0.38	0.38
Pore Volume (cm <sup>3</sup> )	117.4	117.0
Total Wgt. Of Sample After Test		621.57

Tested By: BW

Date: 8/20/2012

Checked By: *Cam*

Date: 8-22-12

# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2 / 1
Project No.	2012-656-08	Sample No.	ST-A10-L1
Lab ID No.	2012-656-08-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.64
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.16
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.30
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	13.80	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	96

**AVERAGE PERMEABILITY = 5.6E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 5.6E-08 m/sec @ 20°C**

DATE	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(mm/dd/yy)	(hr)							
8/21/2012	10	13	0.00	0.0	0.0	127.4	0	23.8	NA
8/21/2012	10	18	0.08	1.5	1.5	124.1	0	23.8	6.9E-06
8/21/2012	10	20	0.12	2.0	2.0	123.0	0	23.9	5.8E-06
8/21/2012	10	23	0.17	2.7	2.7	121.5	0	23.9	5.5E-06
8/21/2012	10	29	0.27	4.1	4.1	118.4	0	24.0	5.6E-06
8/21/2012	10	40	0.45	6.5	6.5	113.1	1	24.1	5.4E-06

Tested By: BW      Date: 8/20/2012      Checked By: *GEM*      Date: 8-22-12



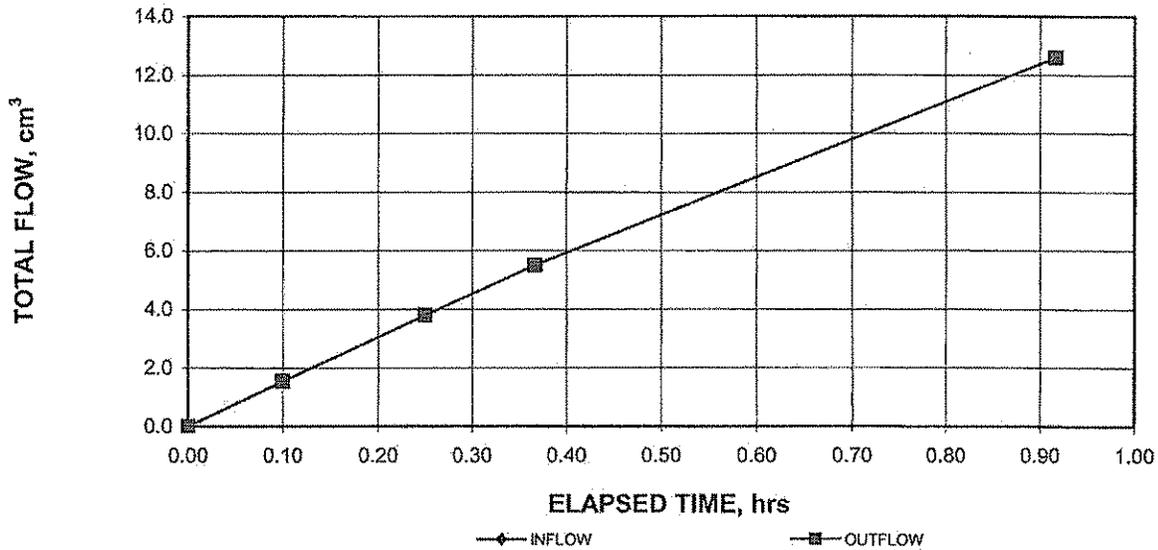
# PERMEABILITY TEST

ASTM D 5084-03  
(SOP-S22A & S22B)

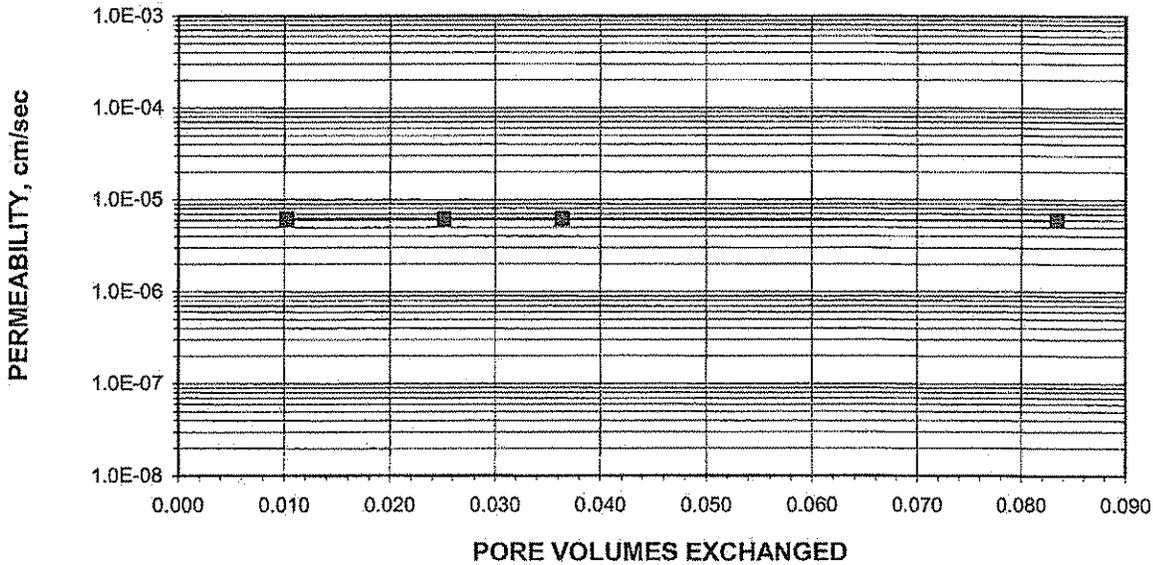
Client	JOYCE ENGINEERING	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-09	Sample No.	ST-A10-L2
Lab ID No.	2012-656-09-02		

AVERAGE PERMEABILITY = 6.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 6.1E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 8/28/2012 Checked By: [Signature] Date: 8/31



# PERMEABILITY TEST

ASTM D 5084-10  
(SOP-S22A & S22B)

Client: JOYCE ENGINEERING  
 Client Project: COBLE SR  
 Project No.: 2012-656-09  
 Lab ID No.: 2012-656-09-02

Boring No.: ACRE 10  
 Depth (ft.): LIFT 2  
 Sample No.: ST-A10-L2

Specific Gravity: 2.70 Assumed  
 Sample Condition: Undisturbed

Visual Description: REDDISH BROWN SILTY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	802	802
Wt. of Tare & WS (gm.)	372.65	366.78
Wt. of Tare & DS (gm.)	324.30	316.92
Wt. of Tare (gm.)	103.58	103.77
Wt. of Water (gm.)	48.35	49.86
Wt. of DS (gm.)	220.72	213.15
Moisture Content (%)	21.9	23.4

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	634.86	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	634.86	642.60
Length 1 (in.)	3.279	3.272
Length 2 (in.)	3.311	3.290
Length 3 (in.)	3.273	3.270
Top Diameter (in.)	2.872	2.858
Middle Diameter (in.)	2.845	2.851
Bottom Diameter (in.)	2.846	2.856
Average Length (in.)	3.29	3.28
Average Area (in. <sup>2</sup> )	6.40	6.40
Sample Volume (cm <sup>3</sup> )	344.74	343.81
Unit Wet Wt. (gm./cm <sup>3</sup> )	1.84	1.87
Unit Wet Wt. (pcf)	115.0	116.7
Unit Dry Wt. (pcf)	94.3	94.6
Unit Dry Wt. (gm./cm <sup>3</sup> )	1.51	1.51
Void Ratio, e	0.79	0.78
Porosity, n	0.44	0.44
Pore Volume (cm <sup>3</sup> )	151.9	150.9
Total Wgt. Of Sample After Test		658.69

Tested By: BW

Date: 8/28/2012 Checked By: *[Signature]*

Date: 8/21

# PERMEABILITY TEST



ASTM D 5084-03  
(SOP-S22A & S22B)

Client	JOYCE ENGINEERING	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 2
Project No.	2012-656-09	Sample No.	ST-A10-L2
Lab ID No.	2012-656-09-02		
	121044		

41

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	8.32
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.25
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.30
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.852
Hydraulic Gradient	12.67	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.972
		B Parameter (%)	98

AVERAGE PERMEABILITY = 6.1E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 6.1E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
8/29/2012	11	35	0.00	0.0	0.0	128.6	0	24.6	NA
8/29/2012	11	41	0.10	1.6	1.6	125.2	0	24.6	6.1E-06
8/29/2012	11	50	0.25	3.8	3.8	120.2	0	24.6	6.1E-06
8/29/2012	11	57	0.37	5.5	5.5	116.5	0	24.6	6.2E-06
8/29/2012	12	30	0.92	12.6	12.6	100.9	0	24.6	5.9E-06

Tested By: BW Date: 8/28/2012 Checked By: *[Signature]* Date: 8/29

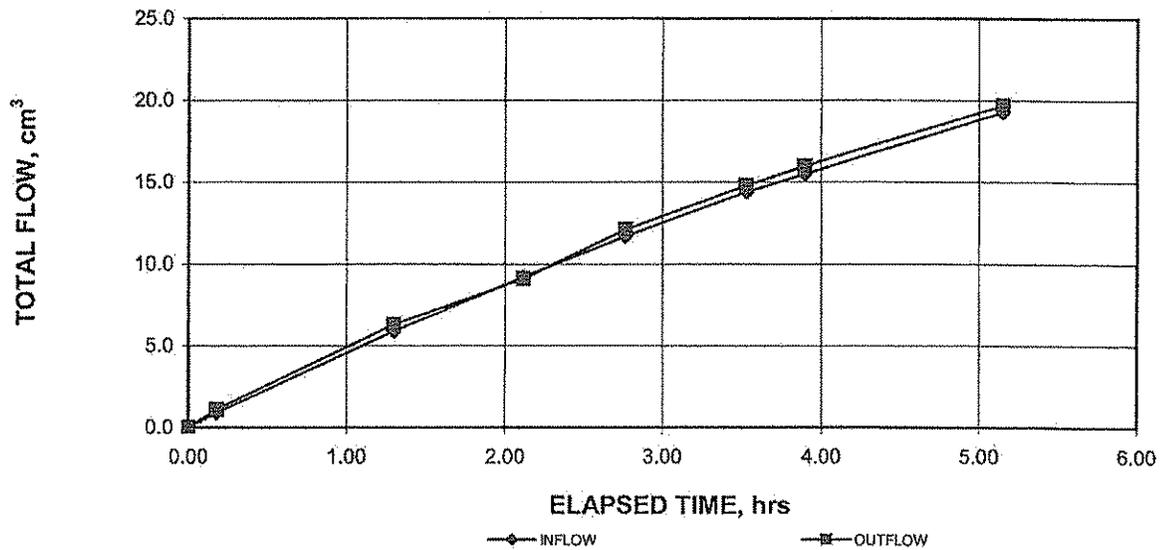
# PERMEABILITY TEST

ASTM D 5084-03

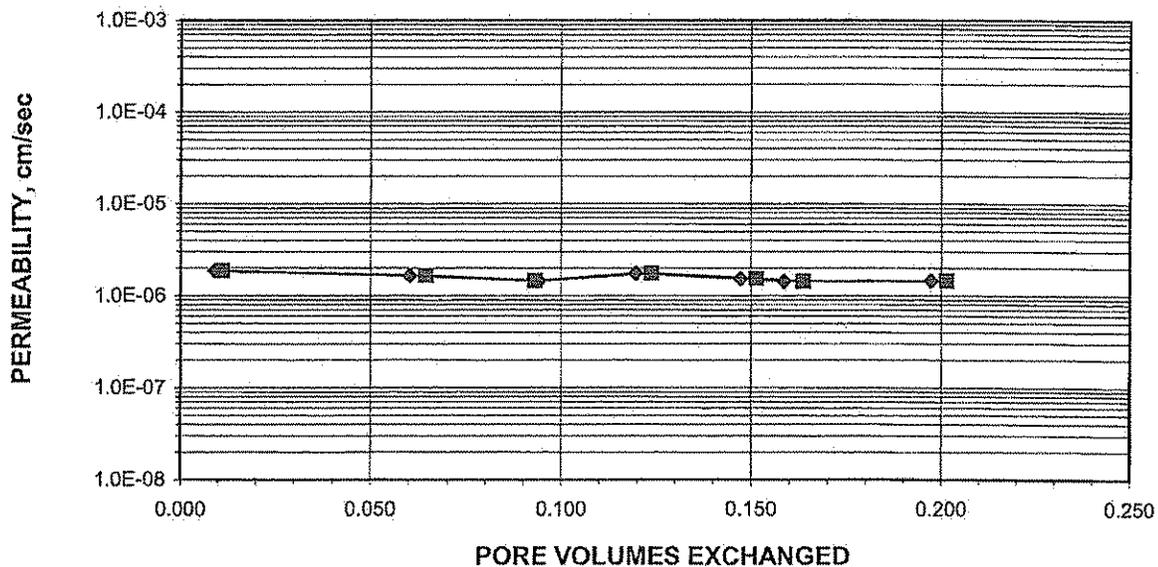
Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-10	Sample No.	ST-A10-L3
Lab ID No.	2012-656-10-01		

AVERAGE PERMEABILITY = 1.5E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.5E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS

Date: 9/6/2012 Checked By: *AMS*

Date: *9/7*



# PERMEABILITY TEST

ASTM D 5084-10

Client JOYCE ENGINEERING, INC. Boring No. ACRE 10  
 Client Project COBLE SR Depth (ft.) LIFT 3  
 Project No. 2012-656-10 Sample No. ST-A10-L3  
 Lab ID No. 2012-656-10-01

Specific Gravity 2.70 Assumed  
 Sample Condition Undisturbed

Visual Description: ORANGE YELLOW SANDY CLAY WITH ROCKS

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	804	806
Wt. of Tare & WS (gm.)	322.82	398.92
Wt. of Tare & DS (gm.)	300.11	350.18
Wt. of Tare (gm.)	105.22	102.05
Wt. of Water (gm.)	22.71	48.74
Wt. of DS (gm.)	194.89	248.13
Moisture Content (%)	11.7	19.6

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	614.27	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	614.27	658.23
Length 1 (in.)	2.988	2.962
Length 2 (in.)	3.001	2.956
Length 3 (in.)	2.938	2.922
Top Diameter (in.)	2.849	2.825
Middle Diameter (in.)	2.844	2.859
Bottom Diameter (in.)	2.817	2.775
Average Length (in.)	2.98	2.95
Average Area (in. <sup>2</sup> )	6.32	6.24
Sample Volume (cm <sup>3</sup> )	308.17	301.52
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.99	2.18
Unit Wet Wt. (pcf)	124.4	136.3
Unit Dry Wt. (pcf)	111.4	113.9
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.79	1.82
Void Ratio, e	0.51	0.48
Porosity, n	0.34	0.32
Pore Volume (cm <sup>3</sup> )	104.4	97.8
Total Wgt. Of Sample After Test		639.05

Tested By: SFS Date: 9/6/2012 Checked By: *AMM* Date: *9/7*

# PERMEABILITY TEST

ASTM D 5084-03



Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 10
Client Project	COBLE SR	Depth (ft.)	LIFT 3
Project No.	2012-656-10	Sample No.	ST-A10-L3
Lab ID No.	2012-656-10-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.48
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.16
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.29
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.865
Hydraulic Gradient	14.09	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.865
		B Parameter (%)	97

AVERAGE PERMEABILITY = 1.5E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 1.5E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
9/6/2012	12	37	0.00	0.0	0.0	133.0	0	25.5	NA
9/6/2012	12	48	0.18	0.9	1.1	130.7	0	25.5	1.9E-06
9/6/2012	13	55	1.30	5.9	6.3	119.0	0	25.5	1.6E-06
9/6/2012	14	44	2.12	9.2	9.1	112.0	0	25.5	1.5E-06
9/6/2012	15	23	2.77	11.7	12.1	105.7	0	25.5	1.7E-06
9/6/2012	16	9	3.53	14.4	14.8	99.5	0	25.5	1.5E-06
9/6/2012	16	31	3.90	15.5	16.0	96.9	0	25.5	1.4E-06
9/6/2012	17	46	5.15	19.3	19.7	88.3	1	25.5	1.5E-06

Tested By: SFS Date: 9/6/2012 Checked By: *AMS* Date: 9/7

# PERMEABILITY TEST

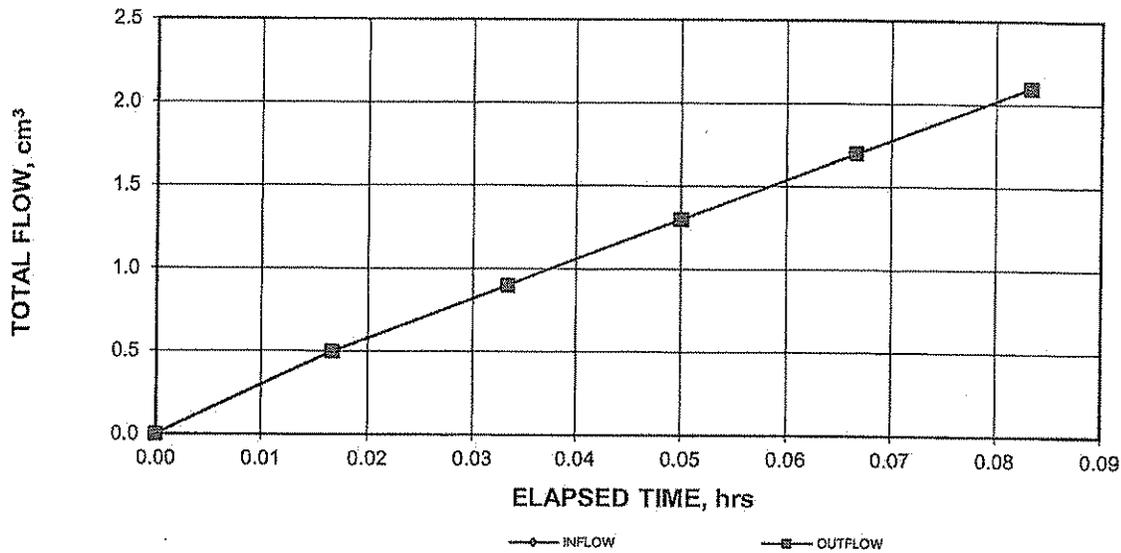
ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-16	Sample No.	ST-A11-01
Lab ID No.	2012-656-16-01		

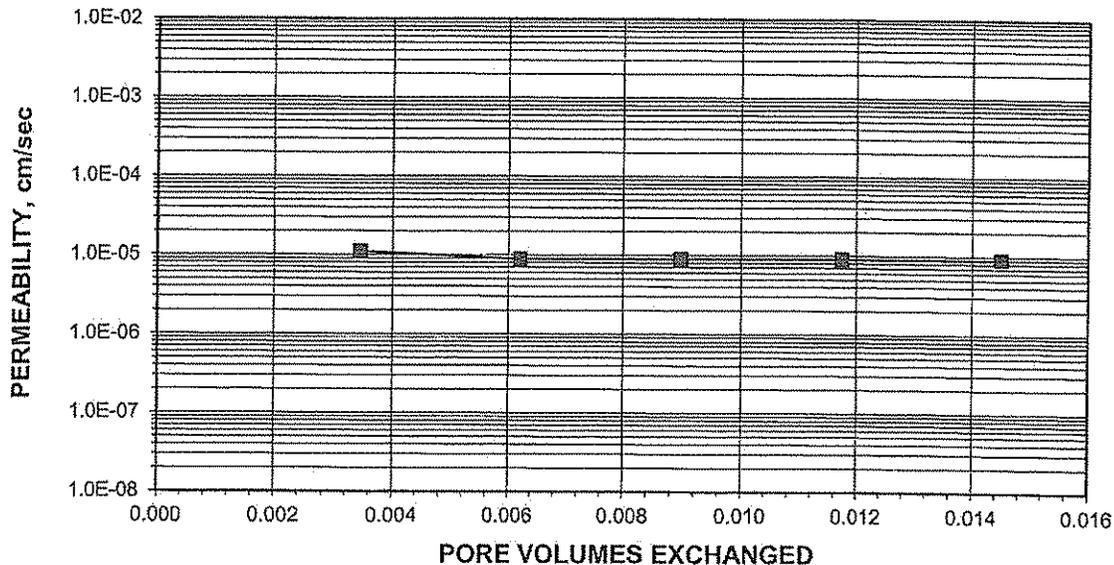
AVERAGE PERMEABILITY = 9.0E-06 cm/sec @ 20°C

AVERAGE PERMEABILITY = 9.0E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 12/11/2012 Checked By: *GAN* Date: 12-14-12

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-16	Sample No.	ST-A11-01
Lab ID No.	2012-656-16-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: RED SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	802	Y-1
Wt. of Tare & WS (gm.)	356.83	356.84
Wt. of Tare & DS (gm.)	313.05	300.41
Wt. of Tare (gm.)	104.10	94.41
Wt. of Water (gm.)	43.78	56.43
Wt. of DS (gm.)	208.95	206.00
Moisture Content (%)	21.0	27.4

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	572.19	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	572.19	602.66
Length 1 (in.)	3.031	3.036
Length 2 (in.)	3.049	3.013
Length 3 (in.)	3.033	3.044
Top Diameter (in.)	2.871	2.863
Middle Diameter (in.)	2.851	2.871
Bottom Diameter (in.)	2.855	2.858
Average Length (in.)	3.04	3.03
Average Area (in. <sup>2</sup> )	6.42	6.44
Sample Volume (cm <sup>3</sup> )	319.57	319.98
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.79	1.88
Unit Wet Wt. (pcf)	111.8	117.6
Unit Dry Wt. (pcf)	92.4	92.3
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.48	1.48
Void Ratio, e	0.82	0.83
Porosity, n	0.45	0.45
Pore Volume (cm <sup>3</sup> )	144.4	144.8
Total Wgt. Of Sample After Test		604.90

Tested By: BW

Date: 12/11/2012 Checked By: 

Date: 12-14-12



# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLE SR	Depth (ft.)	LIFT 1
Project No.	2012-656-16	Sample No.	ST-A11-01
Lab ID No.	2012-656-16-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.70
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.27
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.56
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.897
Hydraulic Gradient	13.70	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.878
		B Parameter (%)	96

AVERAGE PERMEABILITY = 9.0E-06 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 9.0E-08 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
12/13/2012	11	27	0.00	0.0	0.0	129.0	0	23.2	NA
12/13/2012	11	28	0.02	0.5	0.5	127.9	0	23.2	1.1E-05
12/13/2012	11	29	0.03	0.9	0.9	127.0	0	23.2	8.9E-06
12/13/2012	11	30	0.05	1.3	1.3	126.1	0	23.2	9.0E-06
12/13/2012	11	31	0.07	1.7	1.7	125.2	0	23.2	9.0E-06
12/13/2012	11	32	0.08	2.1	2.1	124.3	1	23.2	9.1E-06

Tested By: BW Date: 12/11/2012 Checked By: GEM Date: 12-14-12

# PERMEABILITY TEST

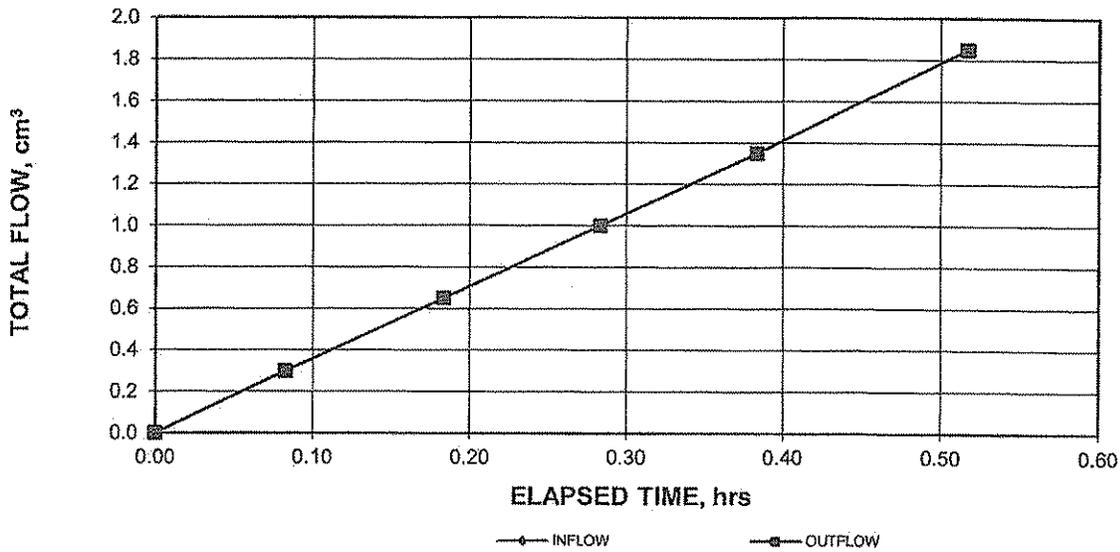
ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLES LF	Depth (ft.)	LIFT 2
Project No.	2013-606-01	Sample No.	ST-A11-L2R
Lab ID No.	2013-606-01-01		

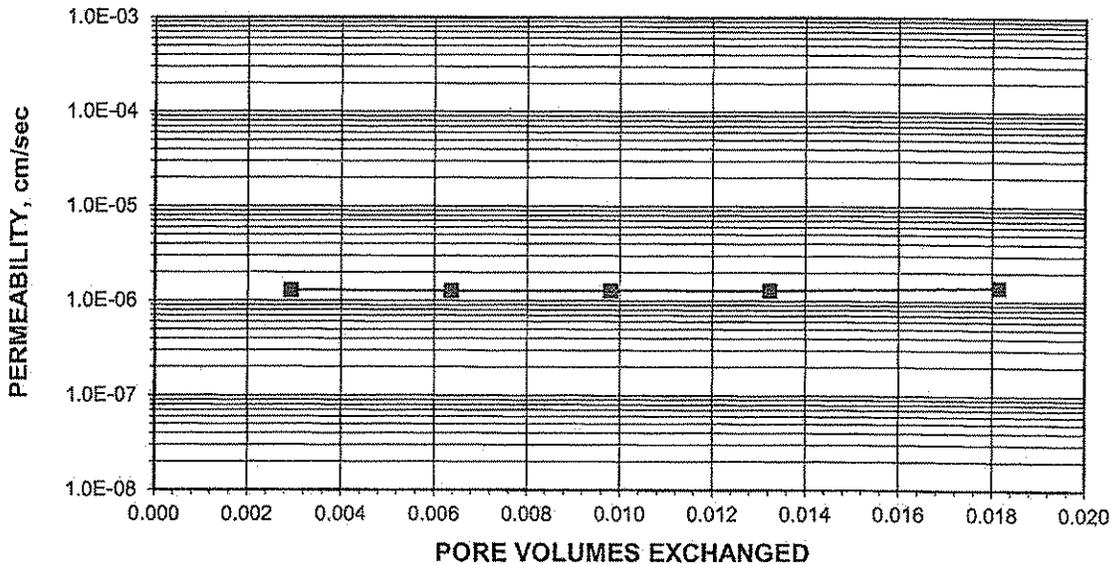
AVERAGE PERMEABILITY = 1.3E-06 cm/sec @ 20°C

AVERAGE PERMEABILITY = 1.3E-08 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 1/11/13 Checked By: *Gan* Date: *HS-13*

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLES LF	Depth (ft.)	LIFT 2
Project No.	2013-606-01	Sample No.	ST-A11-L2R
Lab ID No.	2013-606-01-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description:      ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	806	B-1
Wt. of Tare & WS (gm.)	345.69	308.16
Wt. of Tare & DS (gm.)	319.62	273.78
Wt. of Tare (gm.)	101.94	100.73
Wt. of Water (gm.)	26.07	34.38
Wt. of DS (gm.)	217.68	173.05
Moisture Content (%)	12.0	19.9

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	594.88	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	594.88	636.80
Length 1 (in.)	2.987	2.953
Length 2 (in.)	2.953	2.946
Length 3 (in.)	2.981	2.918
Top Diameter (in.)	2.826	2.801
Middle Diameter (in.)	2.831	2.809
Bottom Diameter (in.)	2.822	2.821
Average Length (in.)	2.97	2.94
Average Area (in. <sup>2</sup> )	6.27	6.20
Sample Volume (cm <sup>3</sup> )	305.72	298.75
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.95	2.13
Unit Wet Wt. (pcf)	121.5	133.1
Unit Dry Wt. (pcf)	108.5	111.0
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.74	1.78
Void Ratio, e	0.55	0.52
Porosity, n	0.36	0.34
Pore Volume (cm <sup>3</sup> )	109.0	102.0
Total Wgt. Of Sample After Test		610.03

Tested By:    SFS                      Date:    1/11/13    Checked By:    *GEM*                      Date:    1/15/13

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLES LF	Depth (ft.)	LIFT 2
Project No.	2013-606-01	Sample No.	ST-A11-L2R
Lab ID No.	2013-606-01-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.47
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.14
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	40.02
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.865
Hydraulic Gradient	14.13	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.892
		B Parameter (%)	97

**AVERAGE PERMEABILITY = 1.3E-06 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 1.3E-08 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
1/14/13	12	56	0.00	0.0	0.0	128.9	0	23.8	NA
1/14/13	13	1	0.08	0.3	0.3	128.2	0	23.8	1.3E-06
1/14/13	13	7	0.18	0.7	0.6	127.4	0	23.8	1.3E-06
1/14/13	13	13	0.28	1.0	1.0	126.7	0	23.8	1.3E-06
1/14/13	13	19	0.38	1.4	1.4	125.9	0	23.8	1.3E-06
1/14/13	13	27	0.52	1.9	1.9	124.8	1	23.8	1.4E-06

Tested By: SFS      Date: 1/11/13      Checked By: *GEM*      Date: *1-15-13*

# PERMEABILITY TEST

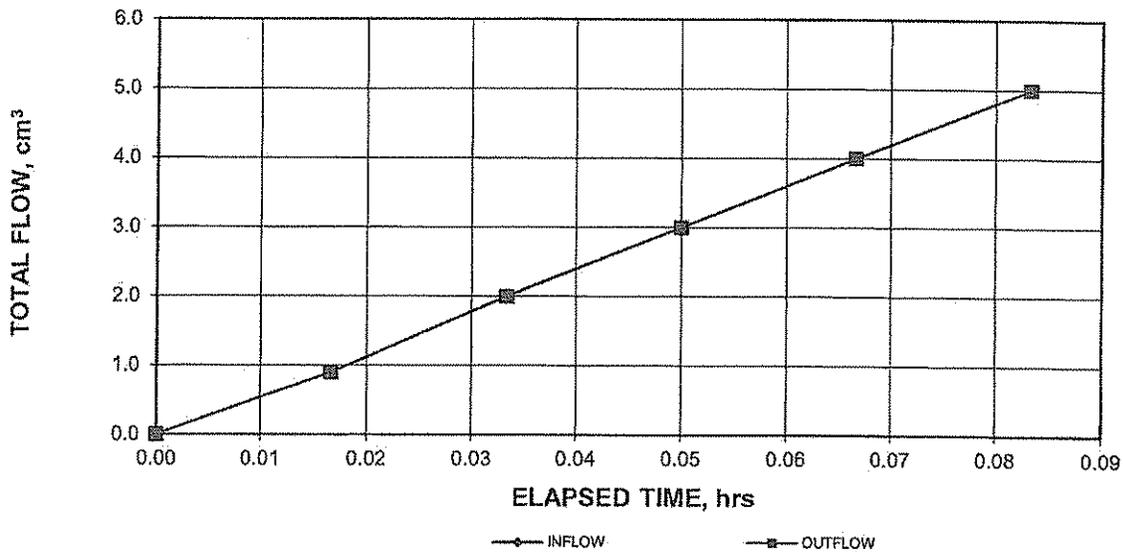
ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLES LF	Depth (ft.)	LIFT 2
Project No.	2013-606-01	Sample No.	ST-A11-L2
Lab ID No.	2013-606-01-01		

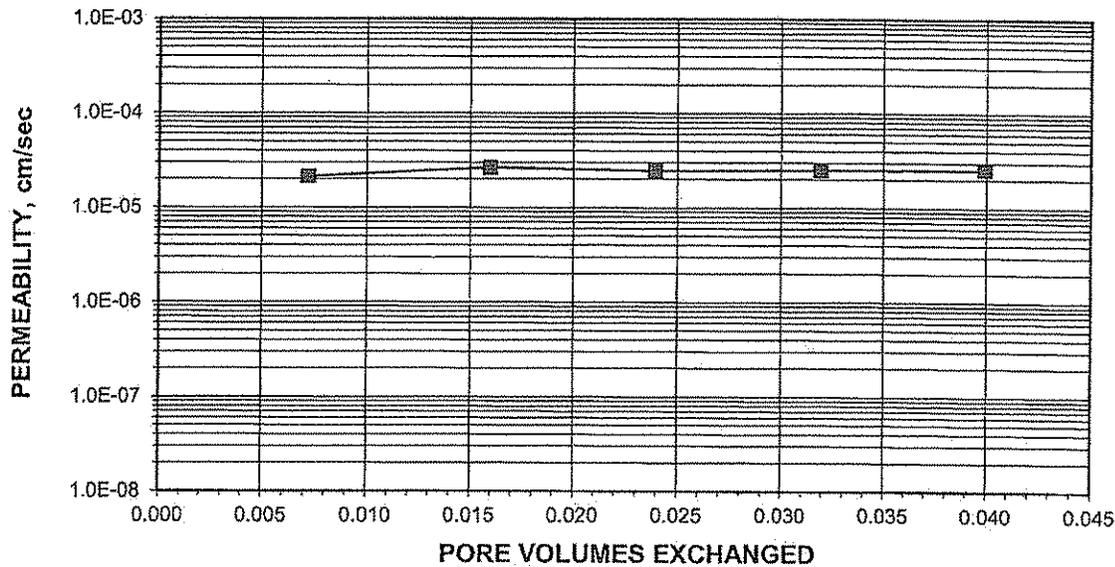
AVERAGE PERMEABILITY = 2.5E-05 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 2.5E-07 m/sec @ 20°C

*FAIL*

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: BW Date: 1/10/13 Checked By: *GEM* Date: *1-14-13*

# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLES LF	Depth (ft.)	LIFT 2
Project No.	2013-606-01	Sample No.	ST-A11-L2
Lab ID No.	2013-606-01-01		

Specific Gravity	2.70 Assumed
Sample Condition	Undisturbed

Visual Description: RED ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	825	814
Wt. of Tare & WS (gm.)	457.96	338.19
Wt. of Tare & DS (gm.)	414.13	297.36
Wt. of Tare (gm.)	136.97	111.71
Wt. of Water (gm.)	43.83	40.83
Wt. of DS (gm.)	277.16	185.65
Moisture Content (%)	15.8	22.0

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	630.45	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	630.45	664.09
Length 1 (in.)	3.162	3.127
Length 2 (in.)	3.148	3.078
Length 3 (in.)	3.140	3.121
Top Diameter (in.)	2.867	2.850
Middle Diameter (in.)	2.858	2.835
Bottom Diameter (in.)	2.861	2.890
Average Length (in.)	3.15	3.11
Average Area (in. <sup>2</sup> )	6.43	6.42
Sample Volume (cm <sup>3</sup> )	332.08	326.88
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.90	2.03
Unit Wet Wt. (pcf)	118.5	126.8
Unit Dry Wt. (pcf)	102.3	104.0
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.64	1.67
Void Ratio, e	0.65	0.62
Porosity, n	0.39	0.38
Pore Volume (cm <sup>3</sup> )	130.5	125.3
Total Wgt. Of Sample After Test		645.60

Tested By: BW Date: 1/10/13 Checked By: *Gan* Date: 1-14-13

# PERMEABILITY TEST

ASTM D 5084-03

Client	JOYCE ENGINEERING, INC.	Boring No.	ACRE 11
Client Project	COBLES LF	Depth (ft.)	LIFT 2
Project No.	2013-606-01	Sample No.	ST-A11-L2
Lab ID No.	2013-606-01-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	38.5	Sample Length (cm), L	7.90
Bottom Cap (psi)	40.0	Sample Diameter (cm)	7.26
Cell (psi)	45.0	Sample Area (cm <sup>2</sup> ), A	41.40
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.905
Hydraulic Gradient	13.36	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.865
		B Parameter (%)	95

**AVERAGE PERMEABILITY = 2.5E-05 cm/sec @ 20°C**  
**AVERAGE PERMEABILITY = 2.5E-07 m/sec @ 20°C**

DATE (mm/dd/yy)	TIME		ELAPSED TIME t (hr)	TOTAL INFLOW (cm <sup>3</sup> )	TOTAL OUTFLOW (cm <sup>3</sup> )	TOTAL HEAD h (cm)	FLOW ( 0 flow ) ( 1 stop )	TEMP. (°C)	INCREMENTAL PERMEABILITY @ 20°C (cm/sec)
	(hr)	(min)							
1/11/13	11	4	0.00	0.0	0.0	123.9	0	22.9	NA
1/11/13	11	5	0.02	0.9	0.9	121.9	0	22.9	2.1E-05
1/11/13	11	6	0.03	2.0	2.0	119.4	0	22.9	2.7E-05
1/11/13	11	7	0.05	3.0	3.0	117.2	0	23.0	2.5E-05
1/11/13	11	8	0.07	4.0	4.0	115.0	0	23.0	2.5E-05
1/11/13	11	9	0.08	5.0	5.0	112.8	1	23.0	2.6E-05

Tested By: BW

Date: 1/10/13

Checked By: *GDM*

Date: *1-14-13*

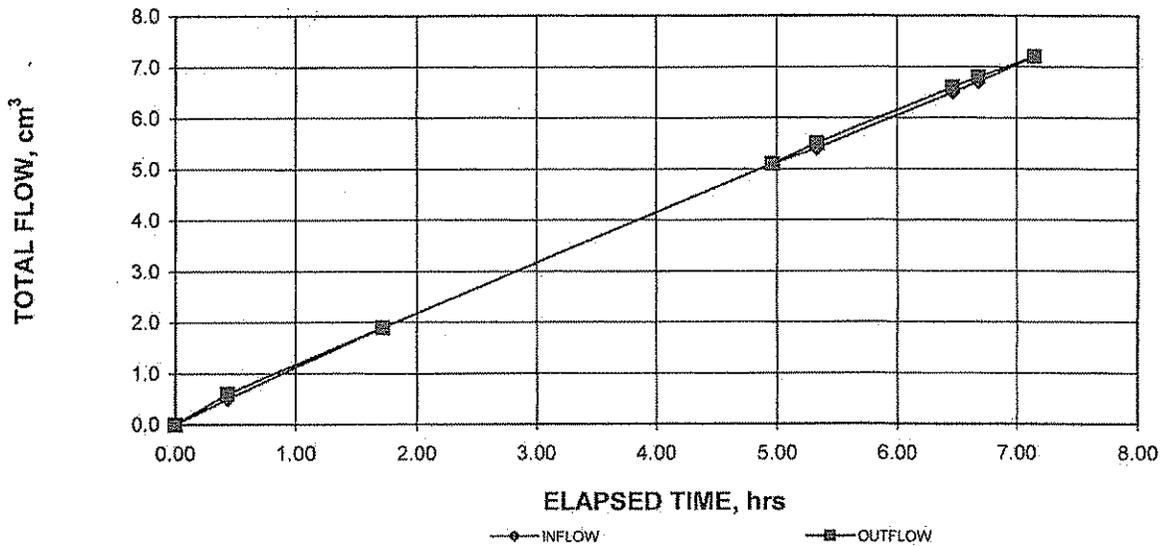
# PERMEABILITY TEST

ASTM D 5084-03

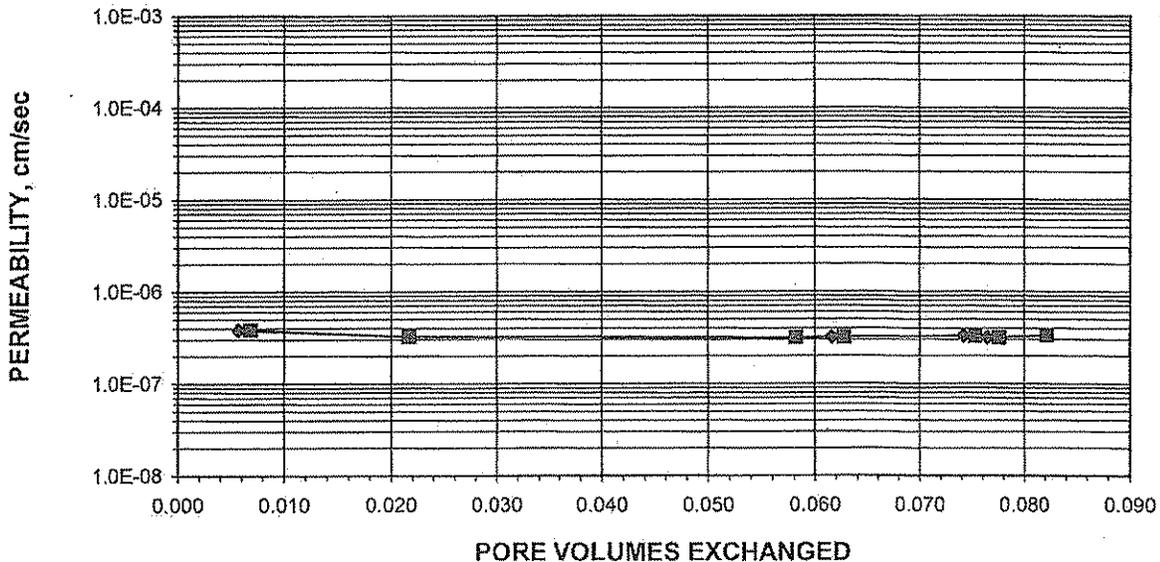
Client	JOYCE ENGINEERING, INC.	Boring No.	N/A
Client Project:	COBLES LF	Depth (ft.)	N/A
Project No.	2013-606-02	Sample No.	ST-A11-L3
Lab ID No.	2013-606-02-01		

AVERAGE PERMEABILITY = 3.3E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 3.3E-09 m/sec @ 20°C

## TOTAL FLOW vs. ELAPSED TIME



## PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: SFS Date: 3/18/13 Checked By: *[Signature]* Date: 3/21/13



# PERMEABILITY TEST

ASTM D 5084-10

Client	JOYCE ENGINEERING, INC.	Boring No.	N/A
Client Project	COBLES LF	Depth (ft.)	N/A
Project No.	2013-606-02	Sample No.	ST-A11-L3
Lab ID No.	2013-606-02-01		

Specific Gravity	2.70 Assumed
Sample Condition	Remolded

Visual Description: ORANGE SANDY CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	814	800
Wt. of Tare & WS (gm.)	316.12	577.94
Wt. of Tare & DS (gm.)	285.93	479.01
Wt. of Tare (gm.)	111.80	103.58
Wt. of Water (gm.)	30.19	98.93
Wt. of DS (gm.)	174.13	375.43
Moisture Content (%)	17.3	26.4

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	471.41	NA
Wt. of Tube (gm.)	0.00	NA
Wt. of WS (calc.)(gm.)	471.41	507.62
Length 1 (in.)	2.336	2.272
Length 2 (in.)	2.345	2.291
Length 3 (in.)	2.328	2.313
Top Diameter (in.)	2.824	2.834
Middle Diameter (in.)	2.826	2.836
Bottom Diameter (in.)	2.826	2.823
Average Length (in.)	2.34	2.29
Average Area (in. <sup>2</sup> )	6.27	6.29
Sample Volume (cm <sup>3</sup> )	240.03	236.42
Unit Wet Wt. (gm./ cm <sup>3</sup> )	1.96	2.15
Unit Wet Wt. (pcf)	122.6	134.0
Unit Dry Wt. (pcf)	104.5	106.1
Unit Dry Wt. (gm./ cm <sup>3</sup> )	1.67	1.70
Void Ratio, e	0.61	0.59
Porosity, n	0.38	0.37
Pore Volume (cm <sup>3</sup> )	91.2	87.6
Total Wgt. Of Sample After Test		474.60

Tested By: SFS

Date: 3/18/13

Checked By: *MBP*

Date: 3/21/13

# PERMEABILITY TEST

ASTM D 5084-03



Client	JOYCE ENGINEERING, INC.	Boring No.	N/A
Client Project	COBLES LF	Depth (ft.)	N/A
Project No.	2013-606-02	Sample No.	ST-A11-L3
Lab ID No.	2013-606-02-01		

Pressure Heads (Constant)		Final Sample Dimensions	
Top Cap (psi)	28.5	Sample Length (cm), L	5.82
Bottom Cap (psi)	30.0	Sample Diameter (cm)	7.19
Cell (psi)	35.0	Sample Area (cm <sup>2</sup> ), A	40.61
Total Pressure Head (cm)	105.5	Inflow Burette Area (cm <sup>2</sup> ), a-in	0.854
Hydraulic Gradient	18.11	Outflow Burette Area (cm <sup>2</sup> ), a-out	0.862
		B Parameter (%)	100

AVERAGE PERMEABILITY = 3.3E-07 cm/sec @ 20°C  
 AVERAGE PERMEABILITY = 3.3E-09 m/sec @ 20°C

DATE	TIME		ELAPSED TIME	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD	FLOW	TEMP.	INCREMENTAL PERMEABILITY
(mm/dd/yy)	(hr)	(min)	t (hr)	(cm <sup>3</sup> )	(cm <sup>3</sup> )	h (cm)	( 0 flow ) ( 1 stop )	(°C)	@ 20°C (cm/sec)
3/20/13	8	37	0.00	0.0	0.0	123.1	0	22.9	NA
3/20/13	9	3	0.43	0.5	0.6	121.8	0	22.9	3.8E-07
3/20/13	10	20	1.72	1.9	1.9	118.7	0	22.9	3.2E-07
3/20/13	13	35	4.97	5.1	5.1	111.3	0	22.9	3.2E-07
3/20/13	13	57	5.33	5.4	5.5	110.5	0	22.9	3.2E-07
3/20/13	15	5	6.47	6.5	6.6	107.9	0	22.9	3.3E-07
3/20/13	15	18	6.68	6.7	6.8	107.4	0	22.9	3.2E-07
3/20/13	15	46	7.15	7.2	7.2	106.4	1	22.9	3.3E-07

Tested By: SFS Date: 3/18/13 Checked By: *MDS* Date: 3/21/13

**APPENDIX 4 – PHOTOGRAPHIC RECORD**



1. Coble's C&D Landfill entrance.



2. Intermediate cover graded and compacted for landfill closure.



3. Infiltration layer of landfill west slope, looking south.



4. Infiltration layer of landfill west slope, looking north.



5. East side infiltration layer completed. Cover soil stockpiled at top of slope.



6. Landfill gas vent pipe installation.



7. Gas vent excavation filled with gravel.



8. Landfill gas passive vent pipes in the closed section.

APPENDIX 5 – RECORD SURVEY DRAWINGS



ALAMANCE COUNTY:  
NORTH CAROLINA:  
I, Michael R. Stout, certify that the contours shown on this plan were obtained by field surveys conducted under my supervision, on the dates listed. This is not a Boundary Survey. Witness my original signature, license number and seal this 6th Day of August, 2013.

*Michael R. Stout*  
Professional Land Surveyor  
License No. L-3492

Contour Interval: 2'  
Dates of Field Survey(s): 3/8/12, 6/5/12, 7/10/12, 7/27/12,  
9/4/12, 11/29/12, 12/13/12.

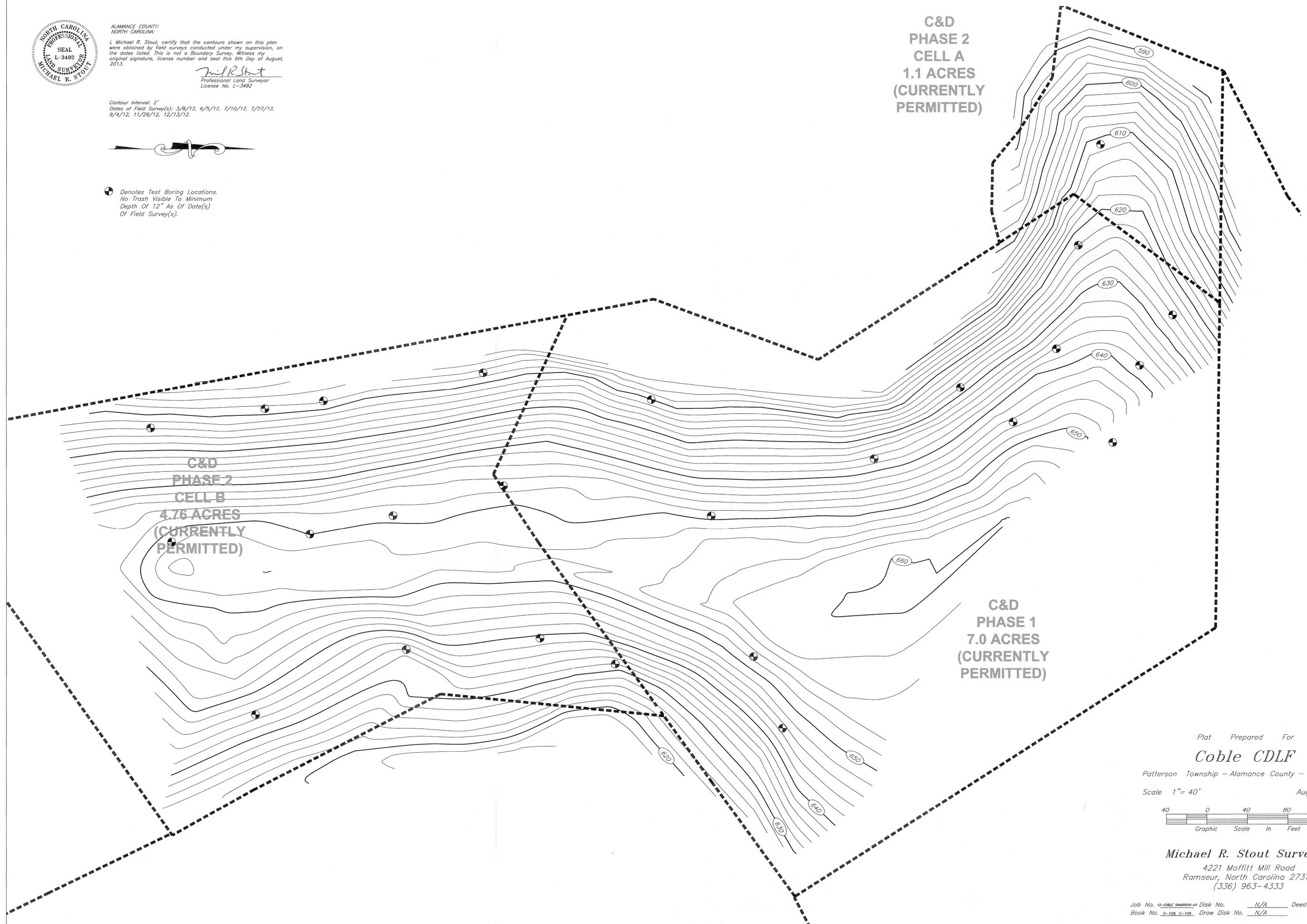


⊕ Denotes Test Boring Locations.  
No Trash Visible To Minimum  
Depth Of 12" As Of Date(s)  
Of Field Survey(s).

**C&D  
PHASE 2  
CELL A  
1.1 ACRES  
(CURRENTLY  
PERMITTED)**

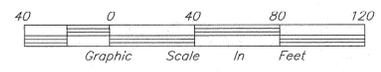
**C&D  
PHASE 2  
CELL B  
4.76 ACRES  
(CURRENTLY  
PERMITTED)**

**C&D  
PHASE 1  
7.0 ACRES  
(CURRENTLY  
PERMITTED)**



RECORD TOP OF INTERMEDIATE COVER

Plat Prepared For  
**Coble CDLF**  
Patterson Township - Alamance County - North Carolina  
Scale 1" = 40' August 6, 2013



**Michael R. Stout Surveying**  
4221 Moffitt Mill Road  
Ramseur, North Carolina 27316  
(336) 963-4333

Job No. 12-COBL CDLF-01 Disk No. N/A Deed Book N/A  
Book No. S-108, S-109 Draw Disk No. N/A



ALAMANCE COUNTY:  
NORTH CAROLINA:

I, Michael R. Stout, certify that the contours shown on this plan were obtained by field surveys conducted under my supervision, on the dates listed. This is not a Boundary Survey. Witness my original signature, license number and seal this 6th Day of August, 2013.

*Michael R. Stout*  
Professional Land Surveyor  
License No. L-3492

Contour Interval: 2'  
Dates of Field Survey(s): 6/5/12, 7/10/12, 7/27/12, 9/4/12,  
10/22/12, 10/23/12, 11/21/12, 12/13/12, 4/27/13.



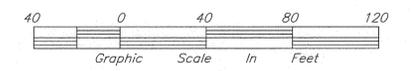
**C&D  
PHASE 2  
CELL A  
1.1 ACRES  
(CURRENTLY  
PERMITTED)**

**C&D  
PHASE 2  
CELL B  
4.76 ACRES  
(CURRENTLY  
PERMITTED)**

**C&D  
PHASE 1  
7.0 ACRES  
(CURRENTLY  
PERMITTED)**

RECORD TOP OF CLAY

Plat Prepared For  
**Coble CDLF**  
Patterson Township - Alamance County - North Carolina  
Scale 1" = 40' August 6, 2013



**Michael R. Stout Surveying**  
4221 Moffitt Mill Road  
Ramseur, North Carolina 27316  
(336) 963-4333

Job No. 12-COBLE SANDROCK-01 Disk No. N/A Deed Book N/A  
Book No. S-108, S-109 Draw Disk No. N/A



ALAMANCE COUNTY:  
NORTH CAROLINA:  
I, Michael R. Stout, certify that the contours shown on this plan were obtained by field surveys conducted under my supervision, on the dates listed. This is not a Boundary Survey. Witness my original signature, license number and seal this 6th Day of August, 2013.

*Michael R. Stout*  
Professional Land Surveyor  
License No. L-3492

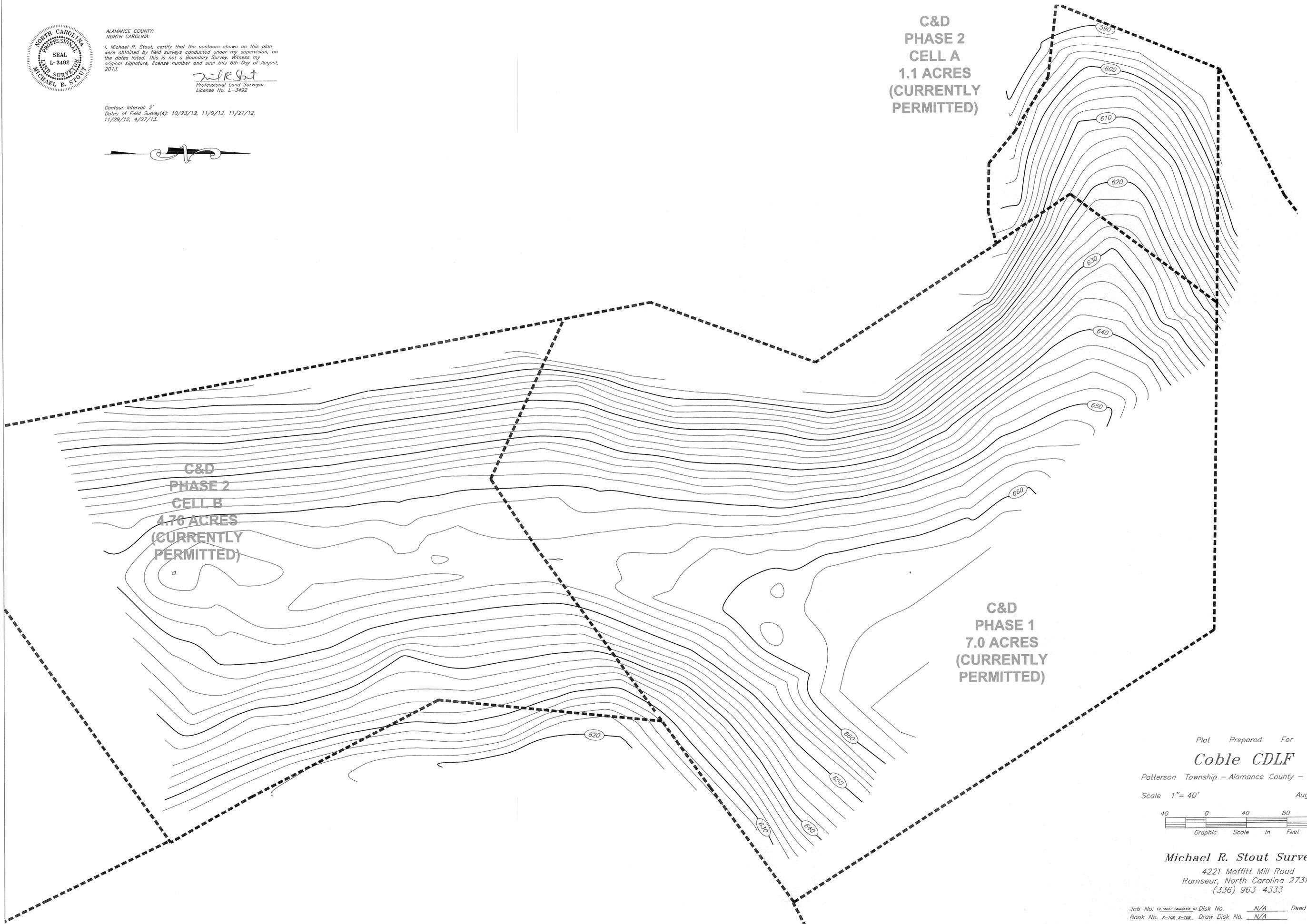
Contour Interval: 2'  
Dates of Field Survey(s): 10/23/12, 11/9/12, 11/21/12,  
11/29/12, 4/27/13.



**C&D  
PHASE 2  
CELL A  
1.1 ACRES  
(CURRENTLY  
PERMITTED)**

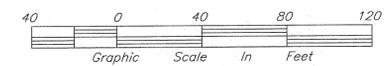
**C&D  
PHASE 2  
CELL B  
4.76 ACRES  
(CURRENTLY  
PERMITTED)**

**C&D  
PHASE 1  
7.0 ACRES  
(CURRENTLY  
PERMITTED)**



RECORD FINAL COVER

Plat Prepared For  
**Coble CDLF**  
Patterson Township - Alamance County - North Carolina  
Scale 1" = 40' August 6, 2013



**Michael R. Stout Surveying**  
4221 Moffitt Mill Road  
Ramseur, North Carolina 27316  
(336) 963-4333

Job No. 12-COBLE 5MURKOK-01 Disk No. N/A Deed Book N/A  
Book No. S-108, S-109 Draw Disk No. N/A

**COBLE SANDROCK C&D LANDFILL PARTIAL CLOSURE 2012-2013**  
**Surveyor: Michael R. Stout Surveying, Ramseur, NC 27316**

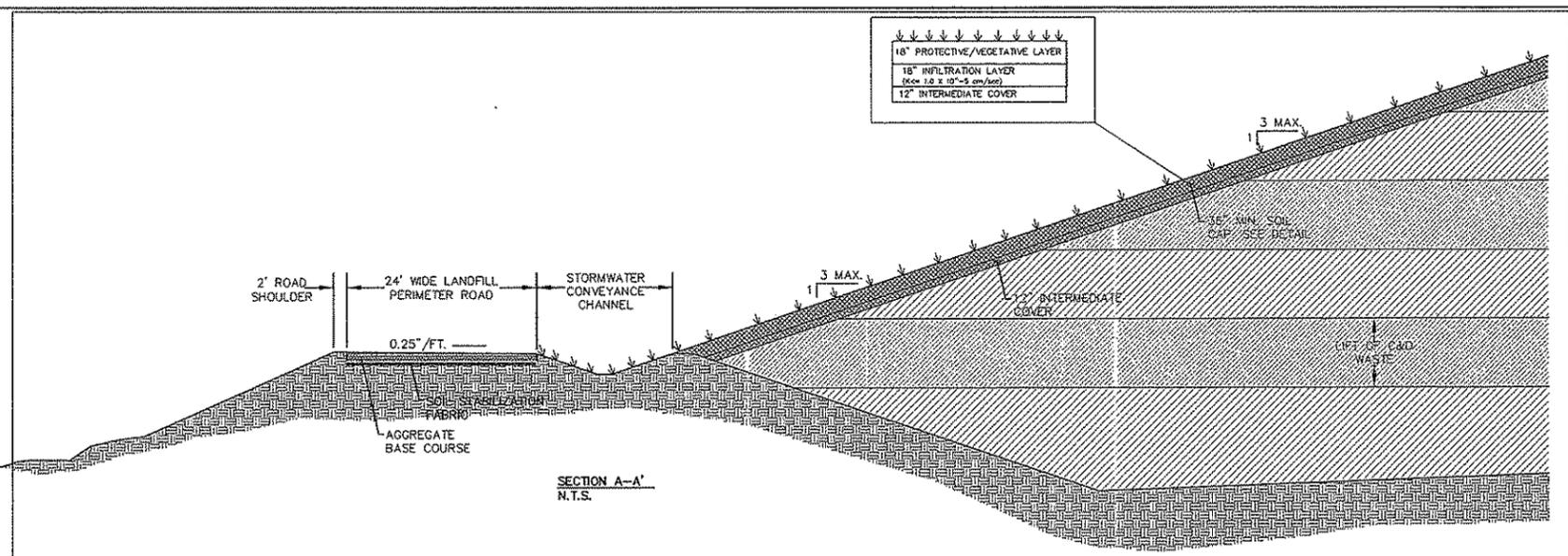
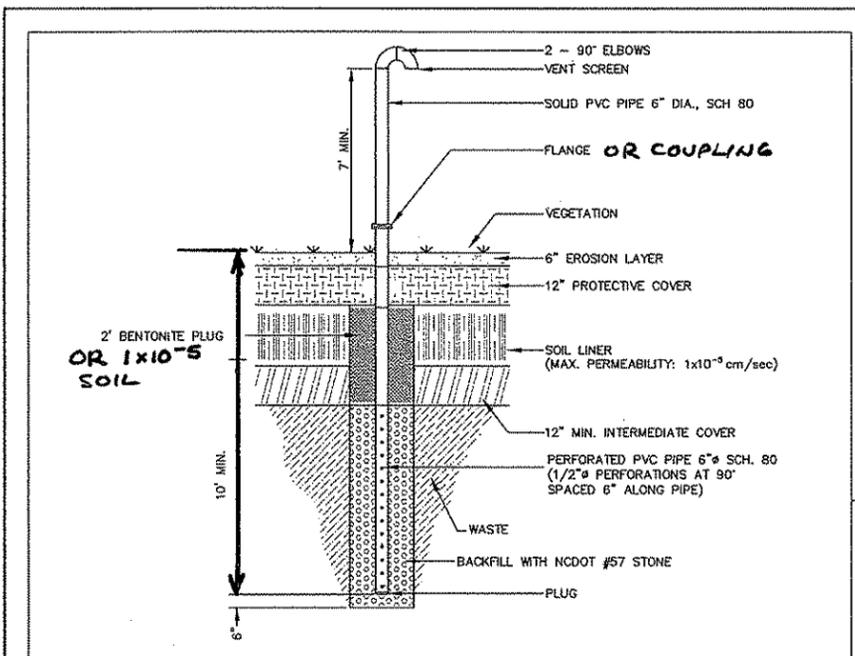
<b>SURVEY POINT</b>	<b>INTERM. COVER ELEV.</b>	<b>LAYER THICKNESS (Ft.)</b>	<b>CLAY SOIL ELEV.</b>	<b>LAYER THICKNESS (Ft.)</b>	<b>FINAL COVER ELEV.</b>	<b>TOTAL THICKNESS</b>
<b>AREA 1</b>						
1001	650.50	1.70	652.2	1.77	653.97	3.47
1002	653.15	1.58	654.73	1.62	656.35	3.20
1003	654.04	1.62	655.66	1.58	657.24	3.20
1004	653.84	1.68	655.52	1.56	657.08	3.24
1005	651.86	1.87	653.73	1.59	655.32	3.46
1006	651.00	1.65	652.65	1.59	654.24	3.24
1007	650.82	1.53	652.35	1.63	653.98	3.16
1008	650.22	1.62	651.84	1.64	653.48	3.26
1009	649.10	1.84	650.94	1.29	652.23	3.13
1010	647.78	1.88	649.66	1.36	651.02	3.24
1011	645.83	1.84	647.67	1.27	648.94	3.11
1012	634.14	1.73	635.87	1.64	637.51	3.37
1013	622.23	2.00	624.23	1.52	625.75	3.52
1014	619.00	1.74	620.74	1.55	622.29	3.29
1015	613.32	1.86	615.18	1.40	616.58	3.26
1016	611.22	1.67	612.89	1.56	614.45	3.23
1017	608.83	1.61	610.44	1.57	612.01	3.18
1018	607.76	1.64	609.4	1.61	611.01	3.25
1019	606.88	1.57	608.45	1.61	610.06	3.18
1020	605.38	1.59	606.97	1.51	608.48	3.10
1021	604.79	1.58	606.37	1.53	607.90	3.11
1022	604.51	1.74	606.25	1.33	607.58	3.07
1023	610.53	1.56	612.09	1.56	613.65	3.12
1024	612.18	2.60	614.78	0.47	615.25	3.07
1025	614.00	1.56	615.56	1.72	617.28	3.28
1026	616.96	2.46	619.42	0.61	620.03	3.07
1027	616.93	3.17	620.10	0.59	620.69	3.76
1028	619.76	1.88	621.64	1.67	623.31	3.55
1029	622.15	2.58	624.73	1.42	626.15	4.00
1030	625.56	1.67	627.23	1.59	628.82	3.26
1031	631.17	2.24	633.41	0.93	634.34	3.17
1032	644.41	1.87	646.28	1.57	647.85	3.44
1033	640.94	1.54	642.48	2.51	644.99	4.05
1034	637.31	1.70	639.01	1.55	640.56	3.25
1035	633.68	1.68	635.36	1.62	636.98	3.30
1036	631.92	2.72	634.64	2.66	637.30	5.38
1037	631.19	1.56	632.75	1.63	634.38	3.19
1038	628.66	2.72	631.38	2.08	633.46	4.80
1039	627.73	1.92	629.65	1.33	630.98	3.25
1040	626.41	2.25	628.66	0.89	629.55	3.14
1041	640.78	1.71	642.49	1.53	644.02	3.24
1042	643.34	1.58	644.92	1.53	646.45	3.11
1043	644.68	1.58	646.26	1.66	647.92	3.24
1044	645.76	1.53	647.29	1.59	648.88	3.12
1045	646.45	1.60	648.05	1.51	649.56	3.11
1046	647.72	1.54	649.26	1.93	651.19	3.47
1047	650.82	1.73	652.55	1.42	653.97	3.15
1048	653.09	1.66	654.75	1.45	656.20	3.11

SURVEY POINT	INTERM. COVER ELEV.	LAYER THICKNESS (Ft.)	CLAY SOIL ELEV.	LAYER THICKNESS (Ft.)	FINAL COVER ELEV.	TOTAL THICKNESS
1049	654.91	1.66	656.57	1.59	658.16	3.25
<b>ACRE 2</b>						
1079	659.25	1.50	660.75	1.65	662.40	3.15
1080	658.68	3.41	662.09	-0.15	661.94	3.26
1081	658.72	1.62	660.34	1.57	661.91	3.19
1082	658.96	1.54	660.5	1.73	662.23	3.27
1090	659.33	1.53	660.86	1.63	662.49	3.16
1091	657.87	3.15	661.02	-0.02	661.00	3.13
1092	651.70	3.44	655.14	-0.23	654.91	3.21
1093	647.47	2.59	650.06	2.22	652.28	4.81
1094	645.60	2.22	647.82	4.03	651.85	6.25
1095	647.47	1.84	649.31	3.68	652.99	5.52
1096	650.53	1.45	651.98	3.91	655.89	5.36
1097	653.48	1.55	655.03	1.84	656.87	3.39
1098	655.23	1.54	656.77	1.59	658.36	3.13
1099	650.45	1.94	652.39	1.61	654.00	3.55
1100	645.34	2.56	647.9	2.32	650.22	4.88
1101	640.99	1.67	642.66	3.92	646.58	5.59
1102	637.50	1.60	639.1	1.78	640.88	3.38
1103	633.85	2.00	635.85	1.12	636.97	3.12
1104	632.96	2.17	635.13	1.02	636.15	3.19
1105	635.75	1.65	637.4	1.51	638.91	3.16
1106	640.62	4.30	644.92	-0.12	644.80	4.18
1107	625.54	1.83	627.37	1.34	628.71	3.17
1108	619.14	1.54	620.68	1.47	622.15	3.01
1109	611.73	1.67	613.4	1.76	615.16	3.43
1110	615.49	1.73	617.22	1.43	618.65	3.16
1111	624.08	1.53	625.61	1.49	627.10	3.02
1112	628.75	2.14	630.89	2.40	633.29	4.54
1113	632.02	1.79	633.81	4.01	637.82	5.80
1114	639.34	2.04	641.38	3.56	644.94	5.60
1115	646.21	1.83	648.04	1.30	649.34	3.13
1116	634.51	1.70	636.21	2.41	638.62	4.11
1117	627.01	1.65	628.66	1.50	630.16	3.15
1118	617.94	1.71	619.65	2.19	621.84	3.90
1119	613.76	2.05	615.81	1.09	616.90	3.14
1120	612.10	1.51	613.61	1.76	615.37	3.27
1121	623.02	1.65	624.67	1.46	626.13	3.11
<b>ACRE 9</b>						
1177	621.60	1.68	623.28	1.44	624.72	3.12
1178	621.40	1.88	623.28	1.28	624.56	3.16
1179	624.44	1.70	626.14	1.41	627.55	3.11
1180	629.22	1.65	630.87	1.48	632.35	3.13
1181	640.04	1.53	641.57	1.75	643.32	3.28
1182	639.65	1.98	641.63	1.35	642.98	3.33
1183	633.81	1.54	635.35	3.55	638.90	5.09
1184	632.93	1.67	634.60	1.81	636.41	3.48
1185	633.04	2.60	635.64	0.63	636.27	3.23
1186	648.14	1.56	649.70	1.99	651.69	3.55
1187	647.07	2.19	649.26	1.21	650.47	3.40
1188	647.85	2.41	650.26	1.55	651.81	3.96
1189	648.72	2.15	650.87	0.99	651.86	3.14

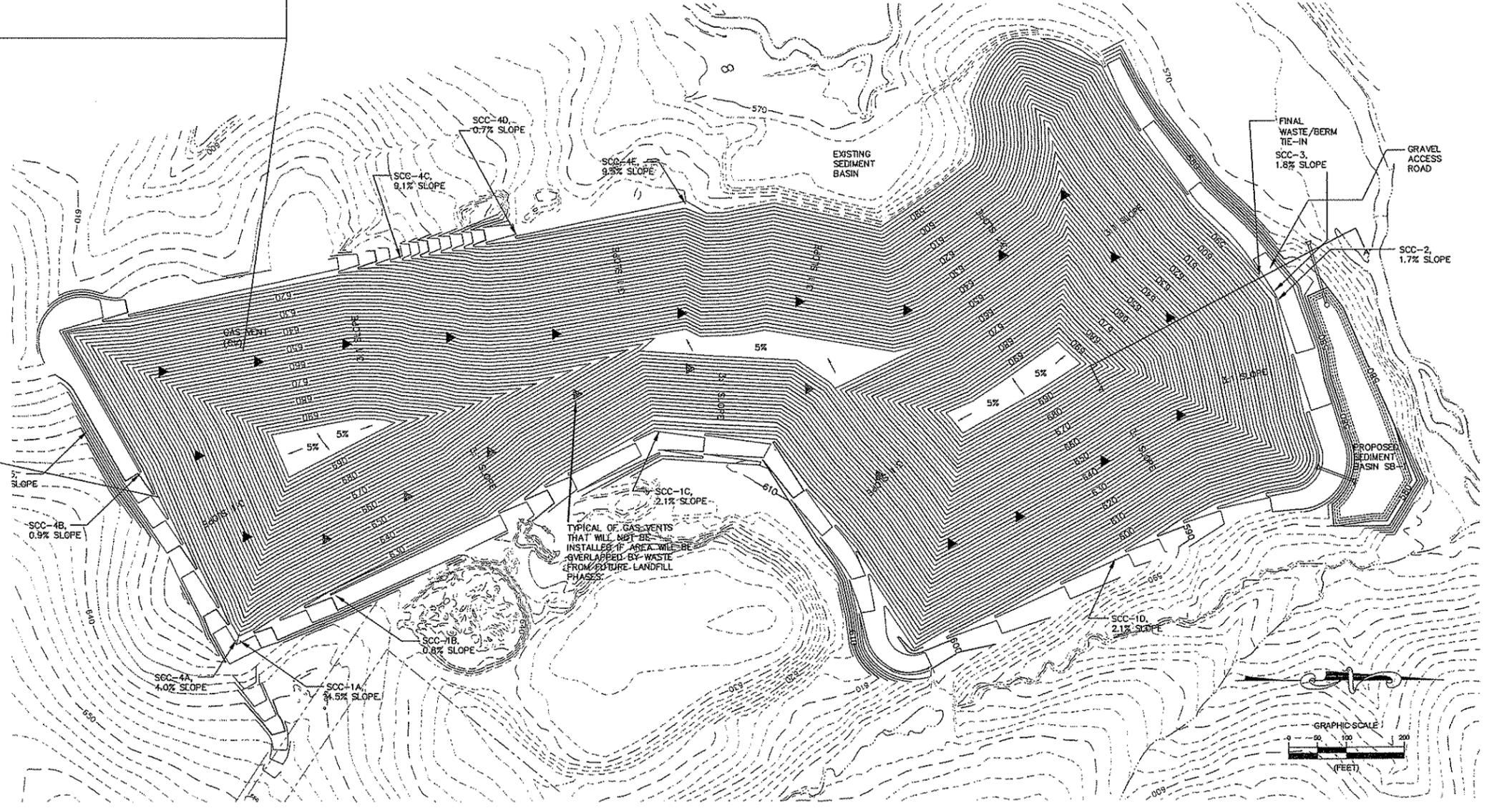
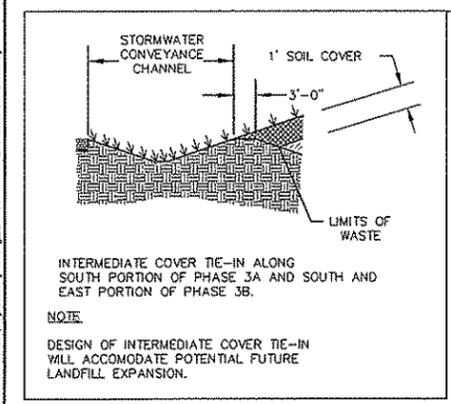
SURVEY POINT	INTERM. COVER ELEV.	LAYER THICKNESS (Ft.)	CLAY SOIL ELEV.	LAYER THICKNESS (Ft.)	FINAL COVER ELEV.	TOTAL THICKNESS
1190	646.01	1.53	647.54	2.60	650.14	4.13
1191	653.00	1.55	654.55	1.63	656.18	3.18
1192	655.75	1.66	657.41	1.53	658.94	3.19
1193	655.90	1.58	657.48	2.53	660.01	4.11
1194	657.72	1.62	659.34	1.46	660.80	3.08
1195	658.32	1.63	659.95	1.39	661.34	3.02
<b>NW AREA</b>						
1236	660.20	1.65	661.85	1.71	663.56	3.36
1237	656.25	1.63	657.88	1.65	659.53	3.28
1238	649.93	1.58	651.51	1.64	653.15	3.22
1239	643.92	1.62	645.54	1.60	647.14	3.22
1240	635.75	1.78	637.53	1.44	638.97	3.22
1241	624.63	1.59	626.22	1.73	627.95	3.32
1242	611.37	1.65	613.02	1.46	614.48	3.11
1243	600.33	1.64	601.97	1.50	603.47	3.14
1244	586.81	1.54	588.35	3.10	589.91	3.10
1245	589.60	1.52	591.12	3.19	592.79	3.19
1246	591.08	1.55	592.63	3.16	594.24	3.16
1247	586.09	1.52	587.61	2.97	589.06	2.97
1248	586.52	1.55	588.07	3.25	589.77	3.25
1249	586.28	1.57	587.85	3.48	589.76	3.48
1250	591.44	1.59	593.03	3.26	594.70	3.26
1251	595.84	1.61	597.45	3.35	599.19	3.35
1252	600.39	1.55	601.94	3.18	603.57	3.18
1253	603.98	1.50	605.48	3.07	607.05	3.07
1254	622.17	1.67	623.84	2.76	626.60	4.43
1255	639.91	1.68	641.59	1.38	642.97	3.06
1256	652.48	1.81	654.29	1.36	655.65	3.17
1257	636.42	2.84	639.26	1.42	640.68	4.26
1258	632.43	2.78	635.21	1.88	637.09	4.66
1259	618.05	1.91	619.96	3.13	623.09	5.04
1260	626.77	2.17	628.94	2.18	631.12	4.35
1261	619.47	1.59	621.06	1.61	622.67	3.20
1262	608.16	1.55	609.71	1.71	611.42	3.26
1263	620.25	1.66	621.91	1.66	623.57	3.32
1264	618.24	2.16	620.40	1.25	621.65	3.41
1265	605.89	1.70	607.59	3.31	610.90	5.01
1266	608.96	1.73	610.69	1.46	612.15	3.19
1267	612.52	1.64	614.16	1.48	615.64	3.12
1268	606.37	2.77	609.14	1.33	610.47	4.10
1269	594.80	1.60	596.40	1.66	598.06	3.26
1270	597.25	1.86	599.11	1.30	600.41	3.16
1271	602.07	2.03	604.10	1.12	605.22	3.15
1272	596.15	1.52	597.67	1.75	599.42	3.27
<b>ACRE 7 &amp; 8</b>						
1322	616.38	1.61	617.99	1.55	619.54	3.16
1323	618.16	1.57	619.73	1.58	621.31	3.15
1324	617.13	1.60	618.73	1.64	620.37	3.24
1325	615.78	1.82	617.6	1.21	618.81	3.03
1326	616.38	1.67	618.05	1.47	619.52	3.14
1327	617.19	1.57	618.76	1.54	620.30	3.11
1328	619.90	1.66	621.56	1.57	623.13	3.23

SURVEY POINT	INTERM. COVER ELEV.	LAYER THICKNESS (Ft.)	CLAY SOIL ELEV.	LAYER THICKNESS (Ft.)	FINAL COVER ELEV.	TOTAL THICKNESS
1329	621.31	1.54	622.85	1.70	624.55	3.24
1330	622.27	1.63	623.9	1.55	625.45	3.18
1331	622.62	1.61	624.23	1.63	625.86	3.24
1332	623.66	1.51	625.17	1.61	626.78	3.12
1333	632.75	1.56	634.31	1.54	635.85	3.10
1334	641.50	1.66	643.16	1.49	644.65	3.15
1335	647.40	1.51	648.91	1.62	650.53	3.13
1336	652.13	1.62	653.75	1.55	655.30	3.17
1337	654.21	1.62	655.83	1.60	657.43	3.22
1338	653.52	1.58	655.10	1.58	656.68	3.16
1339	653.25	1.70	654.95	1.46	656.41	3.16
1340	652.52	1.56	654.08	1.79	655.87	3.35
1341	651.40	1.56	652.96	1.68	654.64	3.24
1342	652.78	1.58	654.36	1.53	655.89	3.11
1343	655.24	1.56	656.8	1.61	658.41	3.17
1344	656.40	1.78	658.18	1.37	659.55	3.15
1345	645.55	1.65	647.20	1.41	648.61	3.06
1346	643.02	2.21	645.23	1.13	646.36	3.34
1347	640.26	1.55	641.81	1.56	643.37	3.11
1348	641.66	2.23	643.89	0.91	644.80	3.14
1349	644.28	1.89	646.17	1.21	647.38	3.10
1350	644.24	1.62	645.86	1.48	647.34	3.10
1351	645.02	1.50	646.52	1.70	648.22	3.20
1352	647.15	1.81	648.96	1.33	650.29	3.14
1353	647.29	1.69	648.98	1.39	650.37	3.08
1354	643.68	1.56	645.24	1.56	646.80	3.12
1355	630.22	2.34	632.56	1.52	634.08	3.86
1356	631.76	1.78	633.54	1.23	634.77	3.01
1357	631.63	1.64	633.27	1.52	634.79	3.16
1358	630.63	2.01	632.64	1.87	634.51	3.88
1359	632.58	1.62	634.20	1.60	635.80	3.22
1360	633.12	2.05	635.17	1.01	636.18	3.06
1361	631.91	1.53	633.44	1.64	635.08	3.17
1362	628.98	1.76	630.74	1.35	632.09	3.11
1363	630.20	2.40	632.60	1.26	633.86	3.66
1364	624.10	1.68	625.78	1.42	627.20	3.10
1365	623.20	1.75	624.95	1.40	626.35	3.15
1366	624.32	1.65	625.97	1.52	627.49	3.17
1367	623.65	1.55	625.20	1.55	626.75	3.10
<b>NORTH-1 AREA</b>						
1758	650.68	1.61	652.29	1.52	653.81	3.13
1759	645.08	3.10	648.18	1.46	649.64	4.56
1760	637.21	3.56	640.77	1.48	642.25	5.04
1761	637.27	2.10	639.37	1.75	641.12	3.85
1762	625.45	1.88	627.33	1.73	629.06	3.61
1763	625.07	1.69	626.76	1.33	628.09	3.02
1764	625.03	1.81	626.84	1.39	628.23	3.20
1765	612.51	1.30	613.81	1.86	615.67	3.16
1766	611.61	1.81	613.42	1.33	614.75	3.14
1767	609.12	1.66	610.78	1.51	612.29	3.17
1768	608.68	1.46	610.14	1.62	611.76	3.08
1769	599.09	1.61	600.70	1.44	602.14	3.05

<b>SURVEY POINT</b>	<b>INTERM. COVER ELEV.</b>	<b>LAYER THICKNESS (Ft.)</b>	<b>CLAY SOIL ELEV.</b>	<b>LAYER THICKNESS (Ft.)</b>	<b>FINAL COVER ELEV.</b>	<b>TOTAL THICKNESS</b>
1770	600.61	1.70	602.31	1.66	603.97	3.36
1771	603.42	1.67	605.09	1.37	606.46	3.04
1772	606.19	1.76	607.95	1.44	609.39	3.20
<b>HAUL ROAD</b>						
1780	644.43	1.85	646.28	1.31	647.59	3.16
1782	644.28	1.87	646.15	1.36	647.51	3.23
1784	649.05	1.92	650.97	1.18	652.15	3.10
1786	650.08	1.95	652.03	1.57	653.60	3.52
1788	651.97	1.94	653.91	1.21	655.12	3.15
1790	651.33	1.94	653.27	1.04	654.31	2.98
1792	652.90	1.93	654.83	1.23	656.06	3.16
1794	652.83	2.00	654.83	1.09	655.92	3.09
1796	652.03	1.92	653.95	1.09	655.04	3.01
1798	652.74	2.00	654.74	1.23	655.97	3.23
1800	652.59	1.99	654.58	1.04	655.62	3.03
1802	652.59	2.02	654.61	1.36	655.97	3.38
1804	652.87	2.00	654.87	1.26	656.13	3.26
1806	651.45	1.97	653.42	1.39	654.81	3.36
1808	650.63	1.94	652.57	1.04	653.61	2.98
1810	652.66	1.98	654.64	1.20	655.84	3.18
1812	652.15	1.98	654.13	1.10	655.23	3.08
1814	651.69	1.99	653.68	1.08	654.76	3.07
1816	652.22	2.00	654.22	1.05	655.27	3.05
1818	650.75	2.10	652.85	1.15	654.00	3.25
1820	652.31	2.06	654.37	1.32	655.69	3.38
1822	652.61	1.98	654.59	1.28	655.87	3.26
1824	651.98	1.95	653.93	1.51	655.44	3.46
1826	654.27	2.01	656.28	1.59	657.87	3.60
1828	654.13	2.04	656.17	1.64	657.81	3.68
1730	653.14	1.92	655.06	1.25	656.31	3.17
1832	655.96	2.10	658.06	1.07	659.13	3.17
1834	656.10	2.05	658.15	1.47	659.62	3.52
1836	658.65	2.11	660.76	1.04	661.80	3.15
1838	658.34	2.17	660.51	0.85	661.36	3.02
1840	659.40	2.15	661.55	0.95	662.50	3.10
1842	660.42	2.14	662.56	0.96	663.52	3.10
1844	660.68	2.15	662.83	1.05	663.88	3.20
1846	660.44	2.28	662.72	1.29	664.01	3.57
1848	659.04	2.13	661.17	1.00	662.17	3.13



GAS VENT DETAIL



L:\Coble Sandrock\Eng\Task 22 response to comments\Engineering\RTCL\EP-06 - FINAL GRADING PLAN.dwg

DATE	REVISIONS AND RECORD OF ISSUE	NO	BY	CHK	APP
5/19/06	MODIFIED GAS VENT DETAIL	2	SC	EA	EA
3/10/06	VENT LOCATIONS REVISION, SHOWED GRASS ON CHNLS	1	SC	EA	EA



DESIGNED	SC
DRAWN	RB
CHECKED	EA
APPROVED	EA
DATE	08/27/07

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**COBLE'S SANDROCK, INC.**  
KIMESVILLE, NORTH CAROLINA

**FINAL GRADING PLAN**

**PROJECT NO.**  
419.22

**SCALE**  
1" = 100'

**DRAWING NO.**  
EP-06